Mathematics Calculation Policy

Date: November 2018
Review: Date: November 2019

Sarum Hall School

- This policy contains the key mental and written procedures that are to be taught in KS1 and KS2 at Sarum Hall School. It has been written to ensure consistency and progression throughout the school. Procedures already introduced in the Early Years are also included.
- The main focus of this policy is on pencil and paper procedures however, it is important to recognise that the ability to calculate mentally lies at the heart of numeracy. Mental calculation is complimentary to written recording as every written method requires some mental processing.
- Each new method is specified for a particular year group however children should not be discouraged from using previously taught methods while they become secure with new concepts.
- Ultimately children should be able to select an efficient method that is appropriate for a given problem.
- This policy has been updated to reflect the changes required for the new National Curriculum maths programmes of study.

| Addition	Subtraction	Multiplication	Division
Number lines (numbered) Nursery / Reception 5 + 2 0 1 2 3 4 5 6 7 8 9 10 Recording by drawing jumps on prepared lines. Teacher models number lines with missing numbers. **+ = signs and missing numbers** Reception 3 + 4 = 3 + = 7 + 4 = 7	**Number lines (numbered)** Reception 6 – 4 (Counting back) 0 1 2 3 4 5 6 7 8 9 10 **Pictures/Marks** Reception Jessica spent 3p what change did she get from 10p? … …….	Nursery / Reception Counting in 2s	Nursery / Reception Sharing

Year 1

Addition	Subtraction	Multiplication	Division

Count to and across **100**, forwards and backwards, beginning with 0 or 1, or from any given number
 	
Number lines (numbered)
 	
7 + 5
 	
0 1 2 3 4 5 6 7 8 9 10 11 12
 	
Recording by drawing jumps on prepared lines.
 	
Teacher models number lines with missing numbers.
 	
+ = signs and missing numbers
 	
3 + 4 =
3 +   = 7
  + 4 = 7
  +   = 7
 	
Teacher models number lines with missing numbers
 	
(Teacher models jottings appropriate for larger numbers)
	Number lines (numbered)
	11 – 7
	(Counting back)
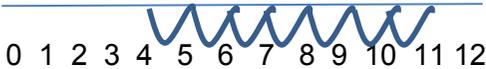	
	0 1 2 3 4 5 6 7 8 9 10 11 12
	
	The difference between 7 and 11
	(Counting up)
	
	0 1 2 3 4 5 6 7 8 9 10 11 12
	
	Recording by
	- drawing jumps on prepared lines
	- constructing own lines.
	
	Pictures/Marks
	Jessica spent 4p what change did she get from 10p?
	
	. . . .
	
	(Teacher models jottings appropriate for larger numbers)
		Counting in 2s, 5s, 10s
		
		Learning Tables
		2, 5 and 10 times tables reciting (using fingers) up to 12x.
		
		Pictures and symbols
		There are two sweets in one bag. How many sweets are there in 5 bags?
		
		Use of objects, pictures, tables.
		
		Arrays
		
		2 x 5 or 5 x 2
			Pictures and symbols
			12 children get into teams of 2 to play a game. How many teams are there?
			
			Halving even numbers to 10 by sharing.

Addition	Subtraction	Multiplication	Division

Use concrete objects and pictorial representations, as in Y1, to add **Partition into tens and ones and recombine**
 	
12 + 23 = 10 + 2 + 20 + 3
     = 30 + 5
     = 35
 	
(For the more able refine to partitioning the second number only and use a number line if necessary.)
 	
23 + 12 = 23 + 10 + 2
     = 33 + 2
     = 35
 	
+ 10   +2
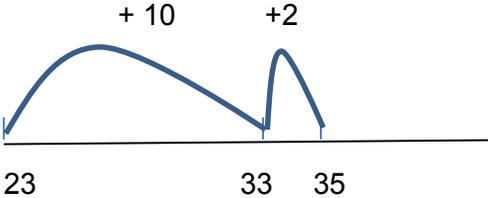 	
23   33 35
	Use concrete objects and pictorial representations, as in Y1, to subtract **Find a *small* difference by counting up**
	
	42 – 39 = 3
	
	+1 +2
	
	39 40 42
	
	Subtract 9 or 11 by subtracting 10 and adjusting by 1
	
	35 – 9
	
	+1
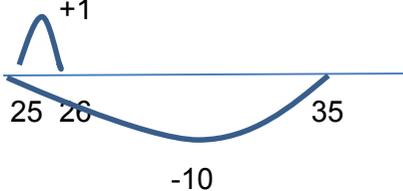	
	25 26 35
	-10
	
	Similarly begin to subtract 19 or 21.
	
