St Just Primary School Calculation Policy

This policy contains the key procedures that are to be taught throughout the school. It has been written to ensure consistency and progression throughout the school. We are aiming to get each child to show fluency, reasoning and problem solving skills from EYFS – Year 6.

- Although the main focus of this policy is showing the core **Concrete, Pictorial and Abstract** ways of solving Maths problems, it is important to recognise that the ability to calculate mentally lies at the heart of numeracy.
- 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.
- Children are encouraged to use the most efficient method for them, making sure they use ones they have a clear understanding of.
- 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:

- **'Do I need to use manipulatives to help me?'**
- **'Can I do this using drawings or jottings?'**
- **'Do I need to use a written method?'**
- **'Can I do this in my head?'**

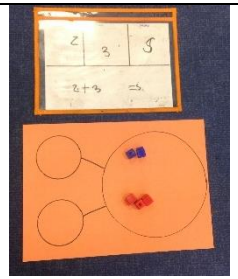
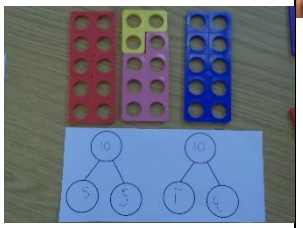
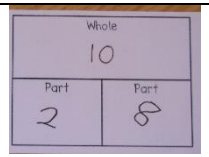
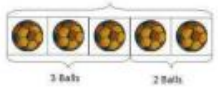
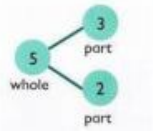
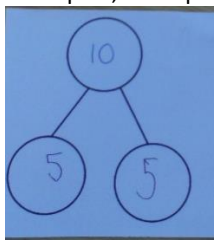
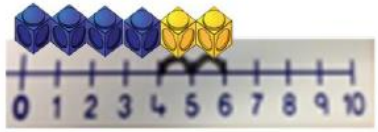
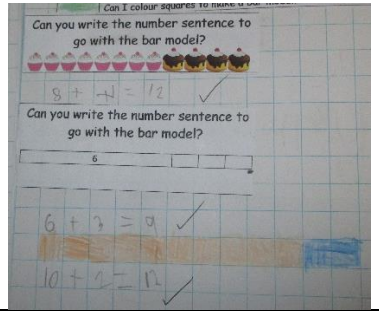
Stem sentences are in red, these are to help children embed their learning.

Compiled by K Williams adapted from White Rose. May 2019.

Addition

Vocab: add, plus, more than, total, sum of,

Bar model, part-part-whole, number line, tens frame, base 10, place value counters, missing numbers,

STEM sentences	Concrete (can we MAKE it?)	Pictorial (can we draw it?)	Abstract (can we write the calculation?)
_____ is a whole, _____ is a part, _____ is a part. There are _____ in total.	 Use cubes, numicon and others to add two numbers together.  Use numicon and cubes to show number bonds.	   Use pictures to add two numbers together as a group or a bar.   Introduce the bar model and the part-whole model to secure number bonds.	5 + 5 = 10 5 is a part, 5 is a part, the whole is ten. 
First… Then… Now… E.g. **First** there were 4 children on the bus, **then** 3 children got on, **Now** there are 7 children on the bus. (this will help with the inverse relationship and	**Counting on using number lines** using cubes or Numicon. 	A bar model which encourages the children to count on rather than count all.  	The abstract number line: What is 2 more than 4? What is the sum of 2 and 4? What is the total of 4 and 2? 4 + 2 

