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Maths Calculation Policy 2015

- This policy contains the key pencil and paper procedures that are to be taught throughout the school. It has been written to ensure consistency and progression throughout the school.

- Although the main focus of this policy in on pencil and paper procedures it is important to recognise that the ability to calculate mentally lies at the heart of Maths.

- Mental calculation is not at the exclusion of written recording and should be seen as complementary to and not as separate from it. In every written method there is an element of mental processing.

- Written recording both helps children to clarify their thinking and supports and extends the development of more fluent and sophisticated mental strategies.

- Although each method should be taught in the year group specified, children should not be discouraged from using previously taught methods with which they are secure, while the new concepts are becoming embedded.

- The long-term aim is for most/all children to be able to select an efficient method of their choice that is appropriate for the given task. They should do this by always asking themselves:

  - Can I do this in my head?
  - Can I do this in my head using drawings or jottings?
  - Do I need to use a written method?

  By the end of Year 6, children will have a range of calculation methods, mental and written.

  Children should not be made to go onto the next stage if:

- They are not ready

- They are not confident

Children should be encouraged to approximate their answers before calculating.

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Effective from: September 2015
To be reviewed: July 2016
By: N. Padgett & The Maths Working Party

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Progression of Number

	Addition	Subtraction	Multiplication	Division
Year 1	* Represent and use number bonds and related subtraction facts within 20 * Add and subtract one-digit and two-digit numbers to 20, including zero		* Can group objects into equal groups and share an amount into equal groups. * Derive and recall doubles and halves amounts up to 20. * Link doubles to making 2 equal groups. * Link halves and quarters to sharing * Make different arrays with the same amount of objects.	
Year 2	* Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100 * 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		* Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers. * Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs * Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot	
Year 3	* Add and subtract numbers mentally, including: • a three-digit number and ones • a three-digit number and tens • a three-digit number and hundreds * Add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction		* Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables * Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods	

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Year 4	* Add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate	* Recall multiplication and division facts for multiplication tables up to 12 x 12 * Multiply 2 digit and 3-digit numbers by a 1 digit number using formal written layout
Year 5	* Add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)	* 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 * 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
Year 6	* Use their knowledge of the order of operations to carry out calculations involving the four operations.	* Multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication. * Divide numbers up to 4-digits by a two-digit whole number using the formal written method of short division where appropriate for the context 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.

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Hemlington Hall Primary School Maths Calculation Policy

Addition

The mental methods that lead to column addition generally involve partitioning, e.g. adding the tens and ones separately, often starting with the tens as this is the larger number. They can also include the use of number squares for counting on.

Foundation Stage

To count on and from a number to find the total, using 1:1 correspondence. Use visual aids to support learning.

Year 1

Children should use numicon to show that addition can be done in any order. Simple number lines, hundred squares and practical equipment should be used to support visual learning of adding on.
By the end of Year 1 all children should be able to add 1 and 2-digit numbers to 20.

Year 2

Children should be able to add a 1-digit number to a 2-digit number within the decade. Moving on to adding a 1-digit number to a 2-digit number over the decade. Later moving on to adding multiples of 10 to a 2-digit number over the decade. Children in Year 2 should also be confident in add 3 one digit numbers together.
The children need to develop the independence to pick the most appropriate method to solve an addition sum (mentally/written method).

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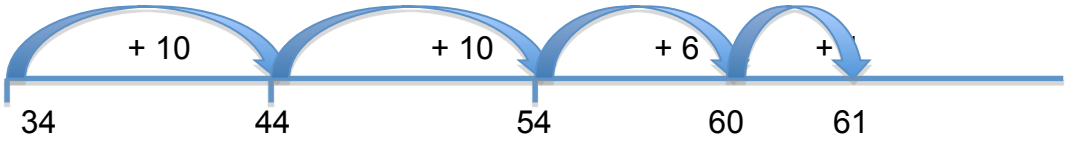
The number line helps to record the steps on the way to calculating the total.

E.g. 34 + 27 =



Then add the jumps up to generate the answer to the equation.

All children need a secure understanding of commutativity with number facts to 100.

Towards the end to Year 2 children need to understand the next stage using partitioning. Add the tens and then add the ones to form partial sums and then add these partial sums.

E.g. 34 + 27 =

	T	O
30 + 20	= 5	0
4 + 7=	+	1 1
	6	1

This leads into a more formal method of column addition.

Year 3

Year 3 needs to build on the formal column addition method introduced in Year 2. The children need to add numbers with up to 3-digits.

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	H	T	O
	2	6	7
+	1	5	9
	1	1	
	4	2	6

In this method, recording is reduced further, carrying digits are recorded above the first answer line, using the language ‘carry ten’ or carry ‘one hundred’, not ‘carry one’.

This can involve carrying when the children understand that it is a ten, hundred etc. they are carrying over to the next column. Push over the boundaries.

Year 4

In Year 4 the column addition method continues, developing the children’s skills and understanding of adding numbers with up to 4 digits. The aim is to increase the numbers to aid fluency.

