GOUDHURST & KILNDOWN
CHURCH OF ENGLAND PRIMARY SCHOOL
Enjoy Achieve Together

Calculation Policy

Policy Control	
Responsible Person:	Peter Goodman
Responsible Governor Team:	Teaching and Learning
Approved by Governors:	May 2015
Date due for review:	May 2018

Our school policies are written with the objective of continuously improving the school in our aim of realising the school's vision:

Goudhurst & Kilndown Church of England Primary School will provide a happy, caring and stimulating environment rooted in Christian values in which every child will flourish. We will realise the potential of every child and instil a lifelong love of learning. Our approach to teaching and learning will be inclusive, supportive and innovative and will embrace new education initiatives and leading technology. We will ensure that our children are aware of the world in which they live, understand the need to play an active role within the local and wider community and appreciate the importance of living a sustainable way of life. In partnership with parents and carers, we will help our children to build high self-esteem, independence and resilience and to develop the life skills they need for their future in an ever-changing world.

Our School Values

Goudhurst and Kilndown Church of England Primary School values

Community • Friendship • Joy • Love • Peace • Trust

and all our stakeholders are encouraged to *reflect* upon their learning and their actions

Progression towards a standard method of Calculation

Introduction:

The Primary Framework provides a structured and systematic approach to the teaching of calculation. There is considerable emphasis on teaching mental calculation methods. Up to the age of 9 (year 4) informal written recording is practised regularly and is an important part of learning and understanding. More formal written methods follow when the child is able to use a wide range of mental strategies. Children are encouraged to talk about their Maths and explain their calculating processes and reasons for selecting specific strategies and methods. At our school, we follow a consistent approach to the teaching of calculation methods in order to establish continuity and progression throughout the school.

It is very important to follow the progression through each operation. A child cannot skip a level of understanding just to keep up with their year group as this will lead to gaps in learning and could cause difficulties in understanding later in school life. Class differentiation ensures that each child is taught to the appropriate level for them and it is important that parents support the class teachers in this in order to avoid confusion. Teachers will be very happy to explain the levels children are at or the method taught at school to parents and/or provides more extensive overviews provided by the Abacus Maths programme.

Aims:

Children should be able to use an efficient method, mental, written or calculator appropriate to the given task. By the end of year 6, children working at Level 4 and above will have been taught, and be **secure** with, a compact standard method for each operation.

General Progression:

- Establish mental methods, based on a good understanding of place value
- Use of informal jottings to aid mental calculations
- Develop use of empty number line to help mental imagery and aid recording
- Use partitioning and recombining to aid informal methods
- Introduce expanded written methods
- Develop expanded methods into compact standard written form

Before carrying out a calculation, children will be encouraged to consider:

- Can I do it in my head? (using rounding, adjustment)
- The size of an approximate answer (estimation)
- Could I use jottings to keep track of the calculation?
- Do I need to use a formal written method?

When are children ready for written calculations?

Addition and subtraction:

- Do they know addition and subtraction facts to 20?
- Do they understand place value and can they partition numbers?
- Can they add three single digit numbers mentally?
- Can they add and subtract any pair of two digit numbers mentally?
- Can they explain their mental strategies orally and record them using informal jottings?

Multiplication and Division:

- Do they know the 2,3,4,5, 6 and 10 times tables and corresponding division facts?
- Do they know the result of multiplying by 1 and 0?
- Do they understand 0 as a place holder?
- Can they multiply two and three digit numbers by 10 and 100?
- Can they double and halve two digit numbers mentally?
- Can they use multiplication and division facts they know to derive mentally other multiplication and division facts that they do not know?
- Can they explain their mental strategies orally and record them using informal jottings?

It is important that children's mental methods of calculation are practised and secured alongside their learning and use of an efficient written method for each operation. Additionally key number skills should be continually revisited to ensure that every child's understanding of concepts in number supports his/her development in calculation.