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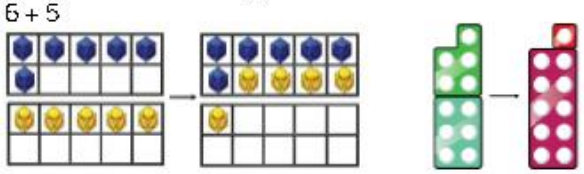
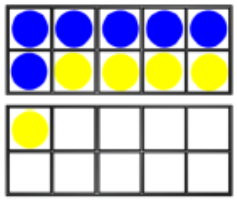
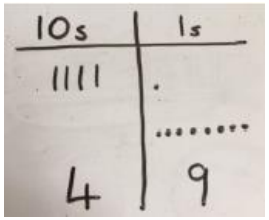
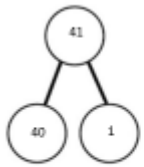
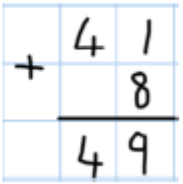
missing number)			
I need ____ to make ten. I have ____ left over. 10 + ___ is _____.	**Regrouping to make 10;** using ten frames and counters/cubes or using Numicon. 6 + 5 	Children to draw the ten frame and counters/cubes. 	Children to develop an understanding of equality e.g. $6 + \square = 11$ $6 + 5 = 5 + \square$ $6 + 5 = \square + 4$
	TO + O using base 10. Continue to develop understanding of partitioning and place value. 41 + 8 	Children to represent base 10 e.g. lines for tens and dots for ones. 	41 + 8  1 + 8 = 9 40 + 9 = 49 

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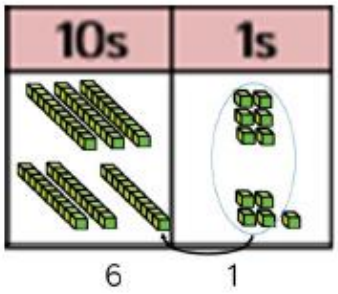
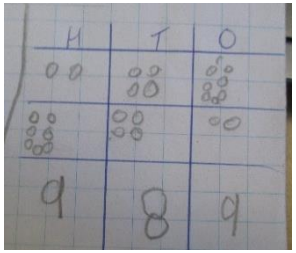
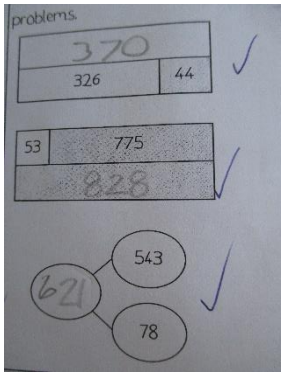
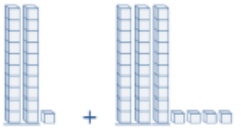
<table>
<tr>
<td></td>
<td>TO + O using base 10. Continue to develop understanding of partitioning and place value.
36 + 25
 

36
+25
___</td>
<td>Children to represent the base 10 or place value counters, in a place value chart
  </td>
<td>Looking for ways to make 10.
36 + 25=
1 5
30 + 20 = 50
5 + 5 = 10
50 + 10 + 1 = 61
36
Formal method: +25
61
1</td>
</tr>
<tr>
<td></td>
<td colspan="3">Conceptual variation; different ways to ask children to solve 21 + 34</td>
</tr>
<tr>
<td></td>
<td> 
</td>
<td>Word problems:
In year 3, there are 21 children and in year 4, there are 34 children.
How many children in total?
21 + 34 = 55. Prove it</td>
<td>21
+34
___
21 + 34 =
☐ = 21 + 34
Calculate the sum of twenty-one and thirty-four.</td>
<td> 
Missing digit problems:
10s | 1s
10 10 | 1
10 10 10 | ?
? | 5</td>
</tr>
</table>

