St. Mary's Calculation Policy

Introduction:

Children are introduced to the processes of calculation through practical, oral and mental activities. As they begin to understand the underlying ideas, they develop ways of recording to support their thinking and calculation methods, so that they develop both **conceptual understanding** and **fluency** in the fundamentals of mathematics.

The ability to calculate mentally forms the basis of all methods of calculation and has to be maintained and refined. A good knowledge of numbers or a 'feel' for numbers is the product of structured practice through progression in relevant practical maths experiences and visual representations.

Underpinning all good calculation are the 4 pillars of:

1. Place value

Place value underpins much of number work and it is important to introduce the children to images before they need them so they have confidence and a consistent approach to solving calculations.

2. Number facts

The regularity and frequency of short sessions recalling number facts can have a great impact on children's learning.

3. Images and Models

The school needs to use consistent images and vocabulary throughout the year groups.

4. Meta skills

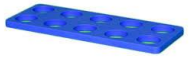
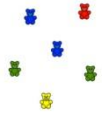
Meta skills cannot be taught but are acquired through learning different skills and then given situations where they have to choose the appropriate method. For example 94– 87 needs the skill of counting on from 87, whereas 22 – 4needs the skill of counting back from 22.

In all calculations children should be taught to use the following processes in deciding what approach they will take to calculations.

Can I do it in my head?
Can I use some apparatus to help me?
Can I use some drawing or jottings to help me?
Should I use a written method?

From Early Years to Year 1:

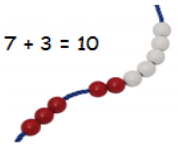
There are fundamental skills that it is important for children to develop an early understanding of as building blocks to future learning in maths, including that linked to calculation. A selection of the skills include:

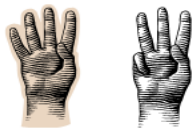
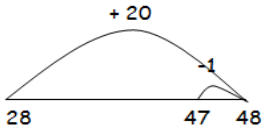
- Ordinality – 'the ordering of numbers in relation to one another' – e.g. (1, 2, 3, 4, 5…)
- Cardinality – 'understanding the value of different numbers'– e.g. (7 =  17 =  +  12 = 
- Equality – 'seven is the same total as four add three' – e.g. =  
- Subitising – 'instantly recognizing the number of objects in a small group, without counting them' – e.g.  → five
- Conservation of number– 'recognising that a value of objects are the same, even if they are laid out differently' – e.g.  
- One-to-one correspondence – e.g. 

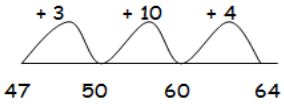
- Counting on and back from any number – e.g. 'five add three more totals eight'  'ten take away three totals seven' 

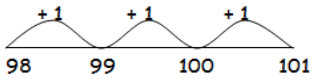
- Using apparatus and objects to represent and communicate thinking – e.g. 
- Maths language – using mathematical words verbally in every-day situations – e.g. 'climb up to the top' / 'climb down to the bottom'

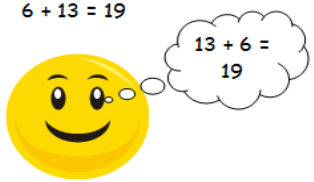
Addition:

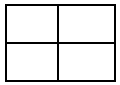
<table>
<tr><td></td><td colspan="5">
<u>Mental Calculation Strategies for Addition and Subtraction</u>
Number Bonds
7 + 3 = 10

Doubles

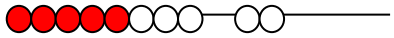
Near Doubles

Adjusting
28 + 19 = 47


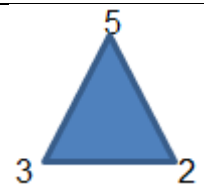
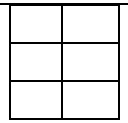
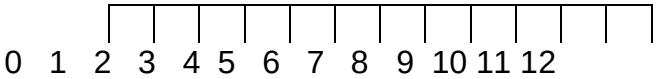
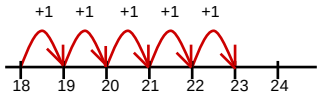
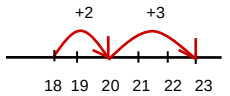
Bridging
47 + 17 = 64