Points to note:

- Children should progress from one method to the next within each operation only when they have a secure understanding and are confident in the method they are using.
- To be successful in learning to calculate children must be able to; count reliably forwards and backwards, recognise individual digits, know what each digit represents, know that digits combine to make numbers and have some understanding of the concept of zero.
- The correct terminology should be used when referring to the value of digits to support the children's understanding of place value. E.g. 68 + 47 should be read 'sixty add forty' not 'six add four'
- Teachers should refer to the key vocab document and the vocabulary section of each block overview for key vocabulary to introduce to their children within each unit.

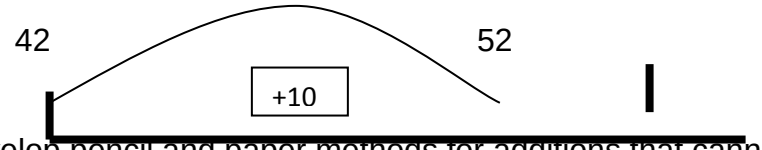
Progression of Written Calculations

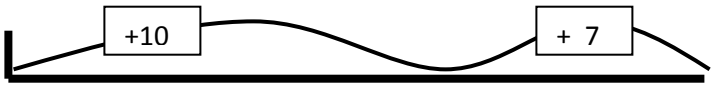
Key Stage	Progression of Written Calculations
Foundation	Children begin to record in the context of play or practical activities and problems.
Key Stage 1 (Years 1 & 2)	Children will: • Develop the use of pictures and mixture of words and symbols to represent numerical activities • Use of standard symbols and conventions (0 – 9, + , - , x , ÷ , =) • Use of jottings to aid mental calculations, number tracks, empty

	number lines, partitioning **(All calculations at KS1 will be presented horizontally)**
Lower Key Stage 2 (Years 3 & 4)	Children will: • Continue use of jottings to aid mental calculations • Use of expanded methods for addition and subtraction • Develop use of compact method for addition and subtraction • Use of expanded methods for multiplication and division (by the end of year 4) • Begin to use a calculator as a calculating tool (by the end of year 4) **(Calculations are presented horizontally and vertically)**
Upper Key Stage 2 (Years 5 & 6)	• Continue use of jottings to aid mental calculations • Secure understanding of compact methods for addition and subtraction (develop use with decimals) • Develop use of compact methods for multiplication and division, expanded methods still acceptable • Effective use of a calculator to support calculations **(Calculations presented horizontally and vertically)**

Progression in Addition

Stage	Progression of Written Calculations
Foundation	**Begin to relate addition to combining two groups of objects** • Make a record in pictures, words or symbols of addition activities already carried out • Construct number sentences to go with practical activities • Relate addition to counting on • Use of games and songs to develop vocabulary

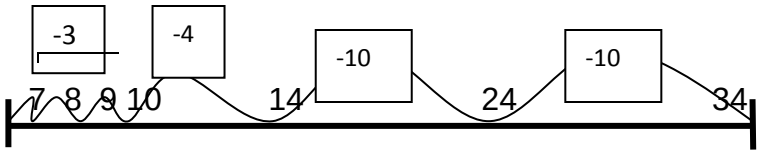
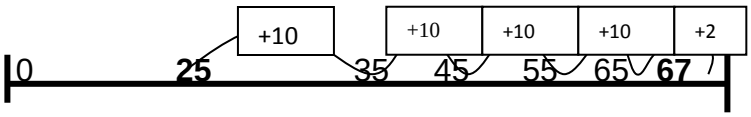
Stage 1
Year 1
	Understand the operation of addition and use the related vocabulary
	• Record simple mental additions in a number sentence using + and =:
	  • number bonds ('story' of 5, 6, 7, 8, 9 and 10).
	  • Add two 1-digit numbers
	  • Add three 1-digit numbers, spotting doubles or pairs to 10
	  • Begin to partition and recombine (seeing 12+15 as 10+10 and 2+5, then 20+7 as 27)
	• Know that addition can be done in any order
	• Add by putting the larger number first
	• Introduction of empty number lines and then:
	  • Count on in 1s from a given 2-digit number
	  • Count on in 10s from any given 2-digit number
	  • Add 10 to any given 2-digit number
	 