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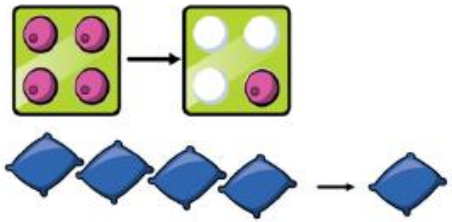
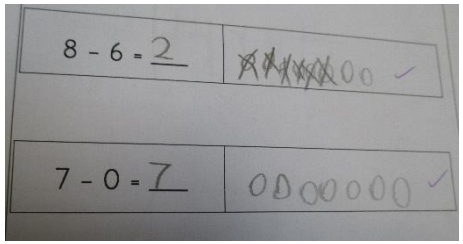
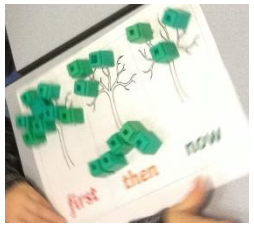
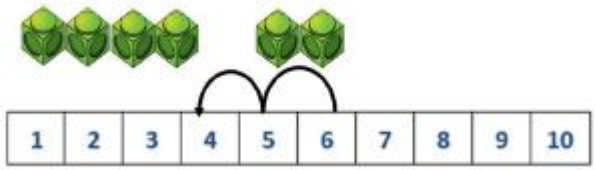
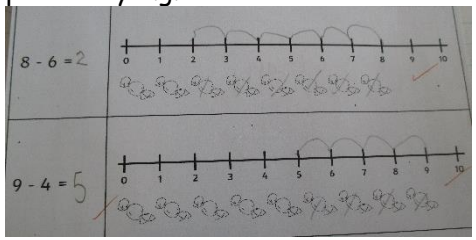
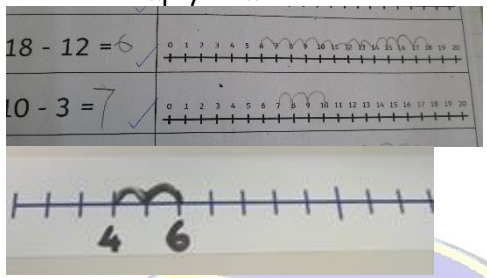
Subtraction

Vocab: take away, less than, the difference, subtract, minus, fewer, decrease, exchange

STEM sentences	Concrete	Pictorial	Abstract
First… Then… Now… e.g. **First** there were 4 children in the car, **then** 1 child got out, **Now** there are 3 children in the car.	**Physically taking away objects from a whole** (tens frame, numicon, cubes etc…) 4 - 3 = 1 	Children to draw the concrete resources they are using and cross out the correct amount. The bar model can also be used. 	 
The whole is _____. The part we are taking away is _____. Start on _____ and count back _____.	**Counting back** (using number lines or tracks) 6-2= Children start at 6 and count back 2 	Children to represent what they see pictorially e.g. 	Children to represent the calculation on a number line or number track and show their jumps. Encourage children to use an empty number line 

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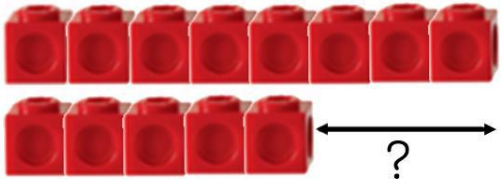
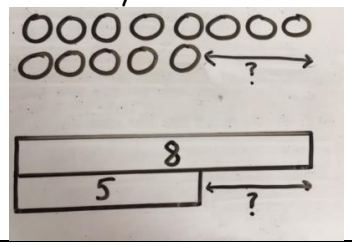
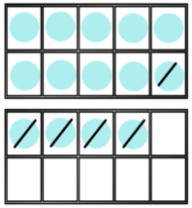
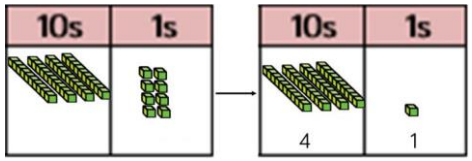
	Finding the difference (using cubes, Numicon or other objects can also be used). Calculate the difference between 8 and 5. 	Children to draw the cubes/other concrete objects which they have used or use the bar model to illustrate what they need to calculate. 	Find the difference between 8 and 5. 8 – 5, the difference is ☐ Children to explore why 9 – 6 = 8 – 5 = 7 – 4 = have the same difference.
		Children to present the ten frame pictorially and discuss what they did to make 10. 	When children are confident they can draw this themselves. Remind them to show order and uniform to help them.
	Column method using base 10 or place value counters. 48-7 	Children to represent the base 10 pictorially. 35 – 23 =  draw the 3 tens and 5 ones cross out the ones cross out the tens look how much remains	Encourage children to use mental strategies

