Progression towards a standard written form of calculations

INTRODUCTION

This calculation policy provides guidance on appropriate calculation methods and progression. The content is set out in yearly blocks under the following headings: addition, subtraction, multiplication and division. Statements taken directly from the programme of study (or Development Matters for Early Years Foundation Stage) are listed in bold at the beginning of each section.
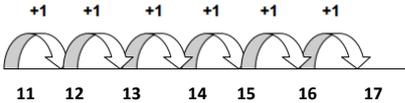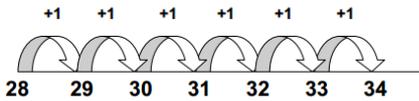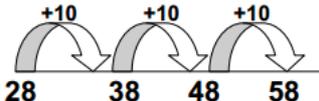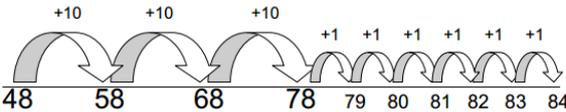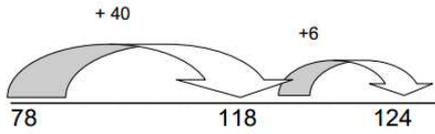
AIMS OF THE POLICY

- To ensure consistency and progression in our approach to calculation
- To ensure that children develop an efficient, reliable, formal written method of calculation for all operations
- To ensure that children can use these methods accurately with confidence and understanding.

HOW TO USE THIS POLICY

- Use this policy as a basis for your planning, but if needed ensure you use the previous years' or following years' where appropriate.
- Use Assessment for Learning to identify appropriate next steps for your children
- If a child is making a number of errors, return to the previous method
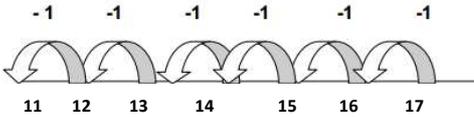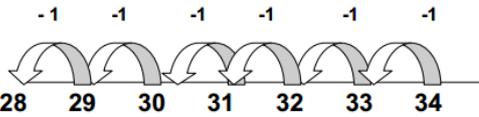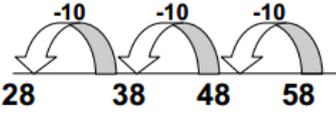- Use suitable resources and models to support children

Addition
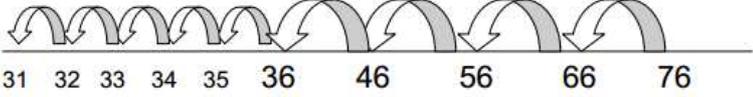
Early Years (EYFS)	Children will use a range of equipment to support them in securing adding at the EYFS stage, to include:
Know what is one more **Use quantities and objects to count** **Add two single digit numbers** **Count on** **Double numbers**	- Straw bundles - Deines - Number lines - Bead strings 100 squares - Place value cards - Pictorial representation
Year 1 **Represent and use number bonds within 20** **Add one-digit and two-digit numbers to 20, including zero** **Solve one-step problems that involve addition**	Using a number line and drawing the jumps. 11 + 6 = 17 Children will also use a range of other equipment to support adding to include: - Pictorial representations - Straw bundles - Deines - Number lines

	• Bead strings • 100 squares • Place value cards Using a range of these will support the securing of these objectives.
Year 2 • **Solve problems with addition using concrete objects and pictorial representations** • **Add two-digit numbers and ones** • **Add two-digit numbers and tens** • **Add two two-digit numbers** • **Adding 3 one-digit numbers**	Begin counting on in ones using an empty number line. 28 + 6 = 34 +1 +1 +1 +1 +1 +1 28 29 30 31 32 33 34 Then move onto counting on in tens using an empty number line. This can be supported by the use of a 100 square grid. 28 + 30 = 58 +10 +10 +10 28 38 48 58 You can continue to use this method to add two two-digit numbers: +10 +10 +10 +1 +1 +1 +1 +1 +1 48 58 68 78 79 80 81 82 83 84 Use in conjunction with a **100 square** to show jumps of tens and ones.
Year 3 • **Add numbers mentally including three-digit numbers and ones, tens and hundreds** • **Add numbers up to 3-digits using formal methods of columnar addition**	Further develop the use of the empty number line with calculations that bridge 100. 78 + 46 = 124 + 40 +6 78 118 124 Further develop the partitioning method for calculations that bridge 100. 85 + 37 = 80 + 5 + 30 + 7 80 + 30 = 110 5 + 7 = 12 110 + 12 = 122 85 + 37 = 122 This method can also be used with three-digit numbers. Children should then move onto the expanded written method for addition. Use this method when you have to bridge 100 as well.

