Calculations

Policy

Date of Policy: **Spring 2013**

Person(s) Responsible for Policy: **Maths Subject Leader**

Committee Responsible: **C&S**

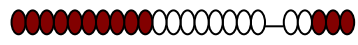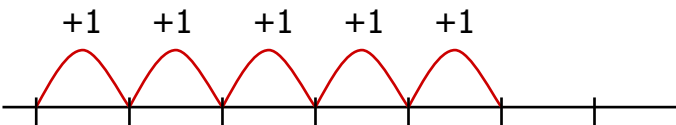Term of Review: **Spring 2014**

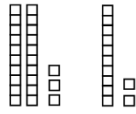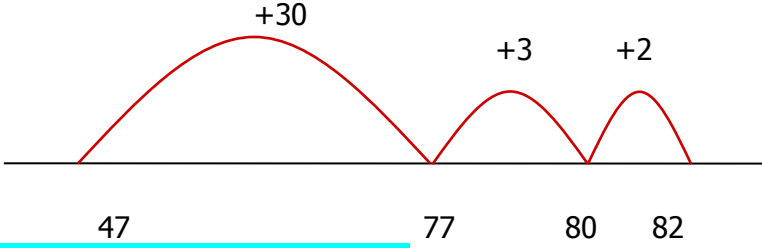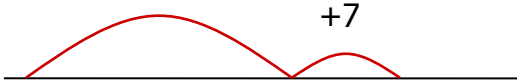# Swindon Village Primary School
Maths Calculations Policy

• This policy contains the key pencil and paper procedures that are to be taught throughout the school. It has been written to ensure consistency and progression throughout the school

• Although the main focus of this policy is on pencil and paper procedures it is important to recognise that the ability to calculate mentally lies at the heart of maths

• Mental calculation is not at the exclusion of written recording and should be seen as complementary to and not as separate from it. In every written method there is an element of mental processing

• Written recording both helps children to clarify their thinking and supports and extends the development of more fluent and sophisticated mental strategies

• Although each method will be taught in the year group specified, children should not be discouraged from using previously taught methods with which they are secure, while the new concepts are becoming embedded

• The long-term aim is for children to be able to select an efficient method of their choice that is appropriate for a given task. They should do this by always asking themselves:

• 'Can I do this in my head?'

• 'Can I do this in my head using drawings or jottings?'

• 'Do I need to use a written method?'

Additionally, children are encouraged to adopt the 4 B's: Brain, Book, Buddy and Boss

Addition

The mental methods that lead to column addition generally involve partitioning, e.g. adding the tens and units separately, often starting with the tens as this is the larger part of the number. They can also include the use of number lines, tracks and squares for counting on.

Year Group	Progression Methods
R *Practical/recorded using ICT (eg digital photos/pictures on IWB)* **Age related expectations:** Addition as 'combining 2 groups'	**1. Pictures / Objects** I eat 2 cakes and my friend eats 3. How many cakes did we eat altogether? *Might be recorded as: 2 + 3 = 5* **2. Symbols** 8 people are on the bus. 5 more get on at the next stop. How many people are on the bus now? ❘❘❘❘❘❘❘❘ ❘❘❘❘❘ [Might be recorded as: *8 + 5 = 13*]
1 *Practical/recorded using ICT. Year 1 children will also build upon pictures and symbol methods mentioned above* **Age related expectations:** Addition as counting on U+U and TU+U (bridging 20)	**1. Number track / Number line – jumps of 1** (modelled using bead strings) 18 + 5 = 23 +1 +1 +1 +1 +1 **2. Partitioning** 35 + 47 40 + 30 = 70 7 + 5 = 12

2 *Picture/Symbols, number lines and partitioning* **Age related expectations:** TU+TU (bridging 10s and 100s)	**1. Pictures / Symbols POT (Partition Ones Tens)** 23 + 12 = 35 (without crossing ten boundaries) 28 + 17 = 45 **POET (Partition Ones EXCHANGE Tens)** (crossing ten boundaries) **2. Number line – jumps in 10s and 1s** 35 + 47 +30 +3 +2 47 77 80 82 [Also jumps can be in 10s and 1s] **3. No number line** 35 + 47 47 + 30 = 77 77 + 3 = 80 80 2 = 82 **4. Partitioning** 35 + 47 40 + 30 = 70 7 + 5 = 12
3 *Number lines, partitioning and expanded vertical method and compact method* **Age related expectations:** TU + TU (bridging 100) HTU + TU	**1. Number line** 57 + 285 = 342 +50 +7 285 335 342 **2. Partitioning**

