

Woodlands Primary School Maths Calculation Policy

Woodlands Primary School is committed to the lively and engaging delivery of mathematics across the age ranges and curriculum. For children to access the majority of their learning in numeracy, a strong and confident grasp of the four number operations is important. For our pupils to develop a deep conceptual understanding as well as a procedural fluency to their calculations, we aim to equip them with a 'toolkit' of methods. This 'toolkit' will consist of:

1. Efficient written methods
2. Efficient mental methods (see below written methods for a detailed breakdown of the progression)
3. Effective use of calculators

Put simply, by the time they leave primary school, they should be able to select an appropriate method to solve a calculation.

This policy blends current practices with the expectations of the new National Curriculum. The expectations for each year group are taken directly from the NC and examples are given. This should form the basis for classroom teaching; **however, the ultimate decision to move a child onto a new method of calculation lies with the teacher.**

Contents:

1. Ongoing Practice
2. Transition between addition methods
3. Transition between subtraction methods
4. Transition between multiplication methods
5. Transition between division methods

Ongoing practice

- A secure understanding of number and the number system through the daily provision of core numeracy sessions (Big Maths).
- Children should estimate before calculating an answer.
- Children should be given the opportunities to determine if a calculation can be done in their head or using a written method.
- Children should check their answer (e.g. by using the inverse operation).
- Children should practice their multiplication facts until they know them off by heart.
- Teachers should move children on when it is appropriate.
- Teachers should encourage children to use alternative, secure methods to check their answers and draw links.
- Teachers should use models and images to support the learning of written and mental methods of calculation.

Written methods (Non statutory objectives are in italics).

Addition

Year R:

Statutory framework for EYFS objectives:

- Add two single digit numbers.
- Count on to find the answer.
- *Read, write and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs*

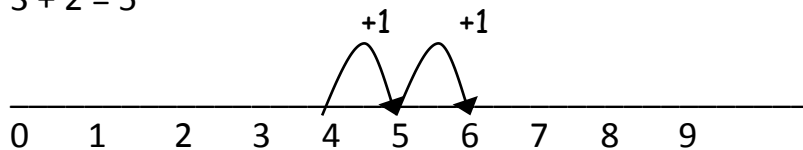
Written method:

1. Pictorial and physical handling of objects for addition.



2. Count in ones

$$3 + 2 = 5$$



Year 1:

National Curriculum Expectations:

- Add and subtract one-digit and two-digit numbers to 20, including zero.
- Read, write and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs.

Written Method:

1. Pictorial and physical handling of objects for addition.



2. Written number line – counting on in ones; counting on in larger steps.

Year 2:

National Curriculum Expectations:

- Add and subtract numbers using concrete objects, pictorial representations, and mentally, including:
 - a two-digit number and ones
 - a two-digit number and tens
 - two two-digit numbers
 - adding three one-digit numbers
- *Record addition and subtraction in columns*

Written Method:

1. Reinforce empty number line.
2. Expanded partitioning

$$67 + 22 = 89$$

$$\begin{array}{r} 60 + 7 \\ 20 + 2 \\ \hline \end{array}$$

$$80 + 9$$

3. Vertical partitioning

$$\begin{array}{r} 67 \\ + 24 \\ \hline 80 \\ \underline{11} \\ 91 \end{array}$$

Year 3:

National Curriculum Expectations:

- Add and subtract numbers mentally, including:
 - a three-digit number and ones
 - a three-digit number and tens
 - a three-digit number and hundreds
 - *two two-digit numbers (including answer crossing 100)*
- Add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction

Written Method:

1. Reinforce vertical partitioning, going beyond 100.
2. Columnar addition

$$\begin{array}{r} 789 + \\ 642 \\ \hline 1431 \\ \small 1 \quad 1 \end{array}$$

Year 4:

National Curriculum Expectations:

- add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate
- Solve simple measure and money problems involving decimals to two decimal places.