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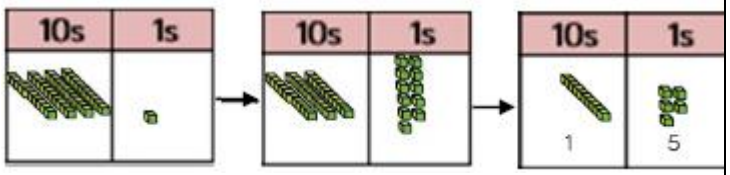
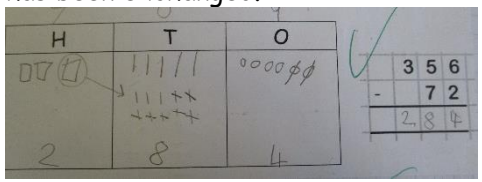
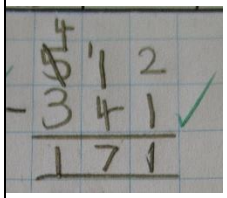
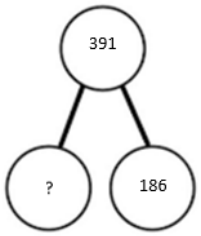
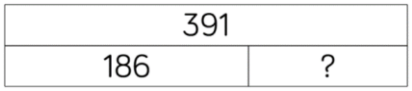
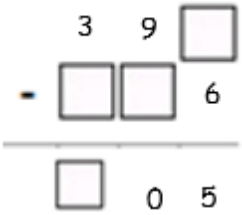
<table>
<tr>
<td></td>
<td>Column method using base 10 or place value counters and having to exchange.
41 – 26
 

41 Here 1 ten has been exchanged for 10 ones Answer</td>
<td>Represent the place value counters pictorially; remembering to show what has been exchanged.
 
</td>
<td>Formal column method. Children must understand what has happened when they have crossed out digits.
  </td>
</tr>
<tr>
<td></td>
<td colspan="3">Conceptual variation; different ways to ask children to solve 391 - 186</td>
</tr>
<tr>
<td></td>
<td> 


</td>
<td>Raj spent £391, Timmy spent £186.
How much more did Raj spend?
Calculate the difference between 391 and 186.</td>
<td>☐ = 391 – 186
391
-186
——
What is 186 less than 391?</td>
<td>Missing digit calculations
 
</td>
</tr>
</table>

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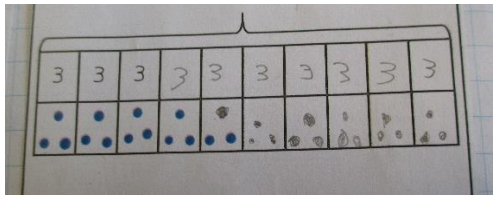
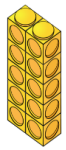
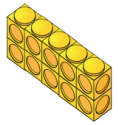
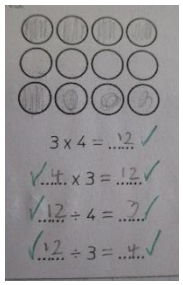
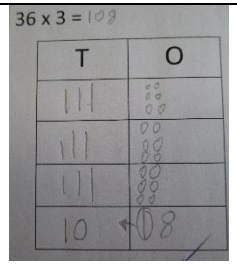
Multiplication

Vocab: double, times, multiplied by, the product of, groups of, lots of, equal groups, exchange