(not bridging 1000) HTU + HTU (not bridging 1000)	57 + 285 $200 + 0 = 200$ $80 + 50 = 130$ $5 + 7 = 12$ **3. Expanded vertical** 336 + 87 = 423 300 and 30 and 6 + 80 and 7 _____ 300 and 110 and 13 **4. Compact vertical** 374 $+$ 248 ——— 622 1 1
4 *Number lines,* *partitioning and* *compact method* **Age related** **expectations:** HTU + TU HTU + HTU (incl bridging 1000) Decimals: money (£7.85 + £3.49)	**1. Number line** 374 + 248 = +200 +40 +8 374 574 614 622 **2. No number line** 374 + 248 374 + 200 = 574 574 + 40 = 614 614 + 8 = 622 **3. Partitioning** 374 + 248 $300 + 200 = 500$ $70 + 40 = 110$ $4 + 8 = 12$
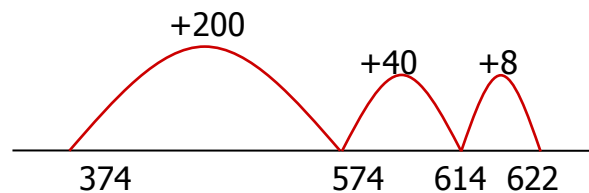
4. Compact vertical

```
   374
 + 248
 ─────
   622
   1 1
```

5. Decimals: money

Introduce process with decimals (to 1 d.p. moving to 2 d.p.)

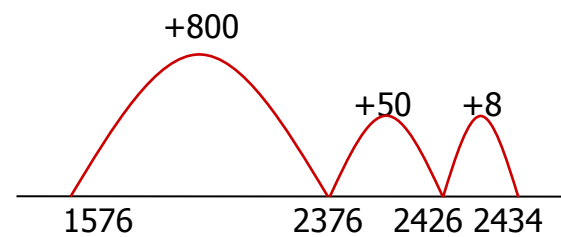£6.72 + £8.56 + £2.33 exchanging of both tenths and hundredths

5
 	
Number lines, partitioning and compact method
 	
Age related expectations:
ThHTU + HTU
 	
Decimals up to 2dp (23.7 + 48.56)
	1. Number line
	
	1576 + 858 =
	
	2. Partitioning
	
	1576 + 858
	
	1000 + 0 = 1000
	  500 + 800 = 1300
	   70 + 50 = 120
	    6 + 8 = 14
	
	3. Compact vertical
	
	  23.70
	+ 48.56
	─────
	  72.26
	─────
	  1 1

For the number line: +800 (1576 → 2376), +50 (2376 → 2426), +8 (2426 → 2434)

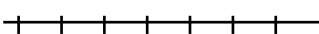|	
6 *Number lines, partitioning and compact method* **Age related expectations:** *Consolidate / extend Y5 including:* Three numbers Decimals up to 3dp (context: measures	**1. Compact vertical** $$\begin{array}{r} 3.243 \\ +\ 18.070 \\ \hline 21.313 \\ \hline 1\quad1 \end{array}$$
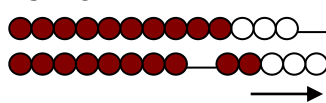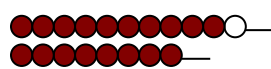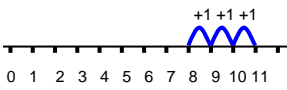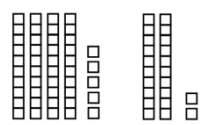
Subtraction

Mental methods should involve counting back in single digit numbers, leading onto counting back in multiples of 10, possibly using a number square. Children find subtraction difficult particularly when they are introduced to column methods at an early stage when they are not ready for it. With continued practise and reinforcement, children will become very comfortable using counting on methods on a number line.

Year Group	Progression Methods
R *Practical/recorded using ICT (eg digital photos/pictures on IWB)* **Age related expectations:** Subtraction as 'taking away' from a group	**1. Pictures / Objects** I have five cakes. I eat two of them. How many do I have left? Might be recorded as: *5 – 2 = 3* **2. Symbols** Mum baked 9 biscuits. I ate 5. How many were left? [Might be recorded as: *9 – 5 = 4*]
1 *Practical/recorded using ICT. Taking away and counting on* **Age related expectations:** Subtraction as 'taking away' and 'difference' (by counting on) U – U TU – U (bridging 10)	**1. Taking away – jumps of 1** (modelled using bead strings) 13 – 5 =8 -1 -1 -1 -1 -1 8 9 10 11 12 13 **2. Counting on – jumps of 1** (modelled using bead strings) 11 – 8 = 3 +1 +1 +1 0 1 2 3 4 5 6 7 8 9 10 11
2 *Pictures/symbols, number lines, partitioning* **Age related expectations:**	**1. Pictures / Symbols** 45 – 22 = 23