E.g. 667 + 359 =

	TH	H	T	O
		6	6	7
+		3	5	9
	1	1	1	
	1	0	2	6

Year 5

The objective in Year 4 is to develop fluency and understanding of the Year 4 methods, using increasingly larger numbers.

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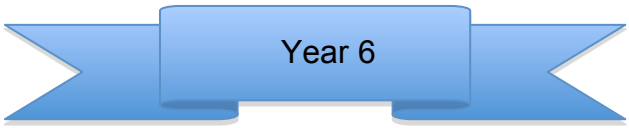
Extend the method Year 4 into adding decimals and carry over any of the columns.



Consolidate the methods from Year 5.

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Subtraction

Children find subtraction difficult particularly when they are introduced to column methods at an early stage. With continued practise and re-enforcement, children will become very comfortable using counting on methods on a number line.

Mental methods should involve counting back in single digit numbers, leading onto counting back in multiples of 10.

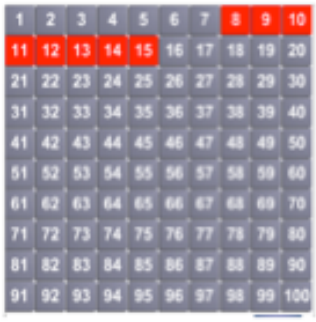
Foundation Stage

Children should experience practical tasks whilst experiencing the vocabulary involved in subtraction. The children will need to understand the term ‘take away’ and ‘find the difference’ and be able to act this out.

Year 1

Counting backwards and forwards using a number square/number line. This should be the first formal stage as children can see that the number is getting less as they count back. They should also understand that you can count up to subtract.

15 – 7 = 8



or

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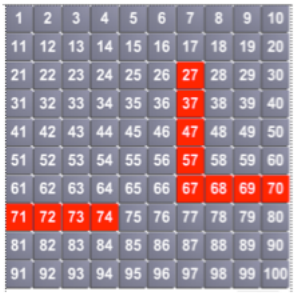
All children in Year 1 need to be confident and be able to memorise numbers bonds to 10 and the subtraction equivalent.

Year 2

When children become more confident and know how to use a hundred square they need to move on to a more complex method of jumping in tens. Children need to understand the correlation between addition and subtraction. Using a hundred square children need to understand they can count on from the number they are taking away up to the start number.

74 – 27 = 47



The children need to move on to a more formal method of recording subtraction.

Partitioning the numbers into tens and ones and writing one under the other mirrors the column method, where ones are placed under ones and tens placed under tens. The expanded method leads children to be more compact method so they understand the structure and efficiency. Children may also use a more traditional diagonal line when crossing out numbers.

Children should start off with numbers that do not cross over the boundaries, to ensure they understand the process before extending it.

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74 – 27 = 47

60

~~7~~0 + 14

- 20 + 7

40 + 7 = 47

Year 3

Year 3 need to extend the method started in Year 2 to working with 3 digit numbers. As the children become confident they need to work on developing a clear understanding of exchanging.

E.g. 741 – 367 = 374

600 130 11

~~700~~ + ~~40~~ + ~~1~~

300 + 60 + 7

300 + 70 + 4 = 374

Year 4

Developing an understanding of the compact method working up to to 4-digit numbers.

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E.g. 74 – 27 = 47

	T	O
6	~~7~~	1 4
-	2	7
	4	7

E.g. 741 – 367 = 374

	H	T	O
	6	13	11
	~~7~~	~~4~~	~~1~~
-	3	6	7
	3	7	4

Year 5/6

Children should be able to subtract different numbers of digits, as well as two or more decimal places. All children need to understand that decimal points should line up under each other.

E.g. 3741 – 2367 = 1474

	TH	H	T	O
	3	7	13 ~~4~~	1
-	2	3	6	7
	1	4	7	4

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Multiplication

Early stages of multiplication will focus on groups and sets, leading onto the learning of the multiplication tables facts up to 12 x 12 by the end of Year 4. All children should be familiar with the related division facts for all multiplication tables.

Foundation Stage

Children in the early stages should experience multiplication through number rhymes, such as two, four, six, eight, ten fat sausages and counting in pairs.

Year 1

Children should be able to count in 2, 5 and 10s with no formal method of recording. Numicon should be used to support patterns in numbers. Children should begin to understand multiplication as doubling numbers and quantities.

Year 2

All children should know their 2, 5 and 10 multiplication tables and the inverse division facts by the end of the year. The 10x tables should be linked to the place value system and the 5x tables should be linked to intervals on a clock face.
All children need to understand multiplication as repeated addition through the use of arrays.

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E.g. 3 x 4 = 12

E.g. 4 x 3 = 12

All children will use commutativity and invers relations to develop multiplicative reasoning, E.g. 4x5=20, 20÷5=4.

Year 3

All children should know their 2, 3, 4, 5, 8 and 10 multiplication tables and the inverse division facts by the end of the year. Children need to make the connection through doubling and connecting the 2, 4 and 8x tables.

All children will use the method of partitioning to solve TU X O.

