Hothfield Junior School Calculations Policy – November 2015

We build children's fluency and deep understanding of the four operations by following a clear and simple journey.

By using only the methods contained in this policy and by using models, images and apparatus to represent learning all along the journey, children develop their secure understanding of the four standard written methods by Year 6 – written addition, subtraction, short and long multiplication, and short and long division.

All staff working with children need to have their own secure understanding of the methods and representations used at Hothfield through each stage of their learning journey so children are not confused by alternative or inappropriate methods.

Operation: Addition	Y1	Y2	Y3	Y4	Y5	Y6
National Curriculum Programme of study	▢ read, write and interpret mathematical statements involving addition (+), subtraction (–) and equals (=) signs ▢ represent and use number bonds and related subtraction facts within 20 ▢ add and subtract one-digit and two-digit numbers to 20, including zero ▢ solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as 7 = ▢ − 9.	▢ 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 ▢ show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot ▢ recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.	▢ 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 ▢ estimate the answer to a calculation and use inverse operations to check answers ▢ solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction.	▢ add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate ▢ estimate and use inverse operations to check answers to a calculation ▢ solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why.	▢ add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction) ▢ add and subtract numbers mentally with increasingly large numbers ▢ use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy ▢ solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.	▢ use their knowledge of the order of operations to carry out calculations involving the four operations ▢ solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why ▢ solve problems involving addition, subtraction, multiplication and division ▢ use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.
Method/s	Adding using concrete objects Number line for counting on – within 10, then beyond 10 Counting on from largest number Numbered and then unnumbered number line Missing numbers eg 10=_+4	Crossing 10s using concrete resources – bead strings, counters, base 10, numicon. Adding 10 – base 10, straw bundles, number line Add by partitioning – base 10, straws, - on number line/ blank number line Expanded column method – with base 10 initially: 52+68= 50+ 2 60 + 8 110 + 10 = 120	352+468= Base 10 to represent: 300 + 50+ 2 400 + 60 + 8 700 + 110 + 10 = 120 326 + 429 1 755 Number line for counting on to support mental methods	To 4 digits: 1326 + 2429 1 3755 For money and measure: £32.64 + £42.91 1 £75.55	Beyond 4 digits: 21326 + 22429 1 43755 More than 2 numbers: 1326 + 2429 204 1 3959 Plus: Decimals to 2 and then 3 places – not just in context of money/measure	Extending to any number of digits; multiple decimal places.

Operation: Subtraction	Y1	Y2	Y3	Y4	Y5	Y6
National Curriculum Programme of study	▢ read, write and interpret mathematical statements involving addition (+), subtraction (–) and equals (=) signs ▢ represent and use number bonds and related subtraction facts within 20 ▢ add and subtract one-digit and two-digit numbers to 20, including zero ▢ solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as 7 = – 9.	▢ 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 ▢show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot ▢ recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.	▢ 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 ▢ estimate the answer to a calculation and use inverse operations to check answers ▢ solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction.	▢ add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate ▢ estimate and use inverse operations to check answers to a calculation ▢ solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why.	▢ add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction) ▢ add and subtract numbers mentally with increasingly large numbers ▢ use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy ▢ solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.	▢ use their knowledge of the order of operations to carry out calculations involving the four operations ▢ solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why ▢ solve problems involving addition, subtraction, multiplication and division ▢ use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.

Method/s	Using concrete objects within 20.
	
	Using number line progressing from within 10/ over 10/ within 20
	
	Number problems represented by numicon and base 10
	
	Recording using – and =
	Missing number challenges
		To support mental subtraction/ finding the difference:
		
		Number line counting from smaller to larger number. Partitioning numbers with base 10.
		
		Column subtraction within 100 represented by base 10 – no carrying
			874 – 523 becomes
			
			  8 7 4
			– 5 2 3
			  3 5 1
			
			932 – 457 becomes
			    8 12 1
			  9 3 2
			– 4 5 7
			  4 7 5
			
			Above represented by base 10
			Continue to support mental subtraction/ finding the difference:
			Number line counting from smaller to larger number/ counting back – depending on size of 'gap'.
			Counting in 10s/ units on number line
				Use formal column method for 4 digit numbers and to two decimal places in context of money or measure.
				
				Continue to support mental subtraction/ finding the difference:
				Number line counting from smaller to larger number – especially for finding the difference/ change/ money and time calculations when more efficient method than formal column
					Extending to 5 digits and money and measurement to 2 decimal places	Extending to any number of digits or decimal places.