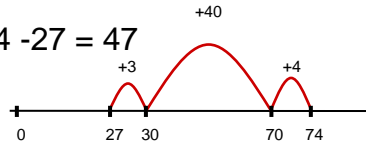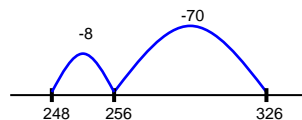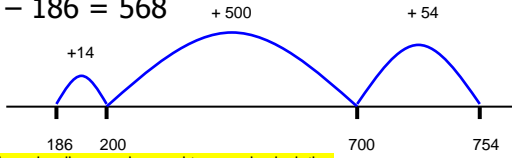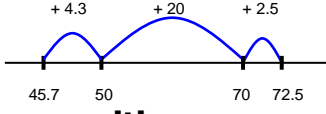| Subtraction as inverse of addition TU – TU (bridging 10s)	**2. Number lines - taking away** 74 -27 = 47 −3 −4 −20 47 50 54 74 [Also jumps can be in 10s and 1s] **3. Partitioning** 74 - 27 74 − 20 = 54 54 − 4 = 50 50 − 3 = 47 **4. Number lines – counting on** 74 -27 = 47 +40 +3 +4 0 27 30 70 74 [Also jumps can be in 10s and 1s]
3 *Pictures/symbols, number lines and decomposition* **Age related expectations:** TU – TU HTU – TU HTU – HTU	**1. Pictures / Symbols** 45 – 22 = 23 **2. Number line – counting on** 141 - 89 = 52 +41 +11 89 100 141 **3. Number line - taking away** 326 – 78 = 248 -70 -8 248 256 326 Vertical number line may be used to record calculation
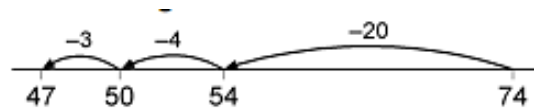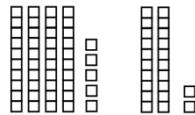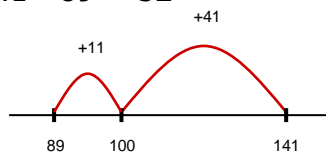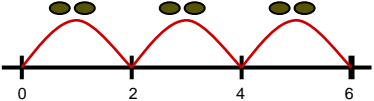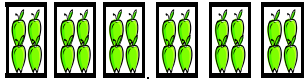
4. Decomposition

272 − 48 = 224
[**Red Alert**]

```
  200   70    2
-        40    8
  200   60   12
         40    8
  200   20    4
```

5. Decomposition
(compact method)

```
  6 13 11
  7 4 1
- 3 6 7
  3 7 4
```

4	1. Number lines – counting on
Number lines, partitioning, and decomposition **Age related expectations:** HTU – TU HTU – HTU Decimals: money (£7.85 - £3.49)	754 − 186 = 568 +14 + 500 + 54 186 200 700 754 Vertical number line may be used to record calculation **2. Partitioning** 754 - 186 754 − 100 = 654 654 − 80 = 574 574 − 6 = 568 **3. Decomposition** (compact method) 72.5 − 45.7 6 7 11 2 15 − 4 5. 7 2 6. 8
5	1. Number lines – counting on
Counting on and decomposition and selecting a written method for efficiency **Age related expectations:** ThHTU – HTU Decimals up to 2dp	72.5 − 45.7 = 26.8 + 4.3 + 20 + 2.5 45.7 50 70 72.5 **2. Decomposition** (compact method)