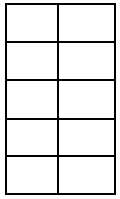
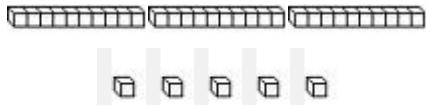
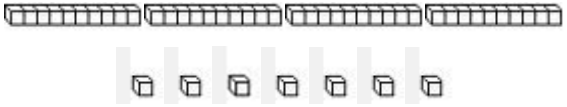
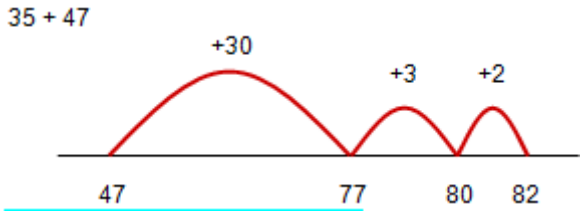
Partitioning
44 + 34 = 78
70 + 8 = 78
Finding the Difference
101 - 98 = 3


Reordering
e.g. put big number in head when counting on
6 + 13 = 19


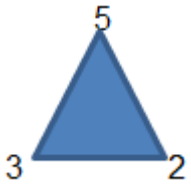
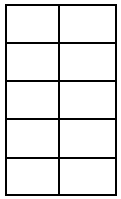
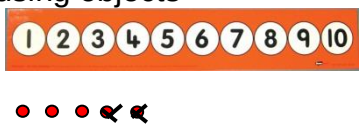
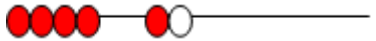
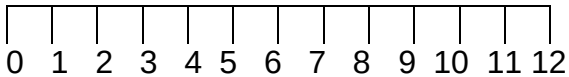
</td></tr>
<tr><td></td><td>Counting</td><td>Mental maths strategies</td><td>Rapid recall</td><td colspan="2">Written calculation and appropriate models and images to support conceptual understanding</td></tr>
<tr><td>Stage 1:</td><td>Count in ones to and across 100 forwards and backwards starting from 0, 1 and other numbers. Count in multiples of</td><td>Pupils use apparatus to explore addition as the inverse of subtraction.
.</td><td>Rapid recall of all pairs of numbers totalling numbers up to 10.
Use structured apparatus – i.e. Numicon, tens frames, abaci, etc.
  </td><td>Combining two groups:
• Children develop a mental picture of the number system for use with calculation. A range of key models and images support this, alongside</td><td>Counting onfingers
Number line on pegs
 

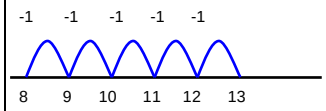
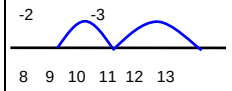
 
3 + 2 = 5
  </td></tr>
</table>

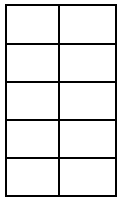
	two, five and ten.	  4 add 1 is 5 5 subtract 4 leaves 1		practical equipment. • Teachers model use of number tracks to count on or line up counters/objects along the number track. This is a precursor to use of a fully numbered number-line.	‘eight add two more makes ten’  ‘one more than four is five’ Hundred square on display Hundred square on display in room with 10’s coloured in Bead Bar with sets of beads in 10’s in different colours
Stage 2:	Continue practicing above skills. Realise the value of missing numbers Count in steps of 2, 3 and 5 forwards and backwards to and from zero. Count in tens from any number – link to coins in a piggy bank as well as a	Reorder numbers when adding,i.e. start with largest number, find bonds, etc. Add doubles and derive near doubles. Round numbers to the nearest 10.	Recall addition facts for all numbers to 20.	**Counting on from any number:** Children begin to use numbered lines to support their own calculations, initially counting in ones before beginning to work more efficiently **Counting on from the largest number:** • Children reorder calculations to start with the largest number.	Number line with all numbers labelled  18 + 5 3+4=7, 3+?=7, ?+4=7, ?+?=7  …to… 