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E.g.12 x 4 =

X	10	2
4	40	8

	T	O
	4	0
+		8
	4	8

Towards the end of the summer term the children need to progress on to the formal short multiplication method (see Year 3 example).

Year 4

All children should know their multiplication tables and the inverse division facts up to 12 x 12 by the end of the year.
The next step is to represent the method of recording in a column format, but showing the working. Draw on the links with the grid method.

E.g. 38 x 7 = 266

	H	T	O
		3	8
x			7
	2	6	6

If children need the support, they can write the multiplication sum at the right hand side of the answers.

All children need to be able to write statements about equality of expressions using the distributive law, E.g. 39x7=30x7+9x7 and associate law (2x3)x4=2x(3x4)

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Year 5

All children should continue to practise their multiplication tables and the inverse division facts up to 12 x 12.

The recording is reduced further, with carrying digits recorded above the line.

Short Multiplication Method

E.g. 338 x 7 = 266

	H	T	O
	3	3	8
x			7
	2	5	
2	3	6	6

Long Multiplication Method

E.g. 342 x 13 =

	TH	H	T	O	
		3	4	2	
x		1	1	3	
	1	0	2	6	
	3	4	2	0	← Placeholder
	4	4	4	6	

Children in Year 5 should be confident in both formal written methods of short and long multiplication.

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Year 6

Extending the above Year 5 method to develop fluency. The children need to understand the importance of the placeholder.

Division

Using written methods for division can be the most difficult for children. Early mental approaches should involve grouping and sharing. Discussing the sharing out of sweets is an example. When there are some left over, the term remainder can be introduced.

Foundation Stage

Counting in two will help lay the foundations for grouping and sharing by maximising opportunities when counting.

Year 1

Children should be deriving and recalling division facts each day, by counting in 2's, 10's and 5's.
Year 1 children should understand equal groups and share items out in play and problem solving.

E.g. share 9 sweets between 3 children

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Children in Year 1 should begin to investigate and find simple fractions of objects and quantities.

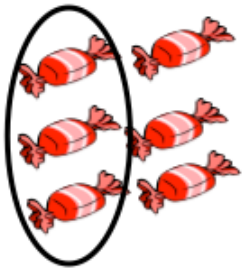
Year 2

Grouping and sharing should be explained and used in Year 2 confidently to ensure all children understand the difference between them. Divisions should be represented in an array to ensure all children see the relationship between multiplication and division.

Sharing equally…

E.g. 6 sweets shared between 2 people, how many do they each get?

Grouping equally…
E.g. there are 6 sweets, how many people can have 2 sweets each?



Extending their understanding to group in quantities.

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E.g. 369 ÷ 3 = 123

Children will continue to use arrays, but in larger numbers (only working in the values 1, 10, 100, 1000 etc.).

Year 3

Children should be taught the short division method. They need to understand the value of each digit to be successful. Initially they need to understand TU ÷ U.

$$8\overline{)96}\quad 12$$

Year 4

Children should be taught the short division method. They need to understand the value of each digit to be successful. All children need to move on to HTU ÷ U. The children should not at this stage be using remainders until they are confident in the method.

$$5\overline{)1^{1}7^{2}5}\quad 035$$

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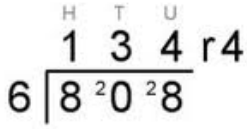
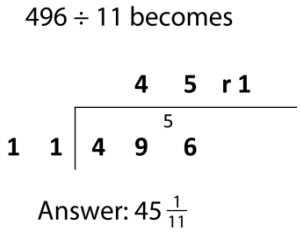
Year 5

Children need to consolidate the short division method as in Year 4. The children should be introduced remainders. Any remainders should be shown as integers, e.g. 14 remainder 2 or 14 r 2.



Pupils need to interpret non-integer answers to division by expressing results in different ways, including remainders as fractions, as decimals or by rounding, E.g. 98÷4=98/4 = 24r2 = 24½ = 24.5 ≈ 25



Children need to be able to decide what to do after division and round up or down accordingly. They should make sensible decisions about rounding up or down after division. For example 62 ÷ 8 is 7 remainder 6, but whether the answer should be rounded up to 8 or rounded down to 7 depends on the context.

E.g.
I have 62p. Sweets are 8p each. How many can I buy?
Answer: 7 (the remaining 6p is not enough to buy another sweet)

Apples are packed into boxes of 8. There are 62 apples. How many boxes are needed?
Answer: 8 (the remaining 6 apples still need to be placed into a box)

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Year 6

Children will move on to more formal methods of recording. Children will start to subtract larger multiples of the divisor. This method is referred to as long division. It is based on subtracting multiples of the divisor, or 'chunks'. Initially children subtract several chunks, but with practise they should look at the biggest multiples of the divisor that they can find to subtract.

432 ÷ 15 becomes

			2	8	
1	5	4	3	2	
		3	0	0	15×20
		1	3	2	
		1	2	0	15×8
			1	2	

$\frac{\cancel{12}}{\cancel{15}} = \frac{4}{5}$

Answer: $28\frac{4}{5}$

All children need to be confident with the long and short methods for division for whole numbers and decimals by the end of Year 6.