(72.5 – 45.7)	72.5 – 45.7
	
	    ⁶7̶ ¹¹2̶. ¹5
	 – 4 5. 7
	     2 6. 8
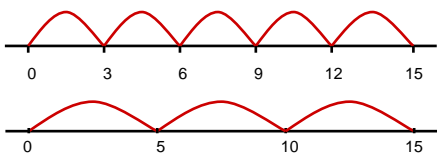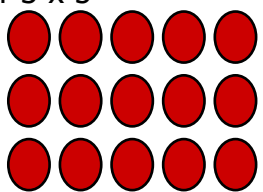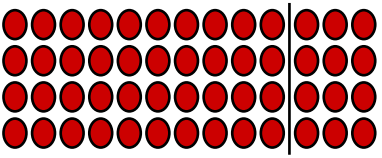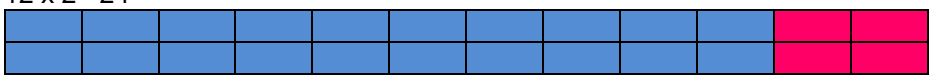
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Age related expectations: *Consolidate and extend. Y5 methods including decimals up to 3d.p relating to measures*
	1. Recognise when one written method is more efficient. (***See Y5 methods of recording***)
	
	  ➤ There was 2.5 litres in the jug. Stuart drank 385 ml. How much was left?
	  ➤ 18.07 km – 3.243 km

Multiplication

Early stages of multiplication will focus on groups and sets, leading onto the learning of multiplication tables facts up to 12 x 12. Most children should have a secure knowledge of **_all multiplication facts by the end of Year 4._**

The next stage is to learn how to multiply a 2-digit number by a 1-digit number. To do this, children will need to be able to partition the 2-digit number and multiply both the tens and the units part separately. This can be done using the grid method as shown below.

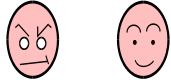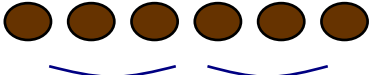| Year Group	Progression Methods
R *Practical/recorded using ICT (eg digital photos/pictures on IWB) pictures, objects and symbols* **Age related expectations:** Count repeated groups of the same size (1s, 2s and 10s)	**1. Pictures / Objects** 3 plates, 2 cakes on each plate: **2. Symbols** 3 plates, 2 cakes on each plate:
1 *Practical/recorded using ICT/ pictures, symbols and number tracks* **Age related expectations:** Solve practical problems that involve combining groups of 2, 5 or 10	**1. Pictures / Symbols** There are three sweets in one bag. How many sweets are there in five bags? **2. Number tracks / Number line** (modelled using bead strings) **2** x 3 **or** 3 x **2** [two, three times] or [three groups of two]
2 *Pictures, symbols, repeated addition and arrays* **Age related expectations:** Multiplication as repeated addition and arrays	**1. Pictures / Symbols** There are four apples in each box. How many apples in six boxes
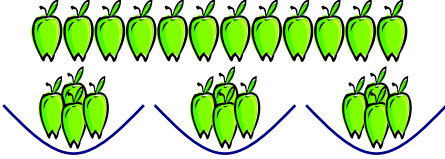
2. Repeated addition

5 x 3 or 3 x 5

3. Arrays

5 x 3 or 3 x 5

Also **14 x 2** as (10 x 2 and 4 x 2)

3 *Building upon Y2 methods and partitioning* **Age related expectations:** TU x U (eg. 13 x 4)	**1. Arrays** 13 x 4 10 x 4 = 40 3 x 4 = 12 Can be drawn as a grid to extend the children's knowledge- moving towards compact grid method 12 x 2= 24 **2. Partitioning** 43 x 6 (estimate: 40 x 6 = 240) 40 x 6 = 240 – note:there should be some relation to times tables knowledge eg 4x6=24 leads to 40x6 =240 – pattern spotting 3 x 6 = 18
4 *Building upon Y3 methods of arrays and partitioning, including grid method and vertical methods* **Age related expectations:**	**1. Compact grid method** 43 x 6

TU x U (eg. 16 x 8; 43 x 6)	**2. Expanded vertical**
	
	   43
	x 6
	
	  18 (3 x 6)
	240 (40 x 6)
	
	258
	
	3. Grid method
	47 × 36
	(estimate: 50 × 40 = 2000)
	
		×	40	7	

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30	1200	210	1410
6	240	42	282
			1692	
5 *Building upon Y4 methods of partitioning, grid method and expanded vertical. Also, using grid method and compact vertical method* **Age related expectations:** **Refine and use efficient methods:** HTU x U TU x TU U.t x U	**1. Grid method –** **really important to emphasise the estimation first to get an approximate answer to check final answer against** 5.65 × 9 (estimate: 6 × 9 = 54) | ×	5	0.6	0.05	
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9	45	5.4	0.45	50.85	 Answer: 5.65 × 9 = 50.85 **2. Compact Vertical** 4.7 × 8 (estimate: 5 × 8 = 40) 4.7 × 8 37.6 5
6 *To use compact vertical method* **Age related expectations:** **use efficient methods:** Integer x U	**1. Compact Vertical- multiply by units then tens**

(eg 2307 x 8)
Decimal x U
 (eg 31.6 x 7)
TU x TU
HTU x TU
	256 × 18
	
	(estimate: 250 × 20 = 5000)
	
	    256
	X 18
	 2048
	 2560
	 4608
	   1
	
	Answer: $256 \times 18 = 4608$

Division

Using written methods for division can be the most difficult for children. Early mental approaches should involve grouping and sharing. Discussing the sharing out of sweets is an example. When there are some left over, the term remainder can be introduced.