	number square.				 Use of questions such as: 'How might I rearrange these to find the total?'
Stage 3:	Continue practicing above skills. Count from 0 in multiples of 4, 8, 50 and 100. Count on by 10 or 100 from any two digit number. Link to counting stick: counting forwards and backwards flexibly. Count up and down in tenths – linking to visual image.	Partitioning by bridging through 10 and multiples of 10 when adding. Adjusting when adding 11 or 9 to a number. Relating inverse number operations – using structured apparatus to explore and understand that subtraction undoes addition.	Connect pairs totalling ten to pairs of multiples of 10 totalling 100.  Use 10ps in tens frame. Recall pairs of two-digit numbers with a total of 100, i.e. 32 + ? = 100.	**Expanded horizontal addition:** • Add numbers using structured apparatus to support understanding of place value. Make connections between partitioning both numbers using structured apparatus and partition the second number only using a number line.	Add…  …and…  By partitioning and recombining 30+ 40 = 70 5 + 7 = 12 70 + 12 = 82 Use of empty number lines 

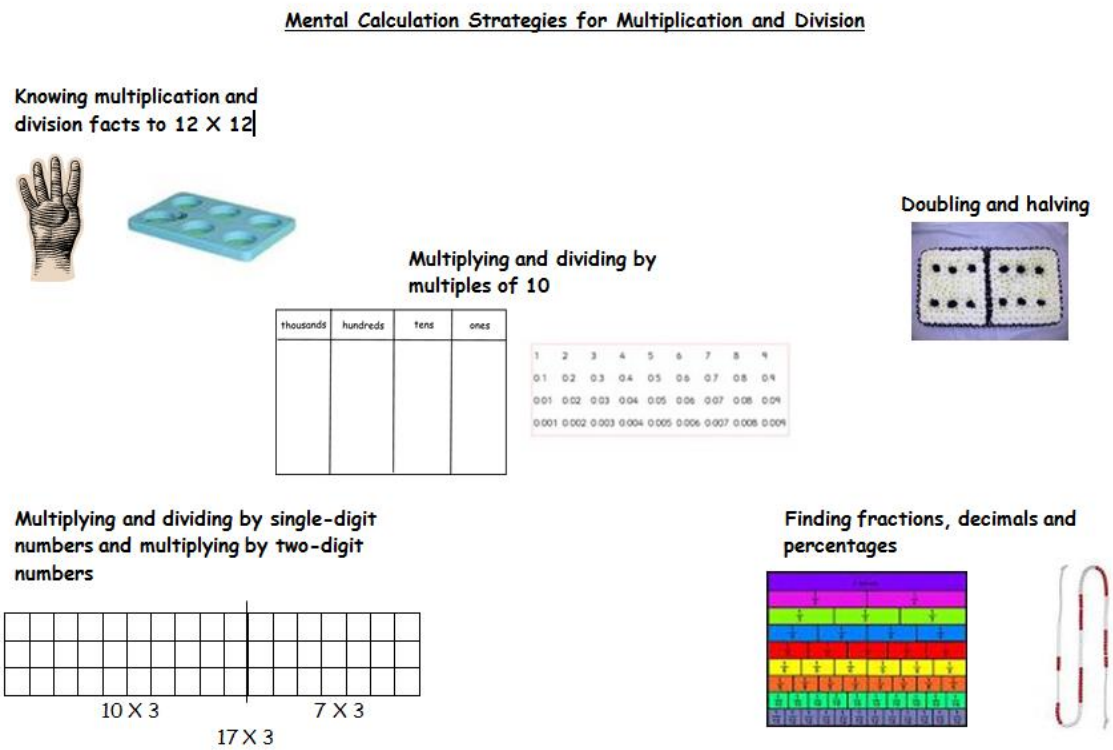
Subtraction:

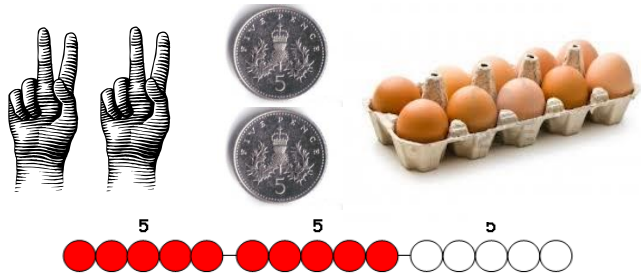
	Counting	Mental strategies	Rapid Recall	Written calculation and appropriate models and images to support conceptual understanding	
Stage 1:	Count in ones to and across 100, forwards and backwards starting from 0, 1 and other numbers. Count in multiples of two, five and ten. I less ,2 less Finding the difference using visual images/concrete apparatus	Pupils use apparatus to explore addition as the inverse of subtraction: .   'four add one is five.' 'five subtract four leaves one'	Rapid recall of subtraction facts for numbers up to 10. Use structured apparatus, i.e. Numicon, tens frames, abaci etc. 	**Subtraction as taking away from a group:** • Children develop a mental picture of the number system for use with calculation. A range of key models and images support this, alongside practical equipment. • Teachers model use of number tracks to count back or remove counters/objects fromthe number track or set. This is a precursor to use of a fully numbered number-line.	Taking away using objects  5- 2 = 3  'six take away two leaves four'  'one less than six is five'
Stage 2:	Continue practicing above skills. Count in steps	Bridging through two digit numbers,i.e. 24 – 19 = 19 + 1 + 4	Recall subtraction (and addition) facts for all	**Subtracting by counting back and on:** • Children begin	Number line with all numbers labelled 

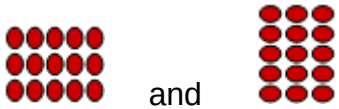
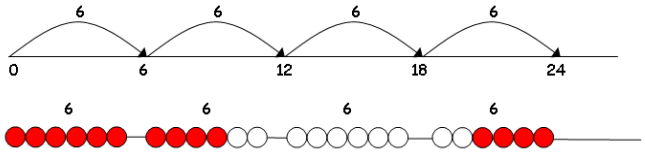
	of 2, 3 and 5, forwards and backwards to and from zero. Count in tens from any number – link to coins in a piggy bank as well as a number square. Missing numbers Finding the difference by counting on using number lines.	using number lines. Subtracting 11 by subtracting 10 and then 1 more. Move to subtracting 9 by subtracting 10 and adding 1 using apparatus.	numbers to 20.		to use numbered lines to support their own calculations, initially counting back in ones before beginning to work more efficiently.	13 – 5 = 8  13 – 5 = 8  7-3= ? 7-?=4 ?-3=4, ?-?=4