Year 5:

National Curriculum Expectations:

- add numbers mentally with increasingly large numbers add and subtract whole numbers with more than 4 digits, including using formal written methods
- Solve problems involving numbers with up to three decimal places.

Year 6:

National Curriculum Expectations:

- perform mental calculations, including with mixed operations and large numbers.
- *practise addition for larger numbers, using the formal written methods of columnar addition and subtraction*
- Solve problems involving numbers with mixed decimal places.

	Year 4	Year 5	Year 6
Written method	Columnar addition	Columnar addition	Columnar addition

Subtraction

Year R:

Statutory framework for EYFS objectives:

- Subtract two single digit numbers.
- Count back to find the answer.
- *Read, write and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs*

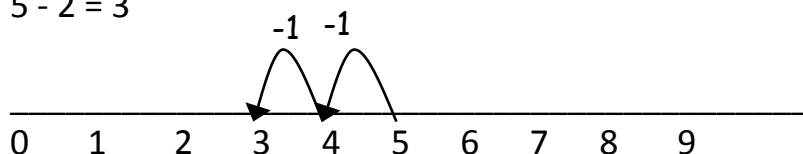
Written method:

1. Pictorial and physical handling of objects for subtraction.



1. Count in ones

$$5 - 2 = 3$$



Year 1:

National Curriculum Expectations:

- add and subtract one-digit and two-digit numbers to 20, including zero
- read, write and interpret mathematical statements involving addition (+), subtraction (–) and equals (=) signs

Written Method:

1. Pictorial and physical handling of objects for subtraction.



2. Number line – counting back in ones and larger steps

Year 2:

National Curriculum Expectations:

- add and subtract numbers using concrete objects, pictorial representations, and mentally, including:
 - a two-digit number and ones
 - a two-digit number and tens
 - two two-digit numbers
 - adding three one-digit numbers
- *record addition and subtraction in columns*

Written Method:

1. Reinforce counting back on number line
2. Expanded partitioning (no decomposition)

$$67 - 22 = 45$$

$$\begin{array}{r} 60 \quad 7 - \\ 20 \quad 2 \\ \hline \end{array}$$

$$40 \quad 5 \longrightarrow 45$$

Year 3:

National Curriculum Expectations:

- add and subtract numbers mentally, including:
 - a three-digit number and ones
 - a three-digit number and tens
 - a three-digit number and hundreds
 - *two two-digit numbers (including answer crossing 100)*
- add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction

Written Method:

1. Expanded partitioning (with decomposition)

$$\begin{array}{r} 94 - 36 = \\ \begin{array}{r} 80 \quad 14 \\ \cancel{90} \quad 4 \\ 30 \quad 6 - \\ \hline 50 \quad 8 \\ \hline \end{array} \\ 58 \end{array}$$

Year 4:

National Curriculum Expectations:

- Add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate.

Written Method:

1. Reinforce two two-digit and introduce two three-digit numbers using expanded partitioning.
2. Columnar subtraction

$$\begin{array}{r} 6141 \\ 754 \\ - 286 \\ \hline 468 \end{array}$$

Year 5:

National Curriculum Expectations:

- subtract numbers mentally with increasingly large numbers (e.g. $12\,462 - 2300 = 10\,162$)
- add whole numbers with more than 4 digits, including using formal written methods
- Solve problems involving numbers with up to three decimal places.

Year 6:

National Curriculum Expectations:

- perform mental calculations, including with mixed operations and large numbers
- *practise addition, subtraction for larger numbers, using the formal written methods of columnar addition and subtraction*
- Solve problems involving numbers with mixed decimal places.

