Calculation Policy

January 2020   To be reviewed January 2023

SOUTHBOROUGH CALCULATION POLICY

Aims and purposes

The purpose of this Calculations Guidance Policy is to develop a consistent approach to the way in which pupils progress through the stages of mental and written calculation strategies. Through this, a clear progression in their recording will become evident.

It aims to inform teaching staff, non-teaching staff, parents and governors as to how the school has chosen to develop calculation methods and record written calculations. It is to supplement the existing Mathematics policy and to support medium and short term planning using the Primary Framework guidelines.

This policy exemplifies a recommended progression through the four operations, beginning in Foundation Stage and carrying on to Year 6. Children should be encouraged to see mathematics as both a written and spoken language. Teachers should support and guide children through the following important stages:

- developing the use of pictures and a mixture of words and symbols to represent numerical activities
- using standard symbols and conventions
- use of jottings to aid a mental strategy
- use of pencil and paper procedures.

It is important that children do not abandon jottings and mental methods once other pencil and paper procedures are introduced. Therefore children will always be encouraged to look at a calculation/problem and then decide which is the best method to choose - pictures, mental calculation with or without jottings/ structured recording.

The long-term aim is for children to be able to select an efficient method of their choice (whether this be mental or written) that is appropriate for a given task.
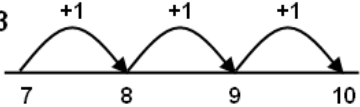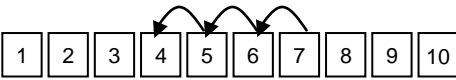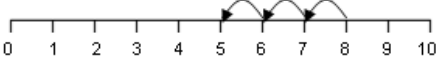
In Key Stage 1, the emphasis should be on children working mentally. Once written methods are introduced, mental skills must be kept sharp by continuing to develop and apply them with appropriate examples.
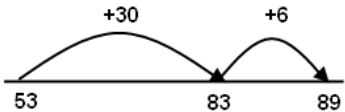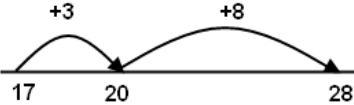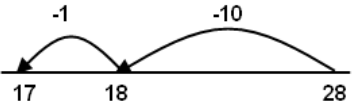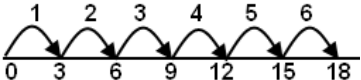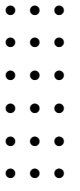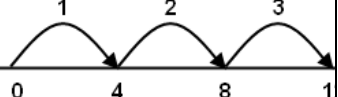
When are children ready to move to the next method?
- Skills should be fully developed and understood before moving onto the next calculation step
- Judgements will need to be made as to whether pupils possess sufficient of these skills to progress onto the next calculation step
- Children should work through the school's agreed progression
- They will be introduced to a compact standard method for each numerical operation by the end of Year 6
- This policy provides examples of the key pencil and paper procedures that will be taught at Southborough
- It has been broken down according to the operation being taught
- There are 4 sections of examples; addition steps, subtraction steps, multiplication steps division steps.

PLEASE NOTE:

1. Although the focus of the policy is on pencil and paper procedures it is important to recognise that the ability to calculate mentally lies at the heart of progression and development in mathematics. In every written method there is an element of mental processing.

2. Not all children find a compact method easy to understand. Should children feel more comfortable using an expanded method it is likely that they are not developmentally ready for the compact method and will be encouraged to use a method that they are confident and accurate with.