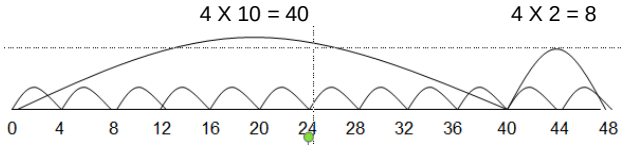
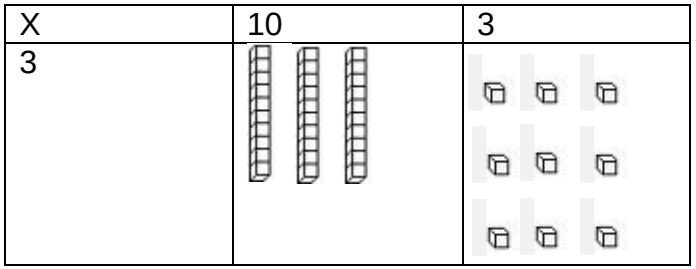
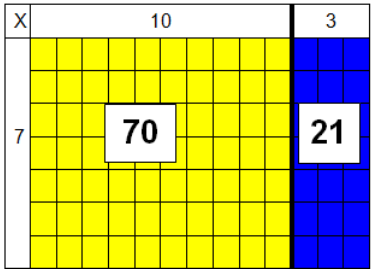
Stage 3:	Continue practicing above skills. Count from 0 in multiples of 4,8,50 and 100. Count on and back by 10 or 100 from any two digit number. Link to counting stick counting forwards and backwards flexibly. Count up and down in tenths – linking to visual image.	Partitioning by bridging through 10 and multiples of 10 when subtracting. Continue to practice adjusting when subtracting 11 or 9 from a number. Relating inverse number operations – use structured apparatus to explore and understand that subtraction undoes addition.	Connect subtractions fromten tosubtractions from multiples of 10 totalling 100.  Use 10ps in tens frame. Subtracttwo digit numbers from 100 i.e.? = 100 - 78	**Finding the difference:** • Teachers model how to find the difference when two numbers are relatively 'close together.' • Initially children compare two sets before moving on to a number line comparison. • **Pupils are taught to choose whether to count on or back** depending on which is more efficient.	Comparing two sets: comparison or difference.  Finding the difference on a number line.  Note: Finding the difference is often the most efficient way of solving a subtraction problem, e.g. 61 – 59 2,003 – 1,997

Multiplication:

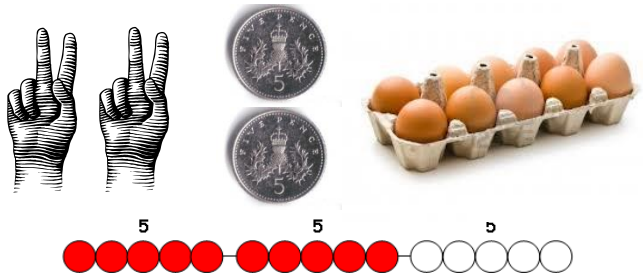
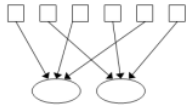
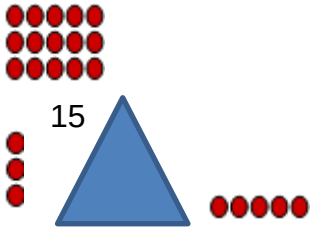
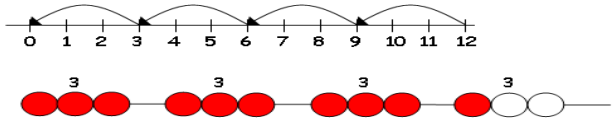
<table>
<tr><td></td><td colspan="5"> 
</td></tr>
<tr><td></td><td>Counting</td><td>Mental strategies</td><td>Rapid recall</td><td colspan="2">Written calculation and appropriate models and images to support conceptual understanding</td></tr>
<tr><td>Stage 1:</td><td>Count forwards and backwards in 2s, 5s and 10s
Doubling and counting groups of the same</td><td>Doubling up to six and then ten whilst using related models and images.</td><td>Derive/recall doubles up to five and derive/recall halves up to ten.

