GREAT FINBOROUGH CHURCH PRIMARY

Calculation Policy

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Great Finborough Church Primary

Calculation Policy

1 Aims and objectives

1.1 Understanding about number, its structures and relationships, underpins progression from counting in nursery rhymes to calculating with and reasoning about numbers of all sizes, to working with measures, and establishing the foundations for algebraic thinking. Understanding of place and number value is crucial to calculating.

The objective of this policy is to provide a progressive program of methods for pupils to improve their understanding of and ability to solve mathematical calculations. Different methods will suit different learners at different points in their understanding and in this way the methods are not age related but designed to develop, with the pupils' choosing the most efficient method for themselves. Pupils will however be taught age appropriate methods as they progress through the school, though if they are not ready to move on to the next stage they may choose to revert to previously learned methods which they find efficient until they are ready to move on.

1.2 The aims of the calculation policy are:

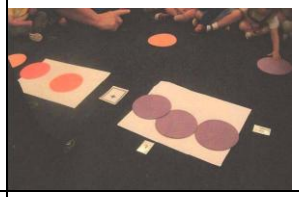
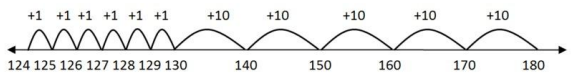
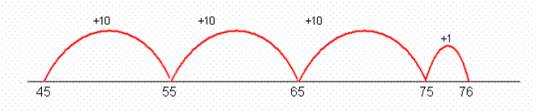
- to ensure understanding of our number system and place value;
- to provide a set of progressive methods enabling pupils to develop efficient methods to suit their understanding;
- to prepare our key stage 2 children for the calculation methodology expected in key stage 3;
- to equip pupils for a future where they can independently solve every day mathematical problems;

2 Teaching and learning style

2.1 The school uses a variety of teaching and learning styles in mathematics lessons. Our principal aim is to develop children's knowledge, skills and understanding in mathematics. We do this through a daily lesson that has a high proportion of whole-class and group-direct teaching. During these lessons we encourage children to ask as well as answer mathematical questions. They have the opportunity to use a wide range of resources such as number lines, number squares, digit cards and small apparatus to support their work. Mathematical dictionaries are available in all classrooms. Children use ICT in mathematics lessons where it will enhance their learning, as in modelling ideas and methods. Wherever possible, we encourage the children to use and apply their learning in everyday situations.

2.2 In all classes there are children of differing mathematical ability. We recognise this fact and provide suitable learning opportunities for all children by matching the challenge of the task to the ability of the child. We achieve this through a range of strategies – in some lessons through differentiated group work, and in other lessons by organising the children to work in pairs on open-ended problems or games. We use classroom assistants to support some children and to ensure that work is matched to the needs of individuals.

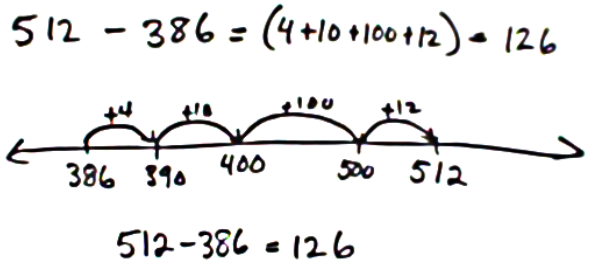
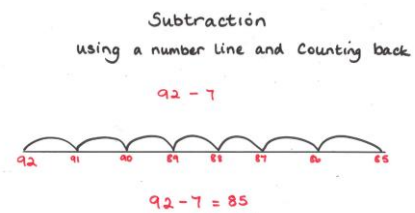
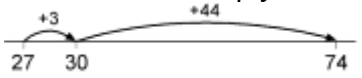
3 Addition