	Year 5	Year 6
Written method	Columnar subtraction	Columnar subtraction

Multiplication

Year R:

Statutory framework for EYFS objectives:

- Solve problems involving doubling

Year 1:

National Curriculum Expectations:

- *double numbers and quantities*
- *make connections between arrays and number patterns*

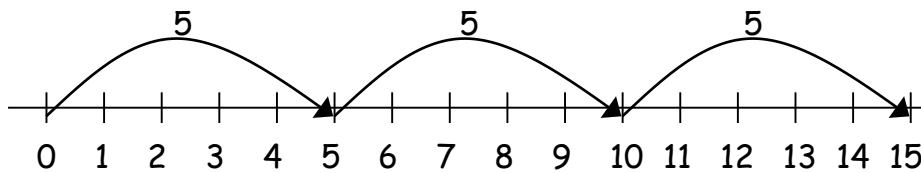
Written Method:

1. Number patterns

3 times 5 is $5 + 5 + 5 = 15$ or 3 lots of 5 or 5×3

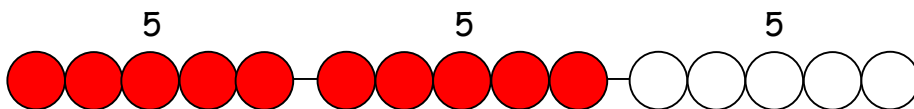
Repeated addition can be shown easily on a number line:

$$5 \times 3 = 5 + 5 + 5$$



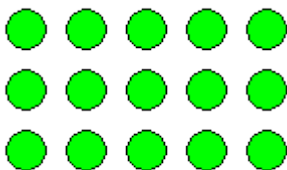
and on a bead bar:

$$5 \times 3 = 5 + 5 + 5$$



Or with Numicon and other physical models.

2. Link to visual arrays



Year 2:

National Curriculum Expectations:

- calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (\times), division (\div) and equals (=) signs.
- Solve problems involving multiplication using materials, arrays, repeated addition, mental method and multiplication facts.

Written Method:

1. Consolidate repeated addition and arrays.
2. Visual grid method (using arrays to bridge the gap).

\times	10										:	4				
6	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

$60 + 24$

$(6 \times 10) + (6 \times 4)$

$60 + 24$

84

Year 3:

National Curriculum Expectations:

- develop reliable written methods for multiplication and division, starting with calculations of two-digit numbers by one-digit numbers and progressing to the formal written methods of short multiplication and division

Written Method:

1. Reinforce visual grid method.
2. Grid method

\times	20	3	
8	160	24	
			160
			$+ 24$
			<hr style="width: 50px; margin: 0;"/> 184

3. Link with part-part-whole $23 \times 8 =$

?	
$20 \times 8 =$	$3 \times 8 =$
160	24

- Short multiplication (if appropriate).

$$\begin{array}{r} 24 \\ \times 6 \\ \hline 144 \\ 2 \end{array}$$

Year 4:

National Curriculum Expectations:

- multiply two-digit and three-digit numbers by a one-digit number using formal written layout

Written method:

- Short multiplication (according to above objective).

$$\begin{array}{r} 24 \\ \times 6 \\ \hline 144 \\ 2 \end{array}$$

Year 5:

National Curriculum Expectations:

- 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

Written method

- Reinforce short multiplication for $3/4 \times 1$ digit.
- Long multiplication

$625 \times 16 =$

$$\begin{array}{r} 625 \times \\ \underline{16} \\ 3750 \\ 13 \\ \hline 6250 \\ 10,000 \end{array}$$

Year 6:

National Curriculum Expectations:

- multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of short and long multiplication
- Multiply numbers up to two decimal places by a one digit whole number
- Multiply numbers up to two decimal places by one digit and two digit whole numbers*

	Year 4	Year 5	Year 6
Written method	Short multiplication	Long multiplication	Long multiplication

Division

Year R:

Statutory framework for EYFS objectives:

- Solve problems involving halving and sharing.

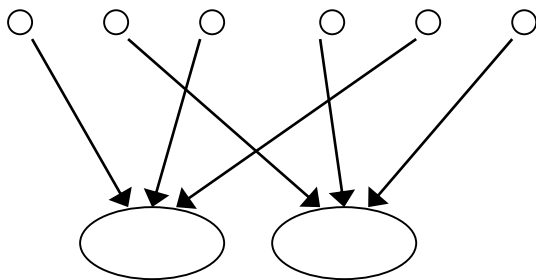
Year 1:

National Curriculum Expectations:

- group and share small quantities
- half numbers and quantities
- make connections between arrays and number patterns

Written Method:

1. Pictorial division to represent grouping and sharing



Year 2:

National Curriculum Expectations:

- calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (\times), division (\div) and equals ($=$) signs
- Solve problems involving division using materials, arrays, repeated addition, mental method and multiplication facts.