Year 1				
Addition	Subtraction	Multiplication	Division	Non-Negotiables
Number bonds ('story' of 5, 6, 7, 8, 9 and 10) Count on in 1s from a given 2-digit number Using empty number line to count on. 7 + 3 Add two 1-digit numbers. Add three 1-digit numbers, spotting doubles or pairs to 10. Count on in 10s from any given 2-digit number. Add 10 to any given 2-digit number. Use number facts to add 1-digit numbers to 2-digit numbers; *e.g. Use 4 + 3 to work out 24 + 3, 34 + 3* Add by putting the larger number first.	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* 7-3 = 4 8 – 3 = 5 	Begin to count in 2s, 5s and 10s. Begin to say what three 5s are by counting in 5s, or what four 2s are by counting in 2s, etc. Double numbers to 10. • • • • • • 4 x 2 • • • • • • • • 2 x 4	Begin to count in 2s, 5s and 10s. 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. *How many groups of 2 in 6?* •• •• •• = 3	Count to and across 100, forwards & backwards from any number. • Read and write numbers to 20 in numerals & words. • Read and write numbers to 100 in numerals. • Say 1 more/1 less to 100. • Count in multiples of 2, 5 & 10. • Use bonds and subtraction facts to 20. • Add & subtract: - 1 digit & 2 digit numbers to 20, including zero. • Solve one-step multiplication and division using objects, pictorial representation and arrays. • Recognise half and quarter of object, shape or quantity. • Sequence events in chronological order. • Use language of day, week, month and year. • Tell time to hour & half past.

Year 2				
Addition	Subtraction	Multiplication	Division	Non-Negotiables
Count on in 1s and 10s from any given 2-digit number. 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 partition into tens and ones and recombine on number line. 36 + 53 = 53 + 30 + 6 +30 +6 53 83 89	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. Use an empty number line to count on/back to find the difference. 28 – 17 = 11 +3 +8 17 20 28 -1 -10 17 18 28	Count in 2s, 5s and 10s. Begin to count in 3s. Begin to understand that multiplication is repeated addition. Multiplication as repeated addition using blank number line, 6 x 3 = 18 1 2 3 4 5 6 0 3 6 9 12 15 18 and to use arrays: 3 x 6 = c x r • • • • • • • • • • • • • • • • • • *e.g. 3 × 4 is three rows of 4 dots.* Begin to learn the ×2, ×3, ×5 and ×10 tables, seeing these as 'lots of' *e.g. 5 lots of 2, 6 lots of 2, 7 lots of 2.* Double numbers up to 20. Begin to double multiples of 5 to 100. Begin to double 2-digit numbers less than 50 with units digits of 1, 2, 3, 4 or 5.	Count in 2s, 5s and 10s. Begin to count in 3s. Using fingers, say where a given number is in the 2s, 5s or 10s count: *e.g. 8 is the fourth number when I count in 2s.* Relate division to grouping *e.g. How many groups of 4 in 12?* 12 ÷ 4 = 3 1 2 3 0 4 8 1 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 and of amounts (whole number answers),	Compare and order numbers up to 100 and use < > =. • Read and write all numbers to 100 in digits & words. • Say 10 more/less than any number to 100. • Count in steps of 2, 3 & 5 from zero and in 10s from any number (forwards and backwards). • Recall and use multiplication & division facts for 2, 5 & 10 tables. • Recall and use +/- facts to 20. • Derive and use related facts to 100. • Recognise place value of any 2-digit number. • Add & subtract: - 2-digit nos & ones - 2-digit nos & tens - Two 2-digit nos - Three 1-digit nos • Recognise and use inverse (+/-). • Calculate and write multiplication & division calculations using multiplication tables. • Recognise, find, name and write 1/3, 1/4, 2/4, 3/4. • Write and recognise equivalence of simple fractions. • Tell time to five minutes, including quarter past/to.

Year 3				
Addition	Subtraction	Multiplication	Division	Non-Negotiables

Use expanded column addition to add two or three 3-digit numbers or three 2-digit numbers.
Begin to use compact column addition to add numbers with 3 digits:
 	
625
+48
  13   5 + 8
  60   20 + 40
600   600 + 0
673
	Subtract 2-digit numbers from numbers > 100 by counting up *e.g. 143 – 76 is done by starting at 76. Then add 4 (80), then add 20 (100), then add 43, making the difference a total of 67.* Subtract multiples and near multiples of 10 and 100.
	
	Use counting up as an informal written strategy for subtracting pairs of 3-digit numbers *e.g. 74 -27.*
	
	(counting on)
	
	+3 +40 +4
	
	27 30 70 74
		Use partitioning (grid multiplication) to multiply 2-digit and 3-digit numbers by 'friendly' 1-digit numbers.
		
