Stanford Junior and Infant School Calculation Policy

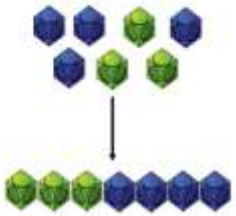
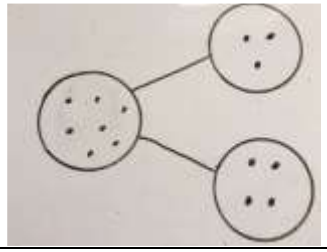
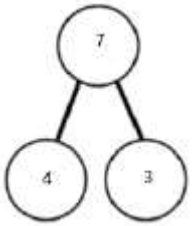
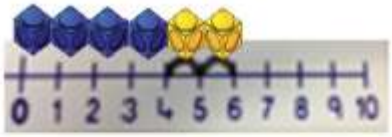
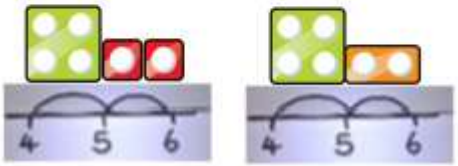
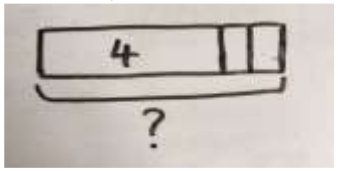
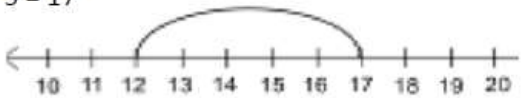
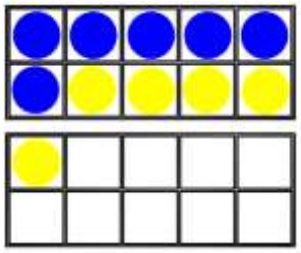
This policy has been adapted from the White Rose Calculation Policy, based on a Mastery approach.

The focus is on deepening conceptual understanding.

Problems are modelled with **concrete** materials, then using **pictorial** representations of the materials, leading to use of **abstract** symbols.

The indications of Year groups are for guidance only; teachers use their professional judgement as to whether consolidation of a certain concept is required before moving to the next.

Addition

	Concrete	Pictorial	Abstract
Early Years-Year 1	**Combining two parts** to make a whole (variety of resources e.g. eggs, shells, teddy bears, cars). 	Children to represent the cubes using dots or crosses. They could put each part on a part-whole model too. 	4 + 3 = 7 or 7 = 4 + 3 Four is a part, 3 is a part and the whole is seven. 
Year 1	**Starting with the bigger number** and counting on using number lines using cubes or Numicon.  	A bar model which encourages the children to count on, rather than count all.  Start at the larger number and jump on in ones or one jump 12 + 5 = 17 	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  Put the larger number in your head and count on the smaller number.
	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, eg 6 + ☐ = 11 6 + 5 = 5 + ☐

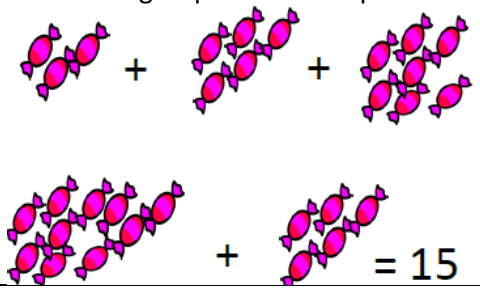
Addition

Year 2

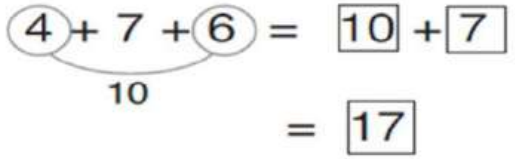
Adding 3 single digits

Combine to make 10 if possible; or bridge 10, then add the third digit.

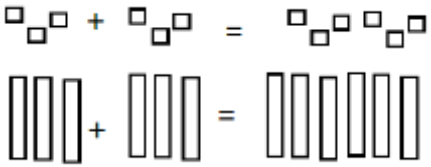
Children regroup and draw representations



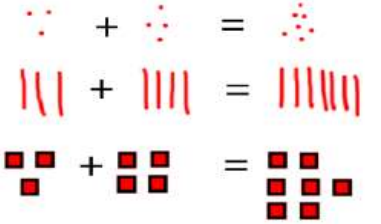
Combine to make 10 if possible; or bridge 10, then add the third digit.



Using known facts



Children draw representations of H,T,U



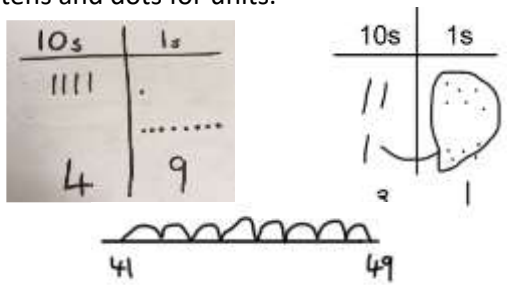
I know 3+3 = 6
so 30 + 30 = 60
and 300 + 300 = 600

TU + U

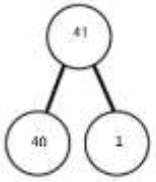
Use dienes to continue to develop understanding of place value e.g. 41 + 8

Initially not crossing 10.
Then moving on to regrouping (exchanging) when crossing 10 e.g. 26 + 5

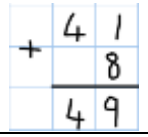
Children to represent the dienes e.g. lines for tens and dots for units.

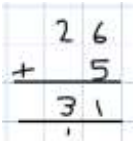


41 +
1 + 8 =



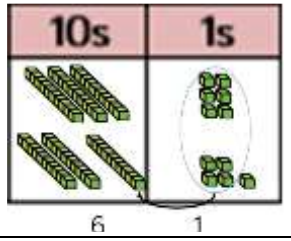
8
9
40 + 9 = 49





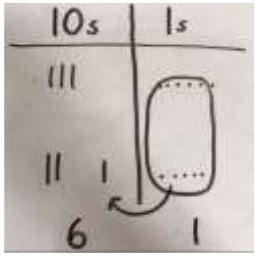
TU + TU

Use dienes to continue to develop understanding of partitioning and place value e.g. 36 + 25

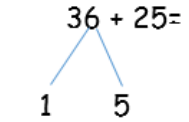


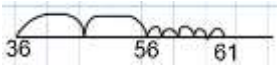
Number lines may also be used.

Children to represent the base 10 in a place value chart.

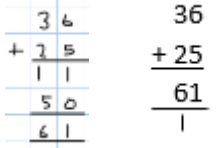


Look for ways to make 10.
36 + 25 = 30 +20 + 5 + 5 + 1
= 50 + 10 + 1
= 61





Formal methods:

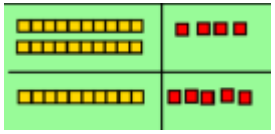


Addition

Year 3

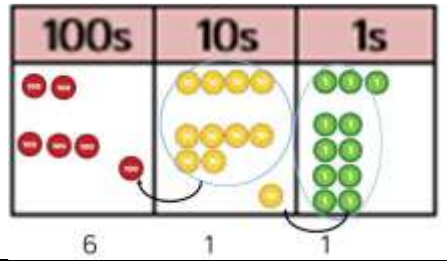
HTU + TU, HTU + HTU

Model with Dienes

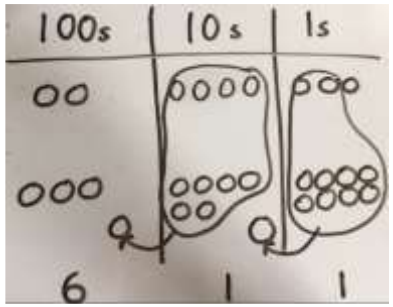


Move on to place value counters.

When there are 10 ones in the 1s column, exchange for 1 ten; when there are 10 tens in the 10s column, exchange for 1 hundred.



Children to represent the counters in a place value chart, circling when they make an exchange.



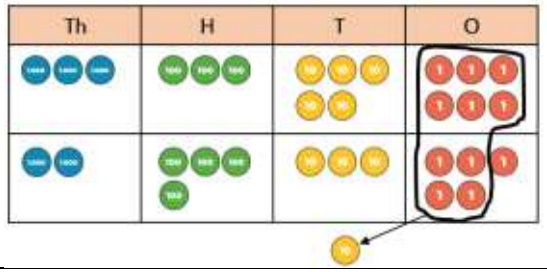
Written method

$$\begin{array}{r} 243 \\ +368 \\ \hline 611 \\ \hline 1\ 1 \end{array}$$

Year 4

ThHTU

Using place value counters up to thousands.



As above, including thousands column

	Th	H	T	O
	3	3	5	6
+	2	4	3	5
	5	7	9	1
			1	

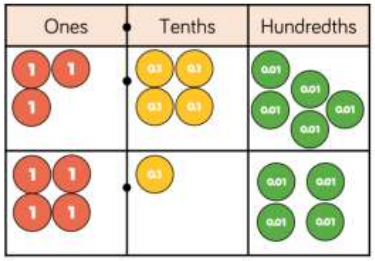
Relate to money and measures problems

Year 5

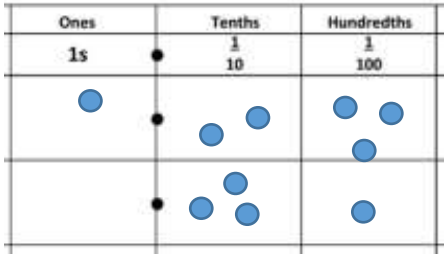
TTh Th H T U and U. t h

Working beyond 4 digits

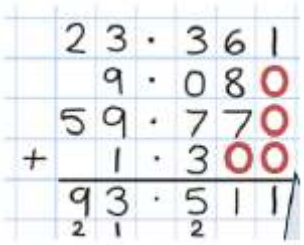
Adding decimals with 2 decimal places



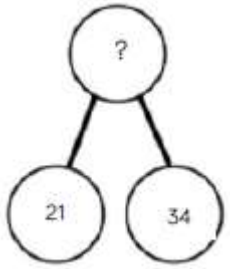
Children represent the counters in a decimal place value chart



$$\begin{array}{r} 4.55 \\ +3.07 \\ \hline \\ \hline \end{array}$$

Addition	Year 6	**Add several numbers of increasing complexity** Using place value counters as Year 5 Adding money and measures, including decimals with different numbers of decimal places	As Year 5	 Use zero as a place holder

Conceptual variation; different ways to ask children to solve 21 + 34



?	
21	34

Word problems:
In year 3, there are 21 children and in year 4, there are 34 children.
How many children in total?

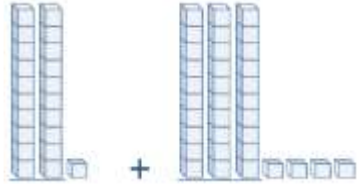
21 + 34 = 55. Prove it

21 + 34 = ___

___ = 21 + 34

$$\begin{array}{r} 21 \\ +34 \\ \hline \quad\quad \end{array}$$

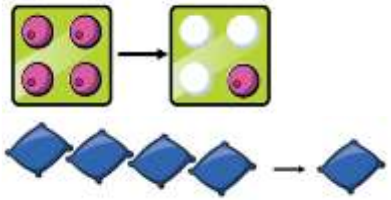
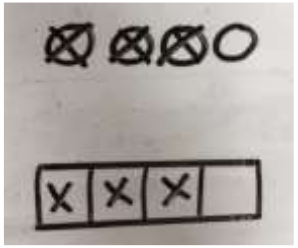
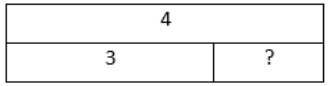
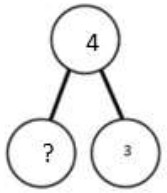
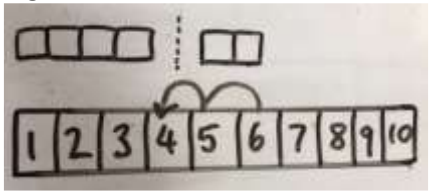
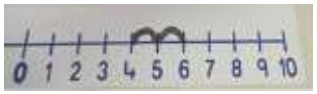
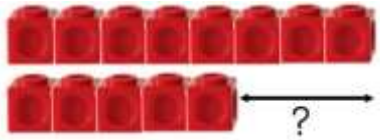
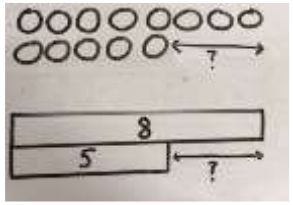
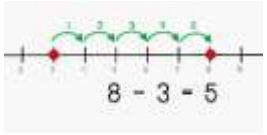
Calculate the sum of twenty-one and thirty-four.



Missing digit problems:

10s	1s
10 10	1
10 10 10	?
?	5

Subtraction

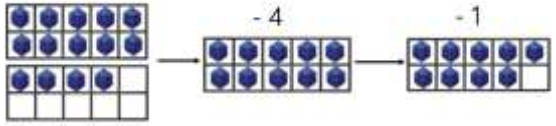
	Concrete	Pictorial	Abstract
Early Years-Year 1	**Taking away ones** Physically taking away and removing objects from a whole (ten frames, Numicon, cubes and other items such as beanbags could be used). 4 – 3 = 1 	Children to draw the concrete resources they are using and cross out the correct amount. The bar model can also be used. 	4 - 3 = ☐ = 4 - 3  
Year 1	**Counting back** Using number lines or number tracks, children start with 6 and count back 2. 6 – 2 = 4 	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. Begin to use an empty number line.   Mental: Put 13 in your head, count back4. What number do you stop on?
	Finding the difference Using cubes, Numicon or Cuisenaire rods, other objects can also be used. Calculate the difference between 8 and 5. 	Children to draw the objects they have used or use a bar model to illustrate what they need to calculate.  Count up on a number line 	Find the difference between 8 and 5. 8 – 5, the difference is ____ Same difference: 9 – 6 = 8 – 5 Word problems: Hannah has 12 sweets, her sister has 5. How many more does Hannah have?

Subtraction

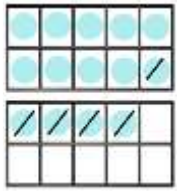
Year 1

Making 10 using ten frames

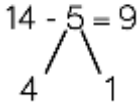
14 – 5



Children present the ten frame pictorially and discuss what they did to make 10.



Children to show how they can make 10 by partitioning the subtrahend.



14 – 5 = 14 - 4 - 1
= 10 - 1
= 9

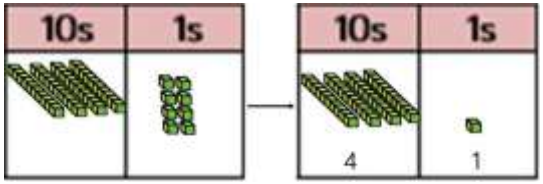
How many do we take off first to get to 10?
How many are left to take off?

Year 2

TU-U

Column method using dienes.

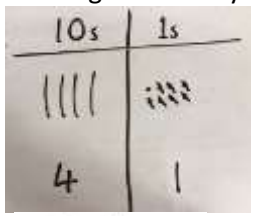
48 – 7

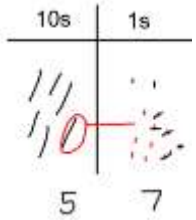


Initially not crossing 10.
Then moving on to regrouping (exchanging) when crossing 10 e.g. 62 - 5

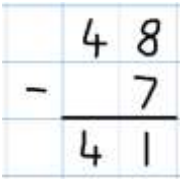
Number lines may also be used.

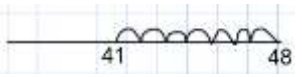
Children to represent the base 10 pictorially, crossing out as they take away.

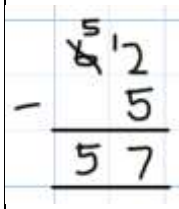


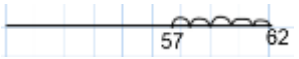


Column method or children could count back 7.





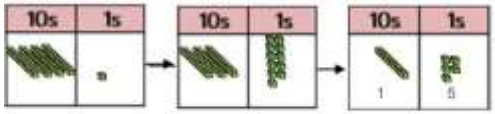




TU-TU

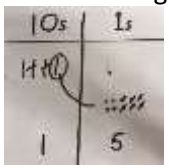
Column method using base 10 and having to exchange, using dienes.

41 – 26

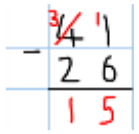