	
	Develop pencil and paper methods for additions that cannot be done mentally
	35 + 52 30 + 50 = 80

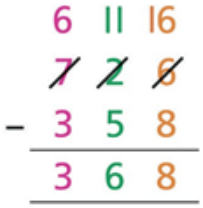
	5 + 2 = 7 ⟶ 87 (no formal layout, informal jotting) • Continue to develop the use of vocabulary • Continue to use practical apparatus and visual aids to support the recording of calculations
Year 2	Continue to record simple mental additions in a number sentence using + and =: • Number bonds – know all the pairs of numbers which make all the numbers to 12, and pairs with a total of 20 • Count on in 1s and 10s from any given 2-digit number Then: • Add two or three 1-digit numbers • Add a 1-digit number to any 2-digit number using number facts, including bridging multiples of 10 e.g. *45 + 4* e.g. *38 + 7*  • Add 10 and small multiples of 10 to any given • 2-digit number • Add any pair of 2-digit numbers • Continue to develop the use of vocabulary • Continue to use practical apparatus and visual aids to support the recording of calculations
Stage 2 Year 3	• Continue informal partitioning, reinforce use of empty numberline. • Expanded written method, horizontal layout no carrying then advancing to carrying. e.g. *466 + 358* 400 60 6 + 300 50 8 700 110 14 = 824 • Compact column addition with two or more 3-digit numbers or towers of 2-digit numbers e.g. *347 + 286 + 495* 347 286 + 495 21 1128

Stage 3 Year 4 **Stage 4** By the end of Year 4	• Children continue to develop expanded written method with larger numbers, using vertical layout, adding the least significant digit first. • Compact column addition with larger numbers e.g. *5347 + 2286 + 1495* 5347 2286 + 1495 121 9128 • Begin to use expanded and compact column addition to add amounts of money. • Add like fractions.
Stage 4 Year 5	**Extend written methods to column addition of two integers less than 10,000** *(explore larger numbers with expanded methods then apply compact method with least significant digit first)* • Add several numbers with different number of digits up to 5-digit numbers • Extend column addition to decimal amounts of money, lengths, and weights. • Add related fractions eg. ¾ + 1/8 = 7/8
Stage 4 Year 6	**Extend written methods for addition** • Any number of digits • Several numbers with different numbers of digits • Decimals with one or two decimal places • Add unlike fractions, including mixed numbers. Eg ¼ + 2/3 = 11/12 and 2 ¼ + 1 1/3 = 3 7/12.

Progression in Subtraction

Stage	Progression of Written Calculations
Foundation	**Begin to relate subtraction to 'taking away'** • Make a record in pictures, words or symbols of subtraction activities already carried out • Use of games and songs to develop vocabulary • Construct number sentences to go with practical activities Relate subtraction to taking away and counting how many objects are left
Stage 1 Year 1	**Understand the operation of subtraction and use the related vocabulary** • Use of pictures and visual aids to record calculations • Record simple mental subtractions in a number sentence using – and = including: • Number bonds ('story' of 5, 6, 7, 8, 9 and 10)

	• Count back in 1s from a given 2-digit number • Subtract one 1-digit number from another • Count back in 10s from any given 2-digit number • Subtract 10 from any given 2-digit number • Use number facts to subtract 1-digit numbers from 2-digit numbers • e.g. Use 7 – 2 to work out 27 – 2, 37 – 2 Then: • Develop use of vocabulary; difference / take away • Use jottings to support mental subtractions (empty numberline) e.g. 34 – 27 = 
Stage 2 Year 2	• Number bonds – know all the pairs of numbers which make all the numbers to 12 • Count back in 1s and 10s from any given 2-digit number • Subtract a 1-digit number from any 2-digit number using number facts, including bridging multiples of 10 e.g. *56 – 3* e.g. *53 – 5* • Subtract 10 and small multiples of 10 from any given 2-digit number • Subtract any pair of 2-digit numbers by counting back in 10s and 1s or by counting up • Continue to use number lines when counting on to find the difference. • Subtraction can be recorded using partitioning to write equivalent calculations that can be carried out mentally e.g. 74 – 27 = 74 – 20 = 54 – 7 = 47 74 – 27 = 70 + 4 – 20 + 7 = 60 + 14 – 20 -7 = 40 + 7 = 47
Stage 2 Year 3	**Develop pencil and paper methods for subtractions that cannot, at this stage, be done mentally (two digit numbers)** **67 – 25 = 42** With jottings and partitioning: 25= 20+5 67 – 20 = 47 ; 47-5=42 Counting on to find a difference (In Abacus, known as 'Frog') 