Year Group	Progression Methods
R *Practical/recorded using ICT (eg digital photos/pictures on IWB) pictures, objects and symbols* **Age related expectations:** Share objects into equal groups and count how many in each group	**1. Pictures / Objects** 6 cakes shared between 2 6 cakes put into groups of 2 **2. Symbols** 6 cakes shared between 2
1 *Practical/recorded using ICT. (Pictures on IWB) pictures, objects and symbols* **Age related expectations:** Solve practical problems that involve sharing into groups	**1. Pictures / Symbols** How many apples in each bowl if I share 12 apples between 3 bowls?

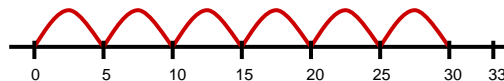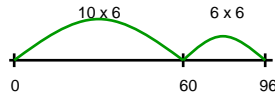|	
2 *Pictures, symbols, number lines, arrays and partitioning* **Age related expectations:** Division and sharing and grouping including remainders TU ÷ U (where divisor is 2, 5 or 10) **3** *Y3 build upon the Y2 methods* **Age related expectations:** TU ÷ U (where divisor is 2, 3, 4, 5, 6 or 10) Round remainders up / down, depending on the context	**1. Pictures / Symbols** Four eggs fit in a box. How many boxes would you need to pack 20 eggs? **2. Number lines / Arrays** $15 \div 5$ **3. Partitioning** $28 \div 2$ $20 \div 2 = 10$ $8 \div 2 = 4$ **4. Number lines (start from zero)** $33 \div 5 = 6\ r3$
4 *Number lines, partitioning, grouping and short division* **Age related expectations:** **Record, support and explain:** TU ÷ U (eg $98 \div 6$)	**1. Number lines (start from zero)** $96 \div 6 = 16$ 10 x 6 6 x 6 0 60 96 **2. Partitioning (multiples of the divisor)** $67 \div 4 = 16\ r3$ $10 \times 4 = 40$ $6 \times 4 = 24 (64)$ **3. Grouping (vertical layout)** $96 \div 7$
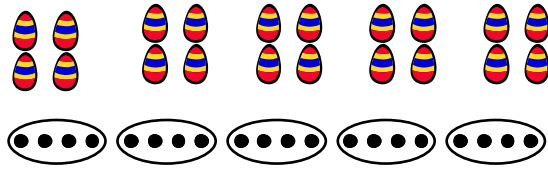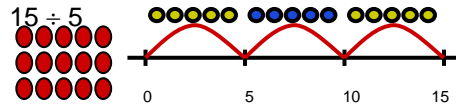
5 *Y5 build upon Y4 methods* **Age related expectations:** **Refine and use efficient methods:** **Call the formal method bus stop** HTU ÷ U	96 -70 (7 × 10) 26 -21 (7 × 3) 5 Answer: 13 R 5 ### 4. Grouping (efficient) $25.6 \div 8$ (estimate: 24 ÷ 8 = 3) 8)25.6 -24.0 (8 × 3.0) 1.6 -1.6 (8 × 0.2) 0 Answer: 25.6 ÷ 8 = 3.2 ### 5. 'Short' division 291 ÷ 3 (estimate: 270 ÷ 3 = 90) $$3)\overline{290+1} = 3)\overline{270+21}$$ with 90 + 7 above This is then shortened to: $$3)2\,9^21$$ with 9 7 above
6 *'Short' division and 'Long' division* **Age related expectations:** **Use efficient methods** Integer ÷ U (eg 123 ÷7) Decimal ÷ U (eg 27.6 ÷8) HTU ÷ TU	### 1. 'Short' division 43 .4 ÷ 7 (estimate: 42 ÷ 7 = 6) 6 .2 7 ⌐ 43 .4 ### 2. 'Long' division 560 ÷ 24 (estimate: 550 ÷ 25 = 22) 23 24) 560 -480 80 -72 8 Answer: 23 R 8 OR 0 2 3 r 8 24) 5₅6₈0