STEM sentences	Concrete	Pictorial	Abstract
We are counting in multiples of ____ so we count every ____. There are ____ in each group. There are ____ groups. We have to add ____ ____ times.	Repeated grouping/repeated addition 7 × 2 2 + 2 + 2 + 2 + 2 + 2 + 2 = There are 7 equal groups, with 2 in each group.  	Children to represent the practical resources in a picture and use a bar model. 	3 × 4 = 12 4 + 4 + 4 = 12
____ lots of ____ is the same as ____ lots of ____.	**Use arrays to illustrate commutativity** counters and other objects can also be used. 2 × 5 = 5 × 2   2 lots of 5 5 lots of 2	 Children to represent the arrays pictorially.	Children to be able to use an array to write a range of calculations e.g. • 10 = 2 × 5 • 5 × 2 = 10 • 2 + 2 + 2 + 2 + 2 = 10 • 10 = 5 + 5
____ can be partitioned into ____ and ____. ____ lots of ____ ones is ____. ____ lots of ____ tens is ____.	 To first introduce the grid method, use Base 10 before moving towards a more compact method. 36 x 3 = Make 36 on each row, there are 3 rows.	Children can represent the work they have done with place value counters in a way that they understand. They can draw the counters, using colours to show different amounts or just use circles in the different columns to show their thinking as shown below.	Start with multiplying by one digit numbers and showing the clear addition alongside the grid.

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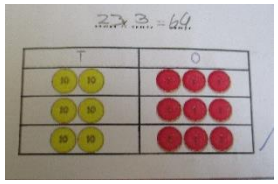
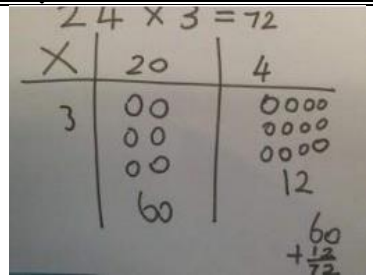
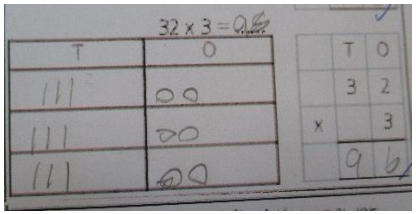
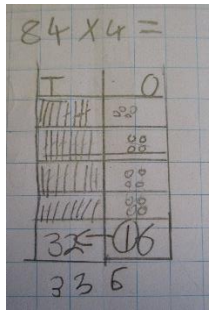
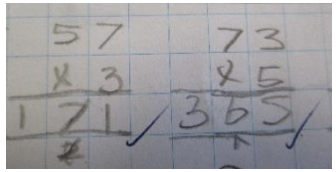
<table>
<tr>
<td>____ ones add ____ tens is ____.</td>
<td>Add up each column, starting with the ones and exchange if needed.

Move on to Place Value Counters to show how we are finding groups of a number. We are multiplying by 3 so need 3 rows.
  </td>
<td>  </td>
<td><table><tr><td>×</td><td>30</td><td>5</td></tr><tr><td>7</td><td>210</td><td>35</td></tr></table>210 + 35 = 245

Moving forward, multiply by a 2 digit number showing the different rows within the grid method.<table><tr><td>X</td><td>1000</td><td>300</td><td>40</td><td>2</td></tr><tr><td>10</td><td>10000</td><td>3000</td><td>400</td><td>20</td></tr><tr><td>8</td><td>8000</td><td>2400</td><td>320</td><td>16</td></tr></table></td>
</tr>
<tr>
<td>____ ones times ____ ones is ___ ones.
____ ones times ____ tens is ____ tens.
Because we are multiplying by ten, we need to add in a zero as a place value holder.

We cannot have more than one digit in any place value column, so we need to exchange ___ ones as ____ ten</td>
<td>Formal column method with place value counters (base 10 can also be used.)
32 x 3
  </td>
<td>  </td>
<td>Children to represent the base 10 or place value counters pictorially.</td>
<td>Formal Written Method
  </td>
</tr>
</table>

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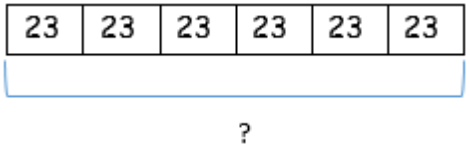
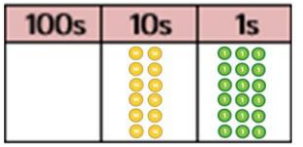
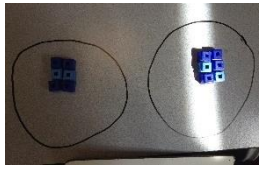
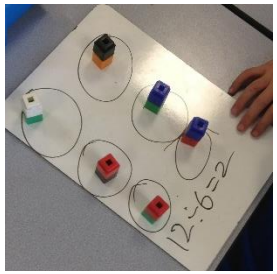
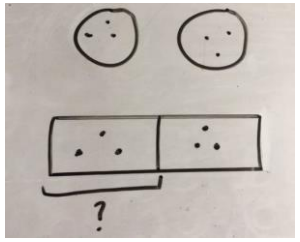
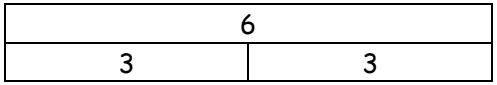
	When children start to multiply 3d × 3d and 4d × 2d etc…, they should be confident with the abstract: To get 744 children have solved 6 × 124. To get 2480 they have solved 20 × 124.	1 2 4 × 2 6 7 4 4 2 4 8 0 3 2 2 4 Answer: 3224

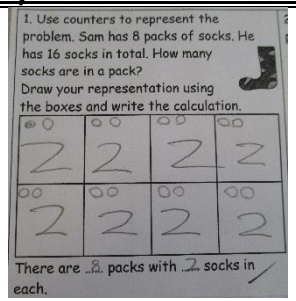
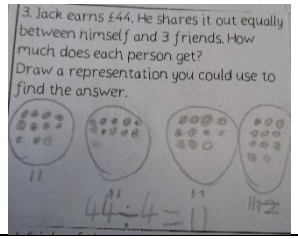
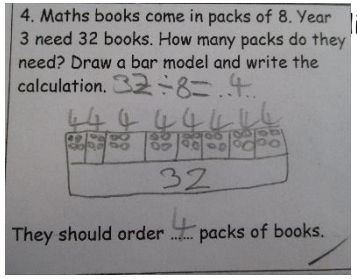
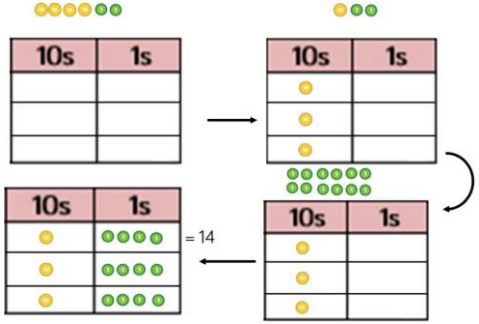
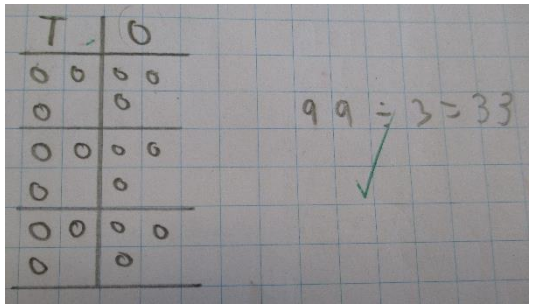
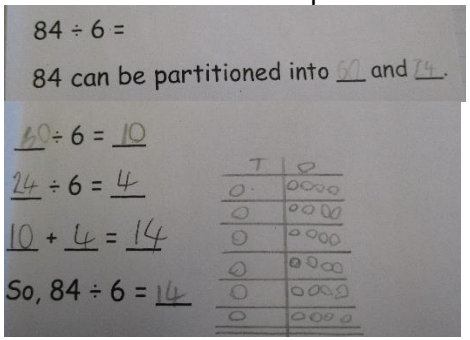
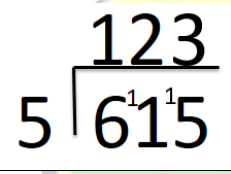
	Conceptual variation; different ways to ask children to solve 23 x 6			
		Mae had to swim 23 lengths, 6 times a week. How many lengths did she swim in one week? With the counters prove that 23 x 6 = 138	Find the product of 6 and 23 6 × 23 = ___ ___ = 6 × 23 6 23 × 23 × 6 ___ ___	What is the calculation? What is the product? 

Division

Vocab: share, group, divide, divided by, half, divisor, dividend, quotient, remainder, exchange

STEM sentences	Concrete	Pictorial	Abstract
____ shared equally between ____ is _____	**Sharing** a range of objects 12 ÷ 2 =  	Represent the **sharing** pictorially 	6 ÷ 2 = 3  Children should also be encouraged to use their 2 times tables facts.

St Just Primary School Calculation Policy

	Sharing – using concrete methods	 We move on to use formal jottings to help us solve the division. These can be in the form of sharing circles (squares!) 	Children can use a bar model to help represent the division. 
In division, we start from the largest place value column. We start from the right. ___ is __ tens and ___ ones. ____ tens divided by ____ is ____. _____ ones divided by _____ is _____. ____ add ____ is _____.	**Sharing** using place value counters. 42 ÷ 3 = 14 	Children to represent the place value counters pictorially. 	Children to be able to make sense of the place value counters and write calculations to show the process. 
	Short division using place value counters to group. 615 ÷ 5	Represent the Place Value counters pictorially	Children to do the calculation using **short division** scaffold 

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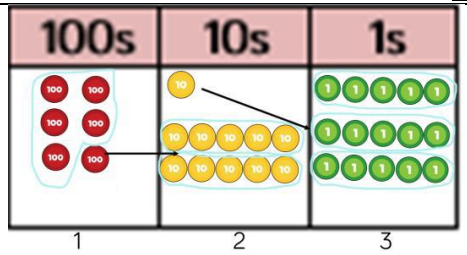
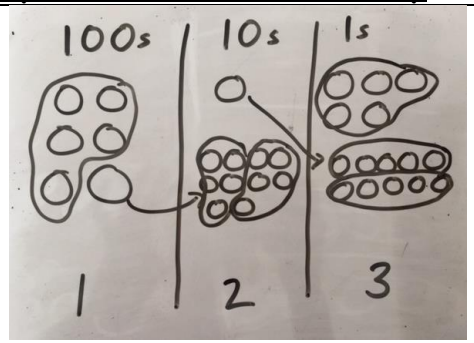


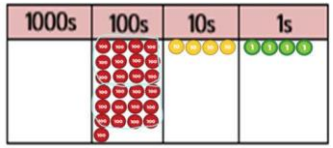
1. Make 615 with place value counters.
2. How many groups of 5 hundreds can you make with 6 hundred counters?
3. Exchange 1 hundred for 10 tens.
4. How many groups of 5 tens can you make with 11 ten counters?
5. Exchange 1 ten for 10 ones.
6. How many groups of 5 ones can you make with 15 ones?



Long division using place value counters

2544 ÷ 12

We can't group 2 thousands into groups of 12 so will exchange them.

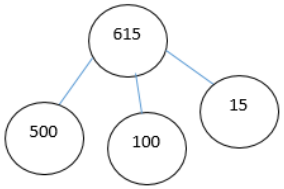


We can group 24 hundreds into groups of 12 which leaves with 1 hundred.

$$12\overline{)2544}\quad \begin{array}{r} 02 \\ \\ 24 \\ \hline 1 \end{array}$$

Conceptual variation; different ways to ask children to solve 615 ÷ 5

Using the part whole model below, how can you divide 615 by 5 without using short division?



I have £615 and share it equally between 5 bank accounts. How much will be in each bank account?

615 pupils need to be put into 5 groups. How many will be in each group?

$$5\overline{)615}$$

615 ÷ 5 = ___

___ = 615 ÷ 5

What is the calculation?
What is the answer?