Stage 3	Some children may use an expanded vertical method of complementary addition, building on from the numberline. Leading onto: • Use counting up subtraction to find change from £1, £5 and £10 e.g. £10·00 – £6·84. • Recognise complements of any fraction to 1 e.g. 1 – 1/4 = 3/4 e.g. 1 – 3/5 = 2/5.
Stage 3 Year 4	• Expanded column subtraction with 3- and 4-digit numbers e.g. *726 – 358*  • Begin to develop compact column subtraction e.g. *726 – 358*  • Continue to use empty number lines to support mental calculation strategies, especially using a counting up (Abacus 'frog') to complete money subtraction problems, eg, What change would be given from £10.00 for an item costing £7.33. • Subtract like fractions e.g. 3/8 – 1/8 = 2/8
Stage 4 Year 5	• Compact column subtraction using decomposition (regrouping) for numbers with up to 5 digits e.g. *16 324 – 8516* 

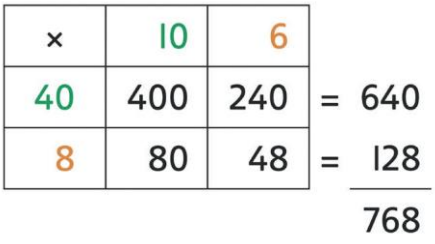
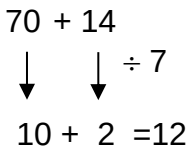
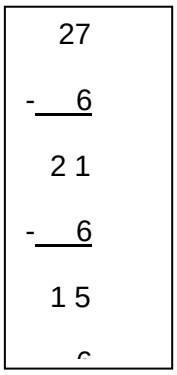
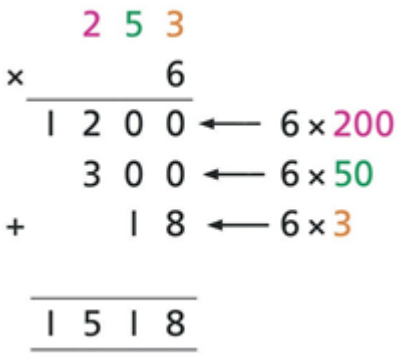
	• Continue to use counting up subtraction for subtractions involving money, including finding change e.g. *£50 − £28·76* • Continue to use counting up subtraction for subtractions involving money, including finding change e.g. £50 − £28·76 • Use counting up subtraction to subtract decimal numbers • Compact written methods involving decomposition (regrouping) • Subtract related fractions. e.g. 3/4 – 1/8 = 5/8 **Note: Counting up subtraction provides a default method for ALL children.**
Stage 4 Year 6	• Further develop compact column subtraction by using even larger numberse.g.*34685-16458*  • Use counting up for subtractions where the larger number is a multiple or near multiple of 1000 or 10 000. • Use counting up subtraction when dealing with money e.g. *£100 – £78·56.* e.g. *£45·23 – £27·57* • Be able to choose the most efficient and appropriate method for each calculation. **Some children will find the final compact method very difficult and will continue to use informal methods in years 5 and 6. This is fine!**

Progression in Multiplication and Division
(Concepts in multiplication and division are very closely linked and should be developed together)

	Multiplication	Division
Foundation	**Real life contexts and use of practical equipment to count in repeated groups of the same size:** • Count in twos**/**fives/ tens	**Share objects into equal groups** Use related vocabulary