	Use known number facts and place value to subtract
	(For the more able, partition second number only).
	37 – 12 = 37 – 10 – 2
	     = 27 – 2
	     = 25
		Counting in 2s, 3s, 4s, 5s and 10s
		Learning Tables
		2, 3, 4, 5 and 10 times tables
		
		x = signs and missing numbers
		
		7 x 2 = = 2 x 7
		7 x = 14 14 = x 7
		  x 2 = 14 14 = 2 x
		  x = 14 14 = x
		
		Arrays and repeated addition
		
		2 x 4 or 4 x 2
		or 4 + 4 or 2 + 2 + 2 + 2
		
		Commutativity
		Show that multiplication of two numbers can be done in any order (commutative)
		e.g. 2 x 4 = 4 x 2
			Understand division as sharing and grouping
			
			Sharing: 6 sweets are shared between 2 people. How many do they have each?
			
			Grouping: There are 6 sweets. How many people can have 2 each? (How many 2s make 6?)
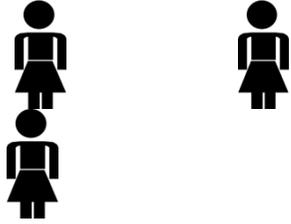			
			÷ = signs and missing numbers
			
			6 ÷ 2 = = 6 ÷ 2
			6 ÷ = 3 3 = 6 ÷
			  ÷ 2 = 3 3 = ÷ 2
			  ÷ = 3 3 = ÷

Add 9 or 11 by adding 10 and adjusting by 1

35 + 9 = 44

35

+10

44   45
    -1
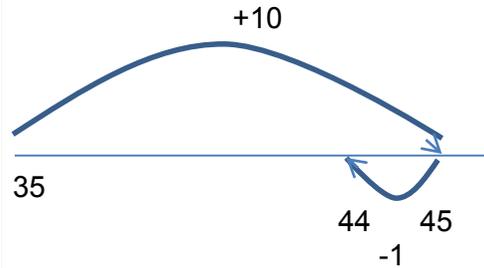
Similarly add 19 or 21 by adding 20 and adjusting.

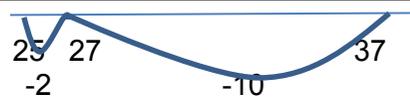**+ = signs and missing numbers**
Continue using a range of equations as in Y1 but with appropriate larger numbers.
Extend to:
14 + 5 = 10 +

Commutativity
Show that addition of two numbers can be done in any order (commutative) e.g. 3+5 = 5+3

25   27   37
-2   -10

- = signs and missing numbers
Continue using a range of equations as in Y1 but with appropriate larger numbers.
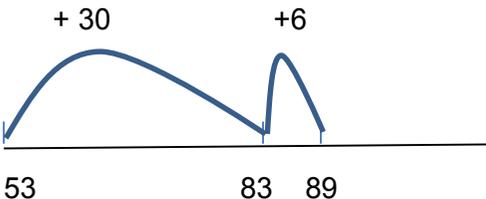Extend to
14 + 5 = 20 –

Commutativity
Show that order matters in subtraction (not commutative) e.g. 5 -3 ≠ 3 -5

Commutativity
Show that order matters in division (not commutative) e.g. 6 ÷3 ≠ 3 ÷6

Addition	Subtraction	Multiplication	Division

Read and write numbers to at least 1000 in numerals and in words
Partition into tens and ones and recombine
Partition both numbers and recombine.
Refine to partitioning the second number only :
 	
36 + 53 = 53 + 30 + 6
     = 83 + 6
     = 89
 	
  + 30   +6
 	
53   83 89
 	
Mental method
57 + 62 =119
 	
  50 + 7
+ 60 + 2
  110 + 9 = 119
Extend to 3digit + 3digit numbers
	Find a *small* difference by counting up
	Continue as in Y2 but with appropriate larger numbers.
	103 – 98 = 5
	
	Subtract mentally a near multiple of 10 and adjust.
	Continue as in Y2 but with appropriate larger numbers:
	
	87 – 49 = 87 – 50 + 1
	     = 38
	
	Use known number facts and place value to subtract
	Continue as in Y2 but with appropriate larger numbers:
	87 – 15 = 87 – 10 – 5
	     = 77 – 5
	     = 72
	Use of number line if needed.
	