		Grid method TU x U
		
		23 x 8
		
		| x
			20	**3**

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8	160	24 |
		
		160 + 24 = 184
			Perform divisions just above the 10th multiple using horizontal or vertical jottings and understanding how to give a remainder as a whole number. Finding remainders after division
			
			1 2 3
			  →r1
			0 5 10 15 16
			
			16÷ 5 = 3r1
				Compare & order numbers up to 1,000.
				• Read & write all numbers to 1,000 in digits and words.
				• Find 10 or 100 more/less than a given number.
				• Count from 0 in multiples of 4, 8, 50 and 100.
				• Recall & use multiplication & division facts for 3, 4, 8 tables.
				• Recognise place value of any 3-digit number.
				• Add and subtract :
				   - 3-digit nos and ones
				   - 3-digit nos and tens
				   - 3-digit nos and hundreds
				• Add and subtract :
				   - Numbers with up to 3-digits using written columnar method.
				• Estimate and use inverse to check.
				• Multiply:
				   - 2-digit by 1-digit
				• Count up/down in tenths.
				• Compare and order fractions with same denominator.
				• Add and subtract fractions with same denominator with whole.
				• Tell time using 12 and 24 hour clocks and using Roman numerals.
				• Tell time to nearest minute.
				• Know number of days in each month and number of seconds in a minute.

Year 4				
Addition	Subtraction	Multiplication	Division	Non-Negotiables
Column addition for 3-digit and 4-digit numbers *e.g.* 5 3 4 7 2 2 8 6 +1 4 9 5 1 2 1 ——— 9 1 2 8	Use expanded column subtraction for 3- and 4-digit numbers: H T U 600 140 14 700 50 4 - ——————— 600 60 8	Use a vertical written method to multiply a 1-digit number by a 3-digit number (ladder method): 346 X 8 ——— 48 8 x 6 320 8 x 40 2400 8 x 300 ——— 2768 Use an efficient written method to multiply a 2-digit number by a number between 10 and 20 by partitioning (grid method): 56 x 27 <table><tr><td>x</td><td>**50**</td><td>**6**</td></tr><tr><td>**20**</td><td>1000</td><td>120</td><td>1120</td></tr><tr><td>**7**</td><td>350</td><td>42</td><td>+ 392</td></tr></table> 1512 1	Use a written method to divide a 2-digit or a 3-digit number by a 1-digit number. Give remainders as whole numbers: $256 ÷ 7 = \mathbf{36\ R4}$ 256 - 140 (20 x 7) 116 - 70 (10 x 7) 46 - 42 (6 x 7) 4	Count backwards through zero to include negative numbers. • Compare and order numbers beyond 1,000. • Compare and order numbers with up to 2 decimal places. • Read Roman numerals to 100. • Find 1,000 more/less than a given number. • Count in multiples of 6, 7, 9, 25 and 1000. • Recall and use multiplication and division fact s all tables to 12x12. • Recognise PV of any 4-digit number. • Round any number to the nearest 10, 100 or 1,000. • Round decimals with 1dp to nearest whole number. • Add and subtract : - Numbers with up to 4-digit s using written columnar method. • Multiply: - 2-digit by 1-digit - 3-digit by 1-digit • Count up/down in hundredths. • Recognise and write equivalent fractions • Add and subtract fractions with same denominator. • Read, write and convert time between analogue and digital 12 and 24 hour clocks.