|	$63 + 32 = 95$
	$$60 + 3$$ $$+ \quad 30 + 2$$ $$\overline{90 + 5} = 95$$
	When children are secure with the expanded method for adding 2- digits, they should practice using the standard method for addition.
	$$\begin{array}{r} 3\ 8 \\ +\ 9\ 3 \\ \hline 1\ 3\ 1 \\ 1 \end{array}$$
Year 4 • **Add numbers with up to four digits using the formal written method of columnar addition** • **Solve addition 2-step problems in contexts**	Further develop the use of the expanded method with larger numbers if necessary. $176 + 147 = 323$ $$\begin{array}{r} 1\ 7\ 6 \\ +\ 1\ 4\ 7 \\ \hline 1\ 3 \quad (7 + 6) \\ +\ 1\ 1\ 0 \quad (70 + 40) \\ 2\ 0\ 0 \quad (100 + 100) \\ \hline 3\ 2\ 3 \end{array}$$ This will then lead into the formal written method: $789 + 642$ becomes $$\begin{array}{r} 7\ 8\ 9 \\ +\ 6\ 4\ 2 \\ \hline 1\ 4\ 3\ 1 \\ 1\ \ 1 \end{array}$$ Answer: 1431 Children should become fluent in this method up to four-digit numbers.
Year 5 • **Add whole numbers with more than 4 digits including using formal written methods (columnar addition)**	Children should practise using the formal written methods of columnar addition with increasingly large numbers to aid fluency. See Year 4 for example.
Year 6 • **Solve problems involving addition**	Children should practise using the formal written methods of columnar addition with increasingly large numbers to aid fluency. See Year 4 for example.

Subtraction

Early Years (EYFS)	Children will use a range of other equipment to support subtraction to include:
Say what is one less than **Subtract two single digits** **Count backwards to find the answer**	- Pictorial representations - Straw bundles - Deines - Number lines - Bead strings 100 squares - Place value cards Using a range of these will support the securing of these objectives.
Year 1 **Represent number bonds and related subtraction facts within 20** **Subtract one-digit and two-digit numbers to 20, including zero** **Solve one-step problems that involve subtraction**	Using a number line and drawing the jumps. **17 - 6 = 11** Children will also use a range of other equipment to support subtraction to include: - Pictorial representations - Straw bunella - Deines - Number lines - Bead strings 100 squares - Place value cards Using a range of these will support the securing of these objectives.
Year 2 **Solve problems with subtraction using concrete objects and pictorial representations** **Subtract two-digit numbers and ones** **Subtract two-digit numbers and tens** **Subtract two two-digit numbers**	Count back in ones using an empty number line: **34 - 6 = 28** Then count back in tens. A 100 square grid can be used alongside to support this. **58 - 30 = 28** Follow on with using partitioning with the support of a number line.