	Paper and pencil procedures
	Complementary addition
	74 – 46 = 28
	
	 +4 + 20 +4
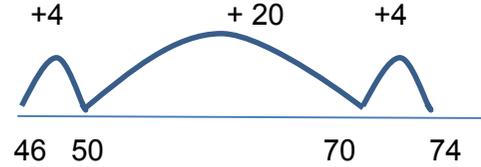	
	46 50 70 74
		Learning Tables
		All times tables up to 12 x 12.
		
		x = signs and missing numbers
		Continue as in Y2 but with appropriate numbers.
		
		Arrays
		Continue as in Y2 but with appropriate numbers.
		
		Doubling multiples of 5 up to 50
		
		35 x 2 = 70
		
		35 x 2 =
		
		 60 + 10 = 70
		
		0r
		
		| x
			30	5
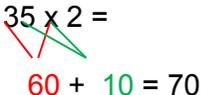
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2	60	10	70 **Use known number facts and place value to carry out simple multiplications** Partitioning as above: 42 x 3 =126	**Understand division as sharing and grouping** Continue as in Y2 but with appropriate numbers. **Remainders** 16 ÷ 3 = 5r1 Sharing: 16 shared between 3, how many left over? Grouping: How many 3s make 16, how many left over? **Paper and pencil procedures** Formal written method for short division with exact answer solutino. (Divisor ≤ 12, up to 3÷1 digit). 64 ÷ 4 16 4 l 64 **÷ = signs and missing numbers** Continue as in Y2 but with appropriate numbers. Application of times tables facts to division.

Paper and pencil procedures
57 + 62 =119
 	
   57
+ 62
 119
  1
 	
Add a near multiple of 10 to a two-digit number
Continue as in Y2 but with appropriate numbers
64 + 19 = 64 + 20 – 1
      = 84 -1
      = 83
 	
+ = signs and missing numbers
Continue using a range of equations as in Y1 and Y2 but with appropriate larger numbers.
	Column method
	
	75 – 56
	   ⁶ ¹
	   7̸5
	 - 57
	  18
	
	- = signs and missing numbers
	Continue using a range of equations as in Y1 and Y2 but with appropriate larger numbers.
		X 40 2
		3 120 6
		
		42 x 3 = 120 + 6
		     = 126
		
		Paper and pencil procedures
		2x1 digit multiplication
		
		   42
		x 3
		    6 (2x3)
		+ 120 (40x3)
		  126
		
		Later in the year
		Prep for Short multiplication
		53 x 7
		
		   5 3
		x 7
		  3 7 1
		   2	

The table for the multiplication grid:

X	40	2
3	120	6

Addition	Subtraction	Multiplication	Division

Partition into hundreds, tens and ones and recombine
Continue/extend method from Y3.
Mostly a mental method by Y4.
 	
Add a near multiple of 10 or 100 then adjust
Continue/extend method from Y3.
Mostly a mental method by Y4.
 	
+ = signs and missing numbers
Continue using a range of equations as in Y1 to Y3 but with appropriate numbers.
 	
Paper and pencil procedures
478 + 83
 	
Partitioning as above or compact column method
 	
   4 7 8
 +   8 3
   5 6 1
   1 1
 	
(Or carries underneath see below.)
Extend to 4 digit numbers.
 	
Extend to decimals in the context of money.
	Count backwards through zero to include negative numbers
	
	Find a *small* difference by counting up
	Continue as in Y3 but with appropriate larger numbers. Mostly a mental method by Y4.
	4003 – 3997 = 6
	
	Subtract a near multiple of 10 or 100 then adjust
	Continue/extend method from Y3.
	Mostly a mental method by Y4.
	
	Use known number facts and place value to subtract
	Continue as in Y3 but with appropriate larger numbers:
	387 –135 = 387 - 100 – 30 – 5
	         = 287 – 30 – 5
	         = 257 – 5
	         = 252
	Use of number line if needed.
	
	Paper and pencil procedures
	Complementary addition
	754 – 76 = 678
	
	 + 24 + 600 + 54
	
	76 100 700 754
		Learning Tables
		Continue to practise all times tables up to 12 x 12.
		
		Extending multiplication
		Use factor pairs and commutative law as in Y3.
		Multiply together three numbers e.g. 4x3x2 = 12 x2 =24
		
		x = signs and missing numbers
		Continue as in Y3 but with appropriate numbers.
		
		Paper and pencil procedures
		Long multiplication
		Beginning 2x1 digit multiplication
		42 x 3
		
		    42
		x 3
		    6 (2x3)
		+ 120 (40x3)
		  126
		
		Later introduction to 2x2 digit multiplication
		   24
		x 13
		  72
		+ 240
		 312
		1
			Understand division as sharing and grouping
			Continue as in Y3 but with appropriate numbers.
			