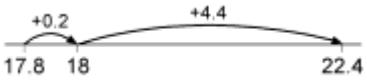
	Framework objective	Methodology
Foundation stage	**Relate addition to combining two groups of objects.** **In practical activities and discussion begin to use the vocabulary involved in adding.**	Role play. Use of concrete activities – counting out the two groups of numbers eg with cubes or counters then counting on from the biggest group to total, with pupils being encouraged to record the number sentence. Use of a marked number line for counting and counting on and back. 
Year 1	Relate addition to counting on. Recognise addition can be done in any order. Use practical and informal methods to support addition of 1 digit numbers or a multiple of 10 to a 1 digit or 2 digit number. (eg 2+7, 19+5, 37+20) **Use the vocabulary related to addition and symbols to describe and record addition number sentences**.	Further use of the concrete activities - use of objects for counting on from largest group. Use of marked number line to 30 for counting on from the largest number. Use of 100s square to count on units and add tens.
Year 2	**Add mentally a one digit number or multiple of 10 to any two digit number.** **Use practical and informal written methods to add two digit numbers** Understand subtraction is the inverse of addition and vice versa. Use this to derive and record related addition and subtraction number sentences. **Use the symbols + - x ÷ and = to record and interpret number sentences involving all four operations.** **Calculate the value of an unknown in a number sentence.** **Eg 14 + □ = 22**	Further use of 100s square. Begin to use an empty number line for addition (units first) 124 + 56 =  (or 10s first)  The empty number line helps to record the steps on the way to calculating the total. Children first count the number of units then the number of tens, while recording the value of the bump and also the value reached under the line. This method aids children's understanding of our number system and reiterates that addition is counting forwards/on. Moving towards formal partitioning and expanded addition. Eg 47+76=123 (Labelling columns as tens and units) TU

		47 +76 13 (units) 110 (in tens) 123 Or 40 + 7 70 + 6 110 + 13 = 123 The use of partitioning and expanded addition is dependent on pupils knowledge of place value Always encouraging the children to add the units first
Year 3	**Add mentally combinations of one-digit and two digit numbers.** Develop and use written methods to record, support or explain addition of 2 digit and 3 digit numbers	Pupils move from use of an empty number line when they are ready, onto partitioning and expanded addition as above. Once secure in these methods, they will move on to; Column method TU 76 +47 = 123 (11) HTU 366 +458 = 824 (11) This method can be used for any number of digits including decimals. It is important that the carried numbers are termed as ten or hundreds rather than carry 1. Pupils must be taught accurate recording in columns using their place value knowledge for this method to be effective.
Year 4	**Add mentally pairs of 2 digit whole numbers.** Refine and use efficient written methods to add two digit and three digit numbers and £.p	
Year 5	**Use efficient written methods to add whole numbers and decimals with up to 2 places**	
Year 6	Calculate mentally with integers and decimals U.t + U.t **Use efficient written methods to add integers and decimals**	

4 Subtraction

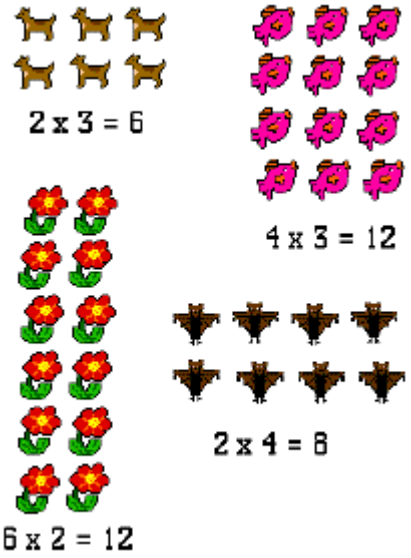
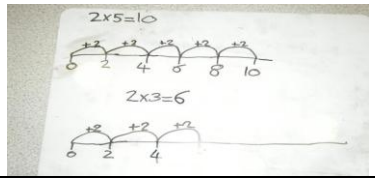
	Framework objective	Methodology
Foundation stage	**Relate subtraction to take away** **In practical activities and discussion begin to use the vocabulary involving subtraction**.	Role play Use of concrete activities –.removing a number of items from a known number inside, begin to encourage recording eg 10 – 2 = 8 
Year 1	Understand subtraction as take away or find the	Further use of the concrete activities -use of objects for subtraction.

	difference between by counting up. Use practical and informal written methods to support the subtraction of a one digit number from a one or two digit number and a multiple of 10 from a two digit number (eg 37-20) **Use of the vocabulary related to subtraction and symbols to record subtraction number sentences**.	Use of number line to 0-30 for counting on from smallest number. Eg 27-20 Count on from 20 to 37 to find the difference between the two numbers Use of 100s square to count on units and tens in the same way as illustrated above, starting from smallest number in the number sentence, the emphasis on finding the difference between
Year 2	**Subtract mentally a one digit number or multiple of 10 from any two digit number.** **Use practical and informal written methods to subtract two digit numbers**. Understand that subtraction is the inverse of addition and vice versa. Use this to derive and record related addition and subtraction number sentences. **Use the symbols + - x ÷ = to record and interpret number sentences involving all four operations.** **Calculate the value of an unknown in a number sentence** **Eg □ - 5 = 20**	Further use of 100s square. Begin to use an empty number line for subtraction 512 - 386 = 234  Pupils record the smallest number in the equation at the beginning of their number line and count on in jumps – first to the nearest 10, then 10s and 100s to find the difference between the two numbers. They find their answer by adding the value of their jumps. Or counting backwards from the larger number 
Year 3	**Subtract mentally combinations of one digit and two digit numbers**. Develop and use written methods to record, support or explain subtraction of two digit and three digit numbers.	Further use of empty number line  TU 74 -27 3 → 30 44 → 74 47
Year 4	**Subtract mentally pairs of two digit whole**	Jottings from the number line calculation