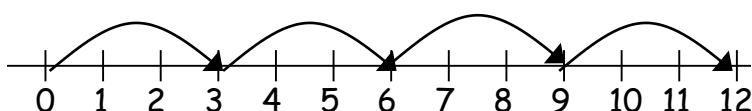
Written Method:

1. Pictorial sharing and grouping
2. Repeated addition

1. Repeated addition

12			
3	3	3	3

$$12 \div 3 = 4$$



Year 3:

National Curriculum Expectations:

- *develop reliable written methods for multiplication and division, starting with calculations of two-digit numbers by one-digit numbers and progressing to the formal written methods of short multiplication and division*

Written Method:

1. Reinforce repeated addition
2. Chunking

Handwritten work on lined paper showing the division $70 \div 3 =$. The student uses a grid method to multiply 3 by 1, 2, 5, 10, 20, 50, and 100. To the right, they subtract these products from 70 in a columnar format, with circled numbers indicating the chunks used: 20×3 , 2×3 , and 1×3 . The final result is $23 \text{ r } 1$.

Year 4:

National Curriculum Expectations:

- *divide numbers up to 3 digit by a one-digit number using the formal written method of short division and begin to interpret remainders.*

Written Method:

1. Reinforce chunking
2. Short division

- No carrying:

23

$$3 \overline{) 69}$$

$$69 \div 3 = 23$$

- Carrying, no remainders:

$$\begin{array}{r} 0 \ 4 \ 2 \\ 3 \overline{) 1 \ 2 \ 6} \\ \underline{1 \ 2} \\ \ 2 \ 6 \\ \underline{ 2 \ 6} \\ \ 0 \end{array}$$

$$126 \div 3 = 42$$

- Carrying, with remainders:

$$\begin{array}{r} 0 \ 3 \ 7 \ \text{r} \ 2 \\ 3 \overline{) 1 \ 1 \ 3} \\ \underline{1 \ 2} \\ \ 1 \ 3 \\ \underline{ 1 \ 3} \\ \ 0 \end{array}$$

$$113 \div 3 = 37 \text{ r } 2 \text{ or}$$

Year 5:

National Curriculum Expectations:

- 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 (*as fractions, as decimals or by rounding (for example, $98 \div 4 = 98/4 = 24 \text{ r } 2 = 24 \frac{1}{2} = 24.5 \approx 25$)*)

Year 6:

National Curriculum Expectations:

- divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context
- divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to context

	Year 5	Year 6
Written method	Long division (if necessary to move on from short i.e because of testing)	Long division (if necessary to move on from short i.e because of testing)

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Mental methods

Appendix A reflects the progression in the teaching and learning of mental methods of calculation at Woodlands. It was developed by the entire staff during two staff meetings. Alongside formal, written methods, our children will be equipped with a range of strategies to solve problems mentally. For example, $1,001 - 299$ can be answered by quickly adjusting the numbers and finding the difference. It would take a lot longer using the formal column method.