			Remainders
			16 ÷ 3 = 5r1
			Sharing: 16 shared between 3, how many left over?
			Grouping: How many 3s make 16, how many left over?
			
			÷ = signs and missing numbers
			Continue as in Y3 but with appropriate numbers.
			Application of times tables facts to division.
			
			Paper and pencil procedures
			Formal written method for short division with no remainders. (Divisor ≤ 12 upto 4÷1 digit).
			464 ÷ 4
			
			   116
			4 ⌐ 464

£2.50 + £1.75 $\quad$ £2.50 $+$ £1.75 $\quad$ £4.25 $\qquad$ 1 **+ = signs and missing numbers** Continue using a range of equations as in Y1 to Y3 but with appropriate larger numbers.	Compact column method 754 – 86 $\quad$ 6 6 1 $\quad$ 7 5 4 $-$ $\quad$ 8 6 $\quad$ 6 6 8 Extend to 4 digit numbers. Extend to decimals in the context of money. As in the case for zeros: 4000 – 2344 Ensure children are writing one digit per square. (up to 4 x 4 digits – Term 1) $\quad$ 3 9 9 1 $\quad$ 4 0 0 0 $-$ $\quad$ 2 3 4 4 $\quad$ 1 6 5 6 **- = signs and missing numbers** Continue using a range of equations as in Y1 to Y3 but with appropriate larger numbers.	Short multiplication 153 x 7 $\quad$ 1 5 3 x $\quad$ 7 $\quad$ 1 0 7 1 $\qquad$ 3 2 Extend to decimal x 1-digit whole (up to 3dp) 28.6 x 3 $\quad$ 28.6 x $\quad$ 3 $\quad$ 85.8 $\qquad$ 21	

Year 5

Addition	Subtraction	Multiplication	Division

Numbers to 1 000 000
Continue using partitioning and near multiples of 10, 100 etc. as in previous years, mostly as mental methods. Extend to adding 0.9, 2.9 etc.
 	
Mental method to add several small (1 or 2 digit) numbers using pairs to make 10, doubles or near doubles, multiples of numbers etc.
 	
+ = signs and missing numbers
Continue using a range of equations as in previous years but with appropriate numbers.
 	
Paper and pencil procedures
Compact column method:
Extended to large numbers up to millions.
45867 + 32192
 	
   45867
 + 32192
   78059
    11
 	
Extended to sum of three or more numbers.
	Numbers to 1,000,000
	Continue using small differences, near multiples, place value and complementary addition as in previous years, mostly as mental methods.
	
	Paper and pencil procedures
	Compact column method:
	Extended to large numbers up to millions.
	Extended to decimals up to 3 d.p with the same number of decimal places.
	
	148.42 - 32.713
	
	     7 111
	  148.420
	- 32.713
	  115.707
	
	- = signs and missing numbers
	Continue using a range of equations as in previous years but with appropriate numbers.
		x = signs and missing numbers
		Continue as in previous years but with appropriate numbers.
		
		Multiply numbers by 10, 100 and 1000 giving answers up to three decimal places
		
		Arrays
		Continue as in Y4 but with appropriate numbers. Application to factors.
		
		Near multiples
		£3.99 x 4
		Round to nearest pound and adjust.
		£3.99 x 4 = £4.00 x 4 – £0.04
		           = £16.00 - £0.04
		           = £15.96
		
		Partition
		Mental method as in Y4.
		
		Paper and pencil procedures
		Short multiplication as in Y4.
		1153 x 7
		
		    1 1 5 3
		x 7
		   2 0 7 1
		   1 3 2
			Understand division as sharing and grouping
			Continue as in Y4 with appropriate numbers and including remainders.
			Divide numbers by 10, 100 and 1000 giving answers up to three decimal places
			
			÷ = signs and missing numbers
			Continue as in Y4 with appropriate numbers.
			Application of times tables facts to division.
			
			Paper and pencil procedures
			Formal written method for short division.
			Extend to division of a 4-digit number by a 1 digit number.
			Extend to division by a 2-digit integer greater than 12.
			164 ÷13
			
			     1 2 r 7
			       ³
			13⌐1 6 3
			
			Extension of short division to division of a decimal number by an integer.
			