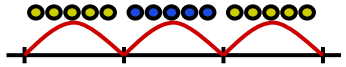
Recall odd and even numbers to 10 in</td><td>Developing early conceptual understanding of multiplication:
Grouping objects in 2’s, 3’s, 5’s and 10’s
Counting in steps of 2,3,5 and 10 using practical objects</td><td>Use objects, pictorial representations and arrays to show the concept of multiplication:
 
</td></tr>
</table>

	size		reference to structured apparatus. 		There are 3 sweets in 1 bag. How many in 2 bags?
Stage 2:	Count forwards and backwards in 2s, 3s, 5s and 10s from zero.	Begin to understand and use inverse number operations:  Stories are used alongside a triad to help children understand links between number operations, e.g. “There are five pencils in two packs, which means that there are ten pencils altogether.”	Derive/recall doubles up to ten and derive/recall halves up to twenty. Recall odd and even numbers to 20 in reference to structured apparatus. Recall & use multiplication facts for the 2X, 5X and 10X-tables.	**Understanding multiplication as repeated addition:** • Investigate multiplication as repeated addition. • Counting in steps of 2,3,5 and 10 using number line jumps • Whilst arrays are also modelled explicitly at this stage, it is important to note that they will continue to be a key model at later stages, alongside more formal methods of calculation.	Arrays: 5 X 33 X 5  Number lines: 6 X 4 = 24  So: ‘Six taken four times”

Stage 3:	Counting forwards and backwards in 2s, 3s, 4s, 5s, 8s and 10s from zero. Count up and down in tenths.	Use doubling to make connections between the 2X, 4X and 8X-tables. Understand that multiplication can be undertaken by partitioning numbers, e.g. 12 X 4 = 10 X 4 + 2 X 4 Introduce the structure of scaling: e.g. Find a ribbon that is 4 times as long as the blue ribbon  	Recall odd and even numbers to 100 in reference to structured apparatus. Recall and use multiplication facts for the 2X, 3X, 4X, 5X, 8X and 10X tables.	**Relate multiplying a 2-digit by 1-digit number using repeated addition and arrays to represent:**	Children use an empty number line to chunk efficiently: 4 X 12 = 48  3 X 13 = 39  7 X 13 = 91 

Division:

	Counting	Mental strategies	Rapid recall	Written calculation and appropriate models and images to support conceptual understanding	
Stage 1:	Count forwards and backwards in 2s, 5s and 10s	Doubling up to six and then ten whilst using related models and images.	Derive/recall doubles up to five and derive/recall halves up to ten. Recall odd and even numbers to 10 in reference to structured apparatus. 	**Developing early conceptual understanding of division as grouping and sharing:**	Use objects, pictorial representations and arrays to show the concept of division as grouping and sharing.  "Two children share six pencils between them"  "Six children are asked toget intothreeequal groups" 
Stage 2:	Count forwards and backwards in 2s, 3s, 5s and 10s from zero.	Begin to understand and use inverse number operations. To realise that division is the inverse of multiplication 	Derive/recall doubles up to ten and derive/recall halves up to twenty. Recall odd and even numbers to 20 in	**Understanding division as repeated subtraction:** • Investigate division as repeated subtraction. • Through teacher modelling,	Number lines and arrays: 12 ÷ 3 = 4 

		3 5 Stories are used alongside a triad to help children understand links between number operations, e.g. “15 children are asked to get into three groups and find out that there are five people in each group.”	reference to structured apparatus. Recall and use multiplication facts for the 2X, 5X and 10X-tables.	children need to know that division is not commutative.	15 ÷ 5 = 3  0 5 10 15
Stage 3:	Counting forwards and backwards in 2s, 3s, 4s, 5s, 8s and 10s from zero.	Use doubling to make connections between the 2X, 4X and 8X-tables. Understand that multiplication can be undertaken by partitioning numbers, e.g. 12 X 4 = 10 X 4 + 2 X 4 scaling: e.g. Find a ribbon that is 4 times shorter than the blue ribbon.  8cm	Recall odd and even numbers to 100 in reference to structured apparatus. Recall & use multiplication facts for the 2X, 3X, 4X, 5X, 8X and 10X tables.	**Dividing a 2-digit by 1-digit number, representing this efficiently on a number line:**	Children use an empty number line to chunk efficiently. 96 ÷ 6 = 16 6 x 6 = 3610 x 6 = 60  0 3696