Year 5				
Addition	Subtraction	Multiplication	Division	Non-Negotiables
Use column addition to add two or three whole numbers with up to 5 digits. Use column addition to add any pair of 2-place decimal numbers, including amounts of money: 24.90 + 7.25 32.15 1 1	Use compact or expanded column subtraction to subtract numbers with up to 5 digits: $\begin{array}{r} 4\ 9\ 13 \\ 5\ 0\ 3 \\ -\ 2\ 7\ 8 \\ \hline 2\ 2\ 5 \end{array}$	Use short multiplication to multiply a 1-digit number by a number with up to 4 digits. Use long multiplication to multiply 3-digit and 4-digit numbers by a number between 11 and 20. Expanded long multiplication: 56 x27 42 (7 x 6) 350 (7 x 50) 120 (20 x 6) 1000 (20 x 50) 1512 **Only when ready** move to standard method for long multiplication using 'carrying': 56 x 27 1120 392 1512 ı	Use short division to divide a number with up to 4 digits by a number ≤ 12: $\ \ 9\ 7$ $3\ \overline{|\ 2\ 9^2 1}$	Count forwards and backward with positive and negative numbers through zero. • Count forwards/backwards in steps of powers of 10 for any given number up to 1,000,000. • Compare and order numbers up to 1,000,000. • Compare and order numbers with 3 decimal places. • Read Roman numerals to 1,000. • Identify all multiples and factors, including finding all factor pairs. • Use known tables to derive other number facts. • Recall prime numbers up to 19. • Recognise and use square numbers and cube numbers. • Recognise place value of any number up to 1,000,000. • Round any number up to 1,000,000 to the nearest 10, 100, 1000, 10,000 or 100,000. • Round decimals with 2 decimal places to nearest whole number and 1 decimal place. • Add and subtract: 　- Numbers with more than 4-digits using formal written method.

				• Use rounding to check answers.
				• Multiply:
				  - 4-digits by 1-digit/ 2-digit
				• Divide:
				  - Up to 4-digits by 1-digit
				• Multiply & divide:
				  - Whole numbers & decimals by 10, 100 and 1,000
				• Recognise and use thousandths.
				• Recognise mixed numbers and improper fractions and convert from one to another.
				• Multiply proper fractions and mixed numbers by whole numbers.
				• Identify and write equivalent fractions.
				• Solve time problems using timetables and converting between different units of time.

Year 6				
Addition	Subtraction	Multiplication	Division	Non-Negotiables

Use column addition to add numbers with up to 5 digits. Use column addition to add decimal numbers with up to 3 decimal places.	Use column subtraction to subtract numbers with up to 6 digits.	Use short multiplication to multiply a 1-digit number by a number with up to 4 digits. Use long multiplication to multiply a 2-digit number by a number with up to 4 digits. Use short multiplication to multiply a 1-digit number by a number with 1 or 2 decimal places, including amounts of money.
		
		$$\begin{array}{r} 56 \\ \times 27 \\ \hline 42 \quad (7 \times 6) \\ 350 \quad (7 \times 50) \\ 120 \quad (20 \times 6) \\ 1000 \quad (20 \times 50) \\ \hline 1512 \end{array}$$
			Use short division to divide a number with up to 4 digits by a 1-digit or a 2-digit number. Use long division to divide 3-digit and 4-digit numbers by 'friendly' 2-digit numbers. Give remainders as whole numbers or as fractions or as decimals.
			
			Informal method (Chunking)
			
			$$256 \div 7 = \textbf{36 R4}$$ $$\begin{array}{r} 256 \\ - 140 \quad (2\underline{0} \times 7) \\ \hline 116 \\ - 70 \quad (1\underline{0} \times 7) \\ \hline 46 \\ - 42 \quad (\underline{6} \times 7) \\ \hline 4 \end{array}$$
			
			Formal method (long division)
			
			$$\begin{array}{r} \quad\quad 2 \quad 8 \quad r\,12 \\ 1\ 5\,\overline{)\ 4\ 3\ 2} \\ 3\ 0\ 0 \\ \hline 1\ 3\ 2 \\ 1\ 2\ 0 \\ \hline 1\ 2 \end{array}$$
				Use negative numbers in context and calculate intervals across zero.
				• Compare and order numbers up to 10,000,000.
				• Identify common factors, common multiples and prime numbers.
				• Round any whole number to a required degree of accuracy.
				• Identify the value of each digit to 3 decimal places.
				• Use knowledge of order of operations to carry out calculations involving four operations.
				• Multiply:
				   - 4-digit by 2-digit
				• Divide:
				   - 4-digit by 2-digit
				• Add and subtract fractions with different denominators and mixed numbers.
				• Multiply simple pairs of proper fractions, writing the answer in the simplest form.
				• Divide proper fractions by whole numbers.
				• Calculate % of whole number.