Operation: Multiplication	Y1	Y2	Y3	Y4	Y5	Y6	Y7
National Curriculum Programme of study	Solve one-step problems involving multiplication by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher	recall and use multiplication facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers Calculate mathematical statements for multiplication within the multiplication tables and write them using the multiplication (×) and equals (=) signs Show that multiplication of two numbers can be done in any order (commutative)	Recall and use multiplication and facts for the 3, 4 and 8 multiplication tables Write and calculate mathematical statements for multiplication using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods	Recall multiplication for multiplication tables up to 12 × 12 Use place value, known and derived facts to multiply mentally, including: multiplying by 0 and 1; multiplying together three numbers Recognise and use factor pairs and commutativity in mental calculations Multiply two-digit and three-digit numbers by a one-digit number using formal written layout	Solve problems involving multiplication where larger numbers are used by decomposing them into their factors 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 Multiply numbers mentally drawing upon known facts Multiply whole numbers and those involving decimals by 10, 100 and 1000	Multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long Multiplication Use estimation to check answers to calculations and determine, in the context of a problem, levels of accuracy.	Apply appropriate calculation strategies and degrees of accuracy to increasingly complex problems Use the four operations, including formal written methods, applied to integers, decimal fractions, simple fractions (proper and improper) and mixed numbers, all both positive and negative
Method/s	Counting in steps of 2,5,10 Use concrete apparatus to count in groups of 2,5,10 Use arrays to represent 2s,5s,10s	Repeated addition of 2,5,10 Represent on arrays and number line Use x= to record Accompany number sentence with array representation (eg 2x4)	Represent on arrays and number line as repeated addition and then multiplication to record Count in 3s,4s,8s, 50s, 100s Accompany number sentence with array representation and find related sentences (eg 4x5 and 5x4) Grid method with base 10 representation 24x8 	x	20	4
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8	160	32	
			
			160+32= 192
			Leading to expanded vertical method:
			  24
			X 8
			―――
			  32 (4x8)
			160 (20x8)
			―――
			192
				Short multiplication:
				(Expanded vertical method recap then:)
				24 × 6 becomes
				
				   2 4
				× **6**
				―――――
				1 4 4
				    2
				
				Answer: 144
				(NB – place carrying figure above first line and cross out when used)
				
				Move to 3 digit by 1 digit
					Move to 3 and 4 digit by 1 digit
					
					Long multiplication for multiplying 2 digit numbers:
					
					24 × 16 becomes
					     2
					    2 4
					× 1 6
					―――――
					2 4 0
					1 4 4
					―――――
					3 8 4
					
					(NB – Revert to grid method to support/explain long multiplication)
					NB – Cross out carrying figure when used
						Multiply up to 4 digits by 2 digits using long multiplication:
						
						124 × 26 becomes
						   1 2
						  1 2 4
						× 2 6
						―――――――
						2 4 8 0
						  7 4 4
						―――――――
						3 2 2 4
						  1 1
						
						NB – Cross out carrying figure when used	

Operation: Division	Y1	Y2	Y3	Y4	Y5	Y6
National Curriculum Programme of study	Solve one-step problems involving division by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher	recall and use division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers Calculate mathematical statements for division within the multiplication tables and write them using the division and equals (=) signs Show that division of one number by another cannot be done in any order	Recall and use division facts for the 3, 4 and 8 multiplication tables Write and calculate mathematical statements for division using the multiplication tables that they know using mental and progressing to formal written methods	Recall division facts for multiplication tables up to 12 × 12 Use place value, known and derived facts to divide mentally, including: dividing by 1 Recognise and use factor pairs and commutativity in mental calculations	Solve problems involving division where larger numbers are used by decomposing them into their factors Divide numbers up to 4-difts by a 1-digit number using the formal written method of short division and interpret the remainders appropriately for the context Divide numbers mentally drawing upon known facts Divide whole numbers and those involving decimals by 10, 100 and 1000	Use estimation to check answers to calculations and determine, in the context of a problem, levels of accuracy. Divide numbers up to 4-digits by a 2-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

Method/s	Sharing using concrete apparatus – quantities up to 20
	
	Grouping in 2s,5s,10s,
	
	Represent as counter arrays
		Represent with counter arrays for known times tables
		
		Introduce concept of remainders when grouping with counters
		
		Repeated addition on a number line
			Represent times table division facts using arrays
			
			Repeated addition on number line using larger numbers and using chunking
			
			Short division no remainders for two digit divided by 1 digit:
			
			98 ÷ 7 becomes
			
			     1 4
			         2
			   7 │ 9 8
				Represent new times table division facts using arrays
				
				Repeated addition on number line using larger numbers, using chunking, identifying remainders
				
				Short division no remainders for three digit divided by 1 digit.
				
				Progressing to remainders
					Repeated addition on number line using larger numbers, using chunking, identifying remainders
					
					Short division with remainder interpretation for up to 4 digits divided by 1 digit
					
					432 ÷ 5 becomes
					
					       8 6 r 2
					              3
					   5 │ 4 3 2
					
					Progressing to representing remainders as fractions, decimals, left as remainders – link to context
						Move from number line to long division dividing by 1 digit and then 2 digits:
						
						432 ÷ 15 becomes
						
						          2 8 r 12
						   1 5 │ 4 3 2
						          3 0 0 ↑
						          1 3 2 (20x15)
						          1 2 0 (8x15)
						                  1 2
						
						432 ÷ 15 becomes
						
						          2 8 · 8
						   1 5 │ 4 3 2 · 0
						          3 0 ↓
						          1 3 2
						          1 2 0 ↓
						                  1 2 0
						                  1 2 0
						                          0