$$76 - 45 = 31$$

Year 3	Further develop the use of the empty number line with calculations that bridge 100.
• **Subtract numbers mentally including three-digit numbers and ones, tens and hundreds** • **Subtract numbers up to 3-digits using formal methods of columnar subtraction**	$126 - 45 = 81$ Then use more efficient jumps. Extend this same method with larger numbers and practising counting back and by counting on to find the difference. Introduce the expanded written method for subtraction. $$78 - 23 = 55$$ $$\begin{array}{r} 70 + 8 \\ -\underline{20 + 3} \\ 50 + 5 = 55 \end{array}$$ You might replace the + sign with 'and' to avoid confusion. This will lead to the formal written method without bridging: $$\begin{array}{r} 73 \\ -\ \underline{23} \\ 50 \end{array}$$
Year 4	Introduce the standard written method where exchange or decomposition is required.
• **Subtract numbers with up to four digits using the formal written method of columnar addition** • **Solve subtraction 2-step problems in contexts**	$$73 - 27 = 46$$ $$\begin{array}{r} 70 + 3 \\ -\ \underline{20 + 7} \end{array} \quad \text{becomes} \quad \begin{array}{r} 60 + 13 \\ -\ \underline{20\ + 7} \\ 40 + 6 = 46 \end{array}$$
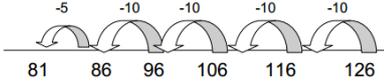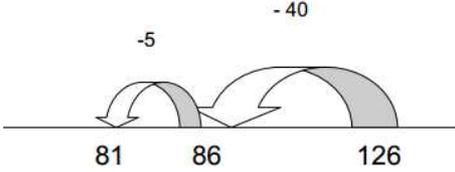
	When children are confident, introduce the formal written method: **235 – 127 = 108** $$\begin{array}{r} {\scriptstyle 2\ 15} \\ 2\,\cancel{3}\,\cancel{5} \\ -\ 1\,2\,7 \\ \hline 1\,0\,8 \end{array}$$
Year 5 • **Subtract whole numbers with more than 4 digits including using formal written methods (columnar addition)**	Children should practise using the formal written methods of columnar subtraction with increasingly large numbers to aid fluency. $$\begin{array}{r} {\scriptstyle 1\ 15} \\ 3\,6\,\cancel{2}\,\cancel{5} \\ -\ 1\,2\,1\,9 \\ \hline 2\,4\,0\,6 \end{array}$$
Year 6 • **Solve problems involving subtraction**	Children should practise using the formal written methods of columnar subtraction with increasingly large numbers to aid fluency. See Year 5 for examples.

Multiplication

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Early Years (EYFS) • **Doubling numbers (understanding the concept)**	Children will learn to double using: • Objects around the classroom • Through song • Pictorial representations
Year 1 • **Solve one-step problems involving multiplication by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.**	Children will count repeated groups of the same things: 'Six pairs of socks. How many socks altogether? 2, 4, 6, 8, 10, 12' Use arrays to support early multiplication.
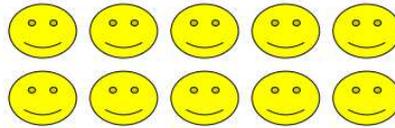
'Five groups of two faces. How many faces altogether? 2, 4, 6, 8, 10'
Two groups of five faces. How many faces altogether? 5, 10'

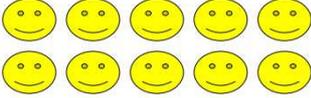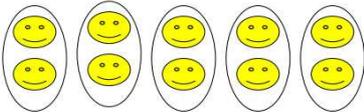| **Year 2**
 • **Recall and use multiplication facts for the 2, 5 and 10 multiplication tables**
 • **Calculate mathematical statements for multiplication within the multiplication tables**
 • **Solve problems involving multiplication** | Relate multiplication to grouping
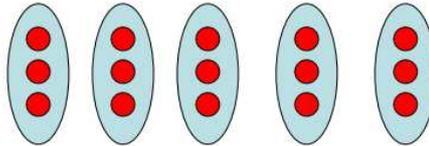
 '5 groups of 3' '5 lots of 3'   '3 + 3 + 3 + 3 +3 = 15'

 '5 times 3' '3 multiplied by 5'   '5 x 3 = 15' '3 x 5 = 15'

 Use arrays to demonstrate repeated addition. When using arrays you should lay them out with the first number in the multiplication as the amount 'down' the array, and then the second number 'across' the array. See below.

 6 x 5 = 30

 '5 + 5 + 5 + 5 + 5 + 5 = 30 '
 '6 rows of 5'
 '6 groups of 5'
 '5 groups of 6'
 '5 x 6 = 30'
 '6 x 5 = 30' |
| **Year 3**
 • **Recall multiplication facts for the 3, 4 and 8 multiplication tables**
 • **Write and calculate mathematical statements for multiplication using the multiplication tables including two-digit numbers times one-digit numbers, using mental and progressing to formal written methods** | Continue to use arrays to demonstrate multiply meaning repeated addition. See Year 2 for example.

 Begin with partitioning method of multiplication.