			£135 is shared equally between 4 people. How much does each person receive?

| Add numbers up to three decimal places (3d.p.)
28.65 + 12.172

  28.650 (0 as a place holder)
+ <u>12.172</u>
  <u>40.822</u>

Model use of number line to add negative numbers. | | **Long multiplication**
Ensure children are writing one digit per square. Carrying is kept separate from the question but crossed out as the carrying is being added (up to 3 x 2 digits – Term 1)

  132 x 24

     132   1̶
x   <u>24</u>
     528   1̶
+ <u>2640</u>
  <u>3168</u>
  1

Extend to long multiplication involving decimals. Same technique as above, however at the end of the calculation count how many numbers to the right of the 2 decimal points in the questions and count back in the final answer to place decimal point (up to 3 x 2 digits- Term 1)

e.g 4.32 x 3.2 = 13.824

      4.32
  X   <u>3.2</u>
    8 6 4   1̶ 1̶
+ <u>1 2 9 6 0</u>
  1 3. 8 2 4 | <u>0 3 3 . 7 5</u>
¯I   ₁₁ ₃ ₂
4 I 1 3 5 . 0 0

£33.75 each
Rounding up or down in context.
Extend to three decimal places (3d.p.)
Model method for long division. |

Year 6

Addition	Subtraction	Multiplication	Division

Numbers to 10 000 000
Continue using partitioning and near multiples of 10, 100 etc. as in previous years, mostly as mental methods.
 	
Mental method to add several small (1 or 2 digit) numbers using pairs to make 10, doubles or near doubles, multiples of numbers etc.
 	
+, -, x, ÷ , = signs and missing numbers
Continue using a range of equations as in previous years but with mixed operations, e.g.
(4 +   ) x 3 = 5 x 8 - 10
BODMAS
 	
Paper and pencil procedures
Compact column method:
Extended to large numbers up to tens of millions.
Extended to decimals up to 3d.p.
Extended to sum of three or more numbers.
 	
45867 + 32192
 	
   45867
 + 32192
   78059
    11
	Continue using small differences, near multiples, place value and complementary addition as in previous years applied to larger numbers, mostly as mental methods.
	
	+, -, x, ÷ , = signs and missing numbers
	Continue using a range of equations as in previous years with mixed operations, e.g.
	(4 +) x 3 = 5 x 8 – 10
	BODMAS
	
	Paper and pencil procedures
	Compact column method:
	Extended to large numbers up to millions.
	Extended to decimals up to 3d.p.
	
	148.42 - 32.713
	
	   7 111
	  148.420
	- 32.713
	  115.707
		Partition and near multiples
		Mental methods as in Y5.
		
		+, -, x, ÷ , = signs and missing numbers
		Continue using a range of equations as in previous years with mixed operations, e.g.
		(4 +) x 3 = 5 x 8 - 10
		BODMAS
		
		Paper and pencil procedures
		Short multiplication as in Y5.
		153 x 7
		
		   1 5 3
		x 7
		  1 0 7 1
		   3 2
		
		Formal method for long multiplication as in Y5.
		132 x 24
		
		   132 1
		x 24
		   528 1
		+ 2640
		  3168
		  1
		
		Decimal x decimal as in Y5.
		
		e.g 4.32 x 3.2 = 13.824
			+, -, x, ÷ , = signs and missing numbers
			Continue using a range of equations as in previous years with mixed operations, e.g.
			(4 +) x 3 = 5 x 8 - 10
			BODMAS
			
			Paper and pencil procedures
			Continue using all methods from Y5.
			Extend to formal method of long division using division of a four-digit whole number by a two-digit whole number.
			
			1092 ÷ 28
			
			      39 r 3
			28 I 1 0 9 5
			- 8 4 0 (28 x 30)
			    2 5 5
			- 2 5 2 (28 x 9)
			      3
			
			Remainders to be treated in context as in Y5
			
			Use of improper fraction and cancelling to simplify division by large numbers in context.
			e.g. A box holds 36 jars of coffee. How many boxes would be needed to hold 4833 jars?
			4833 (cancel by 9) = 537 = 134r1
			 36 4

Model use of number line to add negative numbers.		$$\begin{array}{r} 4.32 \\ \times\ \ 3.2 \\ \hline 8\ 6\ 4 \\ +\ 1\ 2\ 9\ 6\ 0 \\ \hline 1\ 3.8\ 2\ 4 \end{array}$$ 1 1	135 boxes Associate a fraction with division and calculate decimal fraction equivalents e.g. 3/8 $$\begin{array}{r} 0.\ 3\ 7\ 5 \\ \hline 8\ |\ 3.\ ^3 0\ ^6 0\ ^4 0 \end{array}$$ 3/8 = 0.375

Linked guidance, policies and procedures:

Keeping Children Safe in Education (KCSIE) statutory guidance

Working_together_to_safeguard_children.pdf

Relevant school policies:

Keeping Children Safe in Education, Child protection Policy and Code of Conduct.
Mathematics policy