Year 1	**Draw pictures to show equal sets:** 3 sets of 2 make 6 xx xx xx 2 sets of 4 make 8 xxxx xxxx **Count in twos, fives and tens** • Identify patterns of 2s, 5s, 10s on a hundred square • Solve practical problems that combine groups of 2s, 5s and 10s. Double numbers to 10	**Draw pictures to show sharing and grouping:** 10 shared between 2 xxxxx xxxxx How many groups of 4 in 8? xxxx xxxx **Count in twos, fives and tens** • Solve practical problems sharing groups of 2,5 and 10. • Find half of even numbers to 12 and know it is hard to halve odd numbers • Find half of even numbers by sharing • Begin to use visual and concrete arrays or 'sets of' to find how many sets of a small number make a larger number
Year 2	**Develop use of vocabulary for multiplication.** • Use x symbol. **Count confidently in steps of 2, 5 and 10.** • Recall multiplication facts for 2, 5 and 10. **Begin to count in steps of 3 and 4.** • Use of empty numberlines and 100 squares as visual reminders when learning to count in steps of 3, 4 and 5. **Understand the operation of multiplication as repeated addition or as describing an array** • Make arrays practically • Draw on squared paper • Use x and = to record mental calculations (x2,x3,x5,x10): 3 lots of 2 2 lots of 3 'groups of 3 x 2 = 6' • Double numbers up to 20 • Begin to double multiples of 5-100 • Begin to double 2-digit numbers <50 with 1s digits of 1, 2, 3, 4, 5.	**Develop use of vocabulary for division.** • Use ÷ symbol. **Count confidently in steps of 2, 5 and 10.** • Recall division facts for 2, 5 and 10 **Practical tasks:** • Sharing equally: 15 ÷3 = 15 shared between 3 • Grouping: 15 ÷ 3 how many 3s in 15? **Relate grouping to arrays** • Use ÷ and = to record number calculations 6 ÷ 2 = 3 6 ÷ 3 = 2 • Use a numberline to illustrate grouping e.g. 8 ÷2= 4 • Begin to solve practical problems involving remainder • Relate division to grouping • Halve numbers to 20 • Begin to halve numbers to 40 and multiples of 10 to 100 • Find $^{1}/_{2}$, $^{1}/_{3}$, $^{1}/_{4}$ and $^{3}/_{4}$ of a quantity of objects.

Year 3	**Learn additional multiplication facts and work on different ways to derive new facts from those that they already know** • Know by heart multiplication facts for x2, x3, x4, x5, x6, x10. • Recognise multiples of 2, 5 and 10 up to 1000. • Understand effect of multiplying by 10 • Multiply a single digit by 1, 10, 100 7 x 10 =70 4 x 100 = 400 • Double any multiple of 5 up to 50 35 x 2 = 70 ☐ x 2 = 50 • Derive related facts 7 x 5 = 35 5 x 7 = 35 35 ÷ 5 = 7 35 ÷7 = 5 • Use practical apparatus and informal methods to multiply two digit numbers by a single digit e.g. empty number line. • Start to use partitioning to develop grid multiplication, e.g. 23 x 4 × | 20 | 3 4 | 80 | 12 = 92	**Derive quickly division facts corresponding to 2,3, 4, 5, 6 and 10 times tables.** • Continue to use empty number lines for division and introduce remainders. • Solve division calculations by using multiplication strategies • Understand effect of dividing by 10 • Divide a 3-digit multiple of 100 by 10 or 100 800 ÷ 100 = 8 300 ÷ 10 = 30 • Halve any multiple of 10 up to 100 50 ÷ 2 = 25 ☐ ÷2 = 35 • Given three numbers such as 4, 5 , 20; say or write four different multiplication and division statements. • Use practical apparatus and informal methods to divide two digit numbers e.g. 39 ÷ 3. • Round remainders up or down depending on the context.