 13 x 5 = 65 (Partition 13 into 10 + 3)

 10 x 5 = 50
   3 x 5 = 15

 50 + 15 = 65

 Introduce the grid method to children for multiplying two-digit numbers by one-digit numbers. |

	<table><tr><td>X</td><td>10</td><td>3</td></tr><tr><td>8</td><td>80</td><td>24</td></tr></table> 80 + 24 = 104
Year 4 • **Recall multiplication facts for multiplications tables up to 12x12** • **Multiply two-digit and three-digit numbers by a one-digit number using formal written layout**	Children should be taught the formal method of short multiplication. Children may begin using grid method if they are not secure with place value. 24×6 becomes $$\begin{array}{r} 2\ 4 \\ \times \quad 6 \\ \hline 1\ 4\ 4 \\ \ 2 \end{array}$$ Answer: 144
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**	Practise and extend the use of formal written methods for short multiplication. 2741×6 becomes $$\begin{array}{r} 2\ 7\ 4\ 1 \\ \times \quad 6 \\ \hline 1\ 6\ 4\ 4\ 6 \\ \ 4\ 2 \end{array}$$ Answer: 16 446 Children will also begin using formal methods of long multiplication when multiplying by a 2-digit number.

	24 × 16 becomes
	
	     2
	   2 **4**
	 × **1** **6**
	  2 **4** **0**
	  1 **4** **4**
	  3 **8** **4**
	
	Answer: 384
	
	This formal method can also be taught so that they multiply the units first (in this case 6 by 4 and 6 by 20) then the tens. This will support their understanding with larger numbers.

Year 6
  • **Multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication**
	Practise multiplication with larger numbers using short and long multiplication.
	See Year 5 for short method of multiplication.
	Long method for multiplication:
	
	124 × 26 becomes
	
	   1 2
	 1 **2** **4**
	× **2** **6**
	  7 **4** **4**
	2 **4** **8** **0**
	3 **2** **2** **4**
	 1 1
	
	Answer: 3224

Division

Early Years (EYFS) • **Basic halving and sharing**	Children will use practical activities and equipment to carry out basic halving and sharing. e.g. halving a banana, sharing out toys between so many children etc.
Year 1 • **Solve one-step problems involving**	Children will start by sharing objects into a set number of groups. E.g. There are 8 apples, share

division by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.	them between 2 groups. Answer is 2 groups of 4. Teachers will also use arrays to support early division. 'How many faces altogether? How many groups of two?' 'Five groups of two'
Year 2 **Recall and use division facts for the 2, 5 and 10 multiplication tables** **Calculate mathematical statements for division within the multiplication tables** **Solve problems involving division**	Continue to use sharing, grouping and arrays to Introduce the division sign where children write the full sum. $15 \div 5 = 3$ $15 \div 3 = 5$
Year 3 **Recall division facts for the 3, 4 and 8 multiplication tables** **Write and calculate mathematical statements for division using the multiplication tables including two-digit numbers times one-digit numbers, using mental and progressing to formal written methods**	Pupils develop reliable written methods for division, starting with calculations of two-digit numbers by one-digit numbers and progressing to the formal written methods of short division. $98 \div 7$ becomes Answer: 14
Year 4 **Recall division facts for multiplications tables up to 12x12** **Write and calculate mathematical statements for division using the multiplication tables including two-digit numbers times one-digit numbers, using mental and progressing to formal written methods**	Pupils practise to become fluent in the short method of division.

• **Divide 2 and 3 digit using a formal written layout.**	$432 \div 5$ becomes $$\begin{array}{r} 8 \quad 6 \;\; r\,2 \\ \hline 5 \;\lvert\; 4 \quad 3^{3} \quad 2 \end{array}$$ Answer: 86 remainder 2
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 from the context**	Practise and extend the use of formal written methods for short division. $496 \div 11$ becomes $$\begin{array}{r} 4 \quad 5 \;\; r\,1 \\ \hline 1 \quad 1 \;\lvert\; 4 \quad 9^{5} \quad 6 \end{array}$$ Answer: $45\frac{1}{11}$
Year 6 • **Divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders** • **Divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate.**	Practise division with larger numbers using short and long division. See Year 5 for the formal method of short division. Formal method of long division: **Long division** $432 \div 15$ becomes $$\begin{array}{r} 2 \quad 8 \;\; r\,12 \\ \hline 1 \;\; 5 \;\lvert\; 4 \quad 3 \quad 2 \\ 3 \quad 0 \quad 0 \\ \hline 1 \quad 3 \quad 2 \\ 1 \quad 2 \quad 0 \\ \hline 1 \quad 2 \end{array}$$