	numbers and three digit numbers Refine and use efficient written methods to subtract two digit and three digit whole numbers and £.p	are recorded in 10s and units format. Label columns HTU.  TU.t 22.4 - 17.8 0.2 → 18 4.4 → 22.4 Children first count on to the nearest whole number, then count on the remaining jumps in multiples they are secure in counting. Moving on to more formal partitioning towards column subtraction 74 – 27 70 + 4 / -20 + 7 60 14 / ~~70~~ + ~~4~~ / -20 + 7 / 40 + 7 6 14 / ~~74~~ / - 27 / 47 Once again, knowledge of place value is critical before moving on from number line subtraction to partitioning or more traditional column addition. 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 under tens. It does not link directly to mental methods of counting back or on but parallels the partitioning method of addition. It also relies on secure mental skills. The expanded method leads children to the more compact method so that they understand its structure and efficiency.
Year 5	**Use efficient written methods to subtract whole numbers and decimals with up to 2 places**. Extend mental methods for whole number calculations.	
Year 6	Calculate mentally with integers and decimals U.t + U.t **Use efficient written methods to subtract integers and decimals**.	

5 Multiplication

	Framework objective	Methodology
Foundation stage	Count repeated groups of the same size.	Counting of groups of objects of the same size, eg socks in pairs.
Year 1	Solve practical problems which involve combining groups of 2, 5 or 10	Pupils are taught to count in 2s, 5s and 10s. The understanding of this is reinforced using practical activities. As above, including groups of 5 eg how many fingers on 4 hands

Year 2	Represent repeated addition and arrays as multiplication (eg 3x4). Use practical and informal written methods and related vocabulary to support multiplication. **Use the symbols + - x ÷ = to record and interpret number sentences involving all four operations.** **Calculate the value of an unknown eg □ x 4 = 20**	Further use of practical activities to reinforce understanding. Pupils learn to count in 2s, 3s, 4s, 5s and so on. Include the use of arrays to introduce recording eg  Pupils use times tables knowledge to help them calculate. Pupils should also be made aware that multiplication is repeated addition eg 3 x 2 = 2 + 2+ 2 
Year 3	Multiply one digit and two digit numbers by 10 or 100, and describe the effect. Use practical and informal written methods to multiply two digit number by a one digit number. Understand that division is the inverse of multiplication and vice versa. Use this to derive and record related multiplication and division number sentences.	Further work on times tables. Pupils use this knowledge to help them calculate. **Partitioning** Pupils use knowledge of place value to help them calculate multiples of 10 and begin to partition and make jottings to record eg 43 x 6 = 43 40 + 3 × 6 240 + 18 = 258 The 10s or the units can be multiplied first, the totals added to find the product. Alternatively – using partitioning 14 x 3 =(10 + 4) x 3 or (10 + 10 + 10) + (4 + 4 + 4) =(10 x 3) + (4 x 3) = 30 + 12 =42 **The Grid Method**
Year 4	Multiply numbers to 1000 by 10 and then 100 (whole number answers), understanding the effect. Relate to scaling up or down (as in recipes). **Develop and use written methods to record, support and explain multiplication of two digit numbers by one digit numbers.**	
Year 5	Use understanding of place value	

	to multiply whole numbers and decimals by 10, 100 or 1000. Refine and use efficient written methods to multiply HTU x U, TU x TU and U.t x U Extend mental methods for whole number calculations, eg a two digit number by a one digit number.	As the children become confident and accurate with partitioning to multiply, they can move on to the grid method – this is slightly more efficient and quicker to use than the method above, though uses the same principles; Eg 38 x 7 First partition 38 into 30 and 8, calculate 30 x 7, then 8 x 7 and enter these partial products. Finally add the two partial products 210 + 56 to find the total = 266
Year 6	Calculate mentally with integers and decimals: TUx U, U.t x U **Use efficient written methods to multiply integers and decimals by a one digit integer and to multiply two digit numbers and three digit integers by a two digit integer**.	

x	7
30	210
8	56
total	266

It is important that the grid is carefully laid out with the HTU in columns to aid final addition. The grid method may be used throughout KS2 and for larger numbers eg

286 x 29

x	20	9	totals
200	4000	1800	5800
80	1600	720	2320
6	120	54	174
			= 8294

It is a good idea for pupils to estimate first, for example 286 x 29 is approximately 300 x 30 = 9000

Expanded Short Multiplication

58 × 29 is approximately 60 × 30 = 1800.