The majority of mental strategies will develop during the Big Maths session but discrete learning of mental methods may also be appropriate. Put simply, our children should look at a calculation and be able to say: **Can I work this out in my head? Do I need to use a written method? Do I need to use a calculator?**

Head Teacher:

Chair of governors:

Date:

Policy agreed: Autumn 2017

Date of next review: Autumn 2018

Appendix A – Mental Calculations

	Addition	Subtraction		Multiplication	Division
FS 1	Counting on one more.	Counting back single digit numbers using objects. (Counting back 1 less – FS1)	FS1	Double numbers up to 5.	
YR	Add single digit numbers by counting on and counting back.		YR	Double numbers up to 10. Learn its.	Halving even numbers up to 10 or 20 with objects.
Y1	Add T U + U and one digit and two digit numbers up to 20, using counting on. (See progression of mental addition strategies below)	Subtract 1 digit and 2 digit numbers to 20 including zero by counting back.	Y1	Doubling and halving numbers.	Halving even numbers up to 20.
Y2	Add T U + U; T U + U; and any 2 two digit numbers using mental partitioning (See progression of mental addition strategies below)	Subtract T U - U, T U - T and any 2 x 2 digit numbers using counting down. 76-57 76-50 -7	Y2	- Recall & use x facts (2,5 &10) - Read/connect 10 x table to place value 5 x table to clock face - Variety & Language - Doubling & halving 2 digit numbers - Recall & use x facts (3,4,6,8) - Commutatively & associativity:- 4 x 12 x 5 = 4 x 5 x 12 = 20 x 12 = 240	Deriving division facts from x tables eg $6 \div 3 = 2$ (because $3 \times 2 = 6$). Fact Families. Halving numbers up to 50.
Y3	Add H T U + U; H T U + T; H T U + H using mental partitioning.	Subtract H T U - U, H T U - T, H T U - H using counting down.	Y3	- Use known facts to derive related facts. - Missing number problems (simple)	Use x tables to derive division facts up to 2 digit numbers. $3 \times 2 = 6$ $6 \div 3 = 2$ $60 \div 3 = 20$
Y4	Add up to 2 three digit numbers using partitioning or counting on.	Subtract up to 2 x 3 numbers using counting down or counting on.	Y4	- Read & use x facts (all 2 x 12) - x mentally (using partitioning e.g. $9 \times 34 = 9 \times 30$ and 9×4) - 3 digit numbers – derive facts - $2 \times 6 \times 5$; $10 \times 6 = 60$	Halving numbers up to 100. Extend mental methods to 3 digit numbers eg $600 \div 3 = 200$ ($2 \times 3 = 6$) INN - PIM. \div facts for x tables up to 12×12 .
Y5	Increasingly large numbers using 1 of the 3 methods.	Subtract with increasingly large numbers using 1 of the 3 methods (see below)	Y5	Multiply increasing large numbers using partitioning and jottings	Applying coin multiplication: $650 \div 50 = 13$ Calculate adjusted known facts e.g. $2,500 \div 50 = 50$ To include decimals $0.81 \div 9 = 0.09$.
Y6	Add any 2 large numbers or decimal numbers using the most appropriate of the 3 mental methods. - partitioning - counting on - adjusting	Subtract any 2 large numbers or decimal numbers using the most appropriate of the 3 methods - adjusting - counting back - counting on	Y6	Multiply increasing large numbers using partitioning and jottings	Perform mental calculations with large numbers. $1300 \div 14$ Derive known facts with any adjustment. Coin x and combining multiples 1,2,5,10,30,50,100.

Progression for teaching mental addition facts

Year 1 (Within 10)

1. Adding 1 (e.g. $7 + 1$ and $1 + 7$)
2. Doubles of numbers to 5 (e.g. $4 + 4$)
3. Adding 2 (e.g. $4 + 2$ and $2 + 4$)
4. Number bonds to 10 (e.g. $8 + 2$ and $2 + 8$)
5. Adding 10 to a number (e.g. $5 + 10$ and $10 + 5$)
6. Adding 0 to a number (e.g. $3 + 0$ and $0 + 3$)
7. Near doubles (e.g. $3 + 4$ and $4 + 3$)
8. The ones without a family! $5 + 3, 3 + 5, 6 + 3, 3 + 6$

Year 2 (Bridging 10)

9. Doubles of numbers to 10 (e.g. $7 + 7$)
 10. Near doubles (e.g. $5 + 6$ and $6 + 5$)
 11. Bridging (e.g. $8 + 4$ and $4 + 8$)
 12. Compensating
-