Stage 1 Year 4	**Develop and refine written methods for multiplication** • Multiply a 2-digit number by a single digit number, multiplying the tens first • Using multiples of 10 (mentally) 4 x 30 = (4 x 3) x 10 = 120 • Use jottings to show stages of calculation e.g. (TU x U) 32 x 3 = (30 x 3) + (2 x 3) = 90 + 6 = 96 • Grid multiplication incrementally introduced, initially to multiply 3-digit numbers by 1-digit numbers. e.g 253 x 6, then 2 digit by 2 digit numbers. eg. 16 x 48.  	**Develop and refine written methods for division** • Divide a 2-digit number by a single-digit, by using multiples of the divisor • Use informal jottings E.g.: 84 ÷ 7=  • Use division facts to find unit and non-unit fractions of amounts within the times-tables. • **Optional (not within Abacus) Use the repeated subtraction or "chunking" method** e.g. 27 ÷ 6 • How many 6's can I take from 27?'  <u>27 ÷ 6 = 4 r.3</u> <u>repeated subtraction</u>
Stage 2	• Vertical written algorithm (ladder) to multiply 3-digit numbers by 1 digit numbers.  	• Leading to subtracting larger chunks such as multiples of 10; e.g.148 ÷ 4 =

		148 - 40 (10x4) 108 - 40 (10x4) 68 - 40 (10x4) 28 - 28 (7x4) 0

<table>
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<td>Stage 3
Year 5</td>
<td>Extend written methods, encouraging estimation first. Some children will continue with Grid method.

• Short multiplication of 2-, 3- and 4-digit numbers by 1-digit numbers
e.g. 435 × 8

4 3 5
× 8
2 4
3 4 8 0

• Long multiplication of 2-, 3- and 4-digit numbers by ‘teen’ numbers
e.g. 48 × 16

4 8
× 1 6
4 8 0
2 8 4 8
1
7 6 8

• Grid multiplication of numbers with up to 2 decimal places by 1-digit numbers. e.g. 1·34 × 6

<table>
<tr><td>×</td><td>1</td><td>0·3</td><td>0·04</td></tr>
<tr><td>6</td><td>6</td><td>1·8</td><td>0·24</td></tr>
</table>
= 8·04

• Multiply fractions by 1-digit numbers
e.g. 3/4 × 6 = 18/4 = 4 2/4 = 4 ½

Grid multiplication provides a default written method for all children.</td>
<td>Extend written methods, encouraging estimation first.

• Use a written version of a mental strategy to divide 3-digit numbers by 1-digit numbers.
e.g. 326 ÷ 6 as 50 × 6 (300) and 4 × 6 (24), remainder 2.

3 2 6 ÷ 6 = □

□ × 6 = 3 2 6
5 0 × 6 = 3 0 0
2 6
4 × 6 = 2 4
2
5 4

3 2 6 ÷ 6 = 5 4 r2</td>
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<tr>
<td>Stage 4</td>
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Stage 5 Year 6	**Extend written methods for multiplication, encouraging estimation first.** • continue to use grid method as an expanded written method. • Short multiplication of decimal numbers using × 100 and ÷ 100 e.g. 13·72 × 6 as (1372 × 6) ÷ 100 = 82·32 • Short multiplication of money e.g. £13·72 × 6 £ 1 3.7 2 × 6 2 4 1 £ 8 2.3 2 **Most children will be encouraged to continue to use the grid method, as analysis of test results show this to be a more reliable method for most children.** *Pupils will be taught the more compact method of multiplication if and when the teacher feels they are ready for it.* • Multiply simple pairs of proper fractions. e.g. 1/2 × 1/4 = 1/8	**Extend written methods for division, encouraging estimation first.** • Short division of 3- and 4-digit numbers by 1-digit numbers e.g. 139 ÷ 3 4 6 r 1 3 | 1 3 19 • Long division of 3 and 4 digit numbers by 2-digit numbers e.g. *4176 ÷ 13* • Long division of 3- and 4-digit numbers by 2-digit numbers e.g. 4176 ÷ 13 300 + 20 + 1, r 3 4176 ÷ 13 = 321 r 3 13 | 4176 −3900 276 −260 16 −13 3 Short division method can be used when children are confident to divide two and three digit numbers by a single digit. **The extended method of repeated subtraction will remain the main method for division used throughout year 6.**

Date last reviewed: April 2015