58
X 29
52$_{7}$2
11$_{1}$6 0
1682

9x8 = 72 (7 goes into the tens column), 9x5=45 so 9x50 = 450, add the 7tens so you get 520 + the 2 that you've already got

Next, you need to calculate 20 x 58, they know it's easier to add 0 as a place holder and think of it as x 2.

Then we carry out the calculation as before.

Now we can add up the columns to give the final answer.

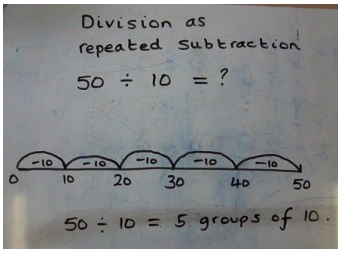
Short Multiplication

38
X 7
266
^{5}

(Mental calculations involved first 7 x 8 = 56, the 50 must carry under the 10s column, record 6 units. Next 30 x 7 = 210 + 50 (carried), Record 26 in 10s column = 266)

		58 **X 29** **522** **(9 x 58) = 522** **1160** **(20x58) = 1160** **1682** Children would usually carry the partial products mentally, eg (9 x 8 = 72) + (9 x 50 = 450). 450 + 72 = 522 and so on. Children's mental agility in multiplication and place value must be secure for them to move onto this method. If after practise they cannot use the column methods, they should return to the grid method.

6 Division

	Framework Objective	Methodology
Foundation stage	Share objects into equal groups and count how many in each group.	Physical activities such as sharing out fruit within a group.
Year 1	Solve practical problems sharing into equal groups	Further use of physical activities, such as how many 2p coins make 20p. Sharing 10 pencils between a group of 5 children, how many each?
Year 2	Represent sharing and repeated subtraction (grouping) as division. Use practical and informal written methods and related vocabulary to support division, include calculations with remainders. **Use symbols + - x ÷ = to record and interpret number sentences involving all four operations.** **Calculate the value of an unknown in a number sentence. Eg □ ÷ 2 = 8**	Further use of physical activities and the use of times tables knowledge, in the understanding that multiplication is the inverse of division. Eg 8 ÷ 2 = □ x 2 Use of repeated subtraction Eg 8 ÷ 2 = 8 -2 -2 -2 -2 (ie 4 lots of 2) answer = 4 Repeated subtraction can be carried out using marked number line or an empty number line.  Move onto chunking when children are secure in their understanding of above.
Year 3	Find unit fractions of numbers and	Chunking (repeated subtraction)

	quantities (eg ½ of 12 litres) Use practical and informal written methods to divide tow digit numbers eg 50 ÷ 5. Round remainders up or down depending on context. Understand that division is the inverse of multiplication and vice versa. Use this to derive and record related multiplication and division number sentences.	Children must be secure in their times tables and knowledge of place value to use this method. Children multiply in round numbers using the smallest number in the calculation, using their inverse knowledge. They then subtract their partial totals from the largest number, their aim is zero. Children are encouraged to keep jottings of a running total as shown. Eg 650 ÷ 5 100 x 5 = 500 (650 – 500 = 150) 10 x 5 = 50 (150 – 50 = 100) 20 x 5 = 100 (100 – 100 = 0) 100 + 10 + 20 = 130 650 ÷ 5 = 130 Short and Long Division Short division can be introduced to children who are confident with division and multiplication facts and with subtracting multiples of 10s mentally, also whose knowledge of place value is secure. T U 8 | 9 1 6 12 1 x 10 is "borrowed" 16 ÷ 8 = 2 (90-10 = 80) 80 ÷ 8 = 10 196 ÷ 6 = 32 r 4 H T U 6)1 9 6 6 0 - (10 x 6) 1 3 6 6 0 - (10 x 6) 7 6 6 0 - (10 x 6) 1 6 1 2 - (2 x 6) 4 As children begin to use their knowledge of multiplication tables, particularly with multiples of ten for each table, they can progress from taking 10 chunks of a divisor to 30 x 6 = 180 and subtract this larger chunk. 10 + 10 + 10 + 2 = 32 4 remaining
Year 4	Divide numbers to 1000 y 10 and then 100 (whole number answers), understand the effect. Relate to scaling up or down. **Develop written methods to record, support and explain division of two digit numbers by a one digit number, include division with remainders.** Find fractions of numbers, quantities or shapes.	
Year 5	Use understanding of place value to divide whole numbers and decimals by 10, 100 or 1000. Refine and us efficient written methods to divide HTU ÷ U Find fractions using division eg ¾ of £60 and percentages of numbers and quantities eg 5% of 80	
Year 6	Calculate mentally with integer and decimals. **Use efficient written methods to divide integers and decimals by a one digit integer**. Relate fractions to multiplication and division. Express a quotient as a fraction or decimal. Find fractions and percentages of whole number quantities.	

7 Contribution of mathematics to teaching in other curriculum areas

7.1 English

Mathematics contributes significantly to the teaching of English in our school by actively promoting the skills of reading, writing, speaking and listening. For example, we encourage children to read and interpret problems in order to identify the mathematics involved. The children explain and present their work to others during plenary sessions. Younger children enjoy stories and rhyme that rely on counting and sequencing. Older children encounter mathematical vocabulary, graphs and charts when using non-fiction texts.

7.2 Information and communication technology (ICT)

Children use and apply mathematics in a variety of ways when solving problems using ICT. Younger children use ICT to communicate results with appropriate mathematical symbols. Pupils also use games and applications to improve their mental agility.

7.3 Personal, social and health education (PSHE) and citizenship

Mathematics contributes to the teaching of personal, social and health education, and citizenship. The work that children do outside their normal lessons encourages independent study and helps them to become increasingly responsible for their own learning. The planned activities that children do within the classroom encourage them to work together and respect each other's views. We present older children with real-life situations in their work on the spending of money.

7.4 Spiritual, moral, social and cultural development

The teaching of mathematics supports the social development of our children through the way we expect them to work with each other in lessons. We group children so that they work together, and we give them the chance to discuss their ideas and results.

8 Teaching mathematics to children with special needs

8.1 We teach mathematics to all children, whatever their ability. It is part of the school curriculum policy to provide a broad and balanced education to all children. We provide learning opportunities that are matched to the needs of children with learning difficulties. Work in mathematics takes into account the targets set for individual children in their Individual Education Plans (IEPs).

8.2 Gifted and More Able children are recorded on our 'GAMA' list. Learning opportunities are matched to their needs. Small extension groups are set up as necessary to extend and broaden the children's, understanding and knowledge.

9 Assessment and recording

9.1 We assess children's work in mathematics from three aspects (long-term, short-term and medium-term). We make short-term assessments which we use to help us adjust our daily plans. These short-term assessments are closely matched to the teaching objectives.

9.2 We make medium-term assessments to measure progress against the key objectives, and to help us plan the next unit of work. We use the class record of the key objectives as the recording format for this.

9.3 We make long-term assessments towards the end of the school year, and we use these to assess progress against school and national targets. We can then set targets for the next school year and make a summary of each child's progress before discussing it with parents. We pass this information on to the next teacher at the end of the year, so that s/he can plan for the new school

year. We make the long-term assessments with the help of end-of-year tests and teacher assessments. We use the national tests and teacher assessment for children in Year 2, plus the optional national tests for children at the end of Years 3,4 and 5. Year 6 children sit the national SAT for maths. We also make annual assessments of children's progress measured against the level descriptions of the Primary Framework.

9.4 Teachers meet regularly to review individual examples of work against the national exemplification material produced by the QCA and the DfEE.

10 Resources

10.1 There is a range of resources to support the teaching of mathematics across the school. All classrooms have a number line and a wide range of appropriate small apparatus. Mathematical dictionaries are available in all classrooms. Calculators and a range of audio visual aids are available from the central storage area. The library contains a range of books to support children's individual research. A range of software is available to support work with the computers.

11 Monitoring and review

9.1 Monitoring of the standards of children's work and of the quality of teaching in mathematics is the responsibility of the mathematics coordinator. The work of the mathematics coordinator also involves supporting colleagues in the teaching of mathematics, being informed about current developments in the subject, and providing a strategic lead and direction for the subject in the school. The mathematics coordinator keeps the head teacher informed of the strengths and weaknesses in the subject and indicates areas for further improvement. The head teacher allocates regular management time to the mathematics coordinator so that s/he can review samples of children's work and undertake lesson observations of mathematics teaching across the school. A named member of the school's governing body is briefed to oversee the teaching of numeracy. This governor meets regularly with the subject leader to review progress.

9.2 This policy was written using information currently available from the Primary Framework for Mathematics, The Foundation Stage (EYFS) Framework, "Good practice in primary mathematics: evidence from 20 successful schools" published by Ofsted November 2011 and with reference to Stowmarket High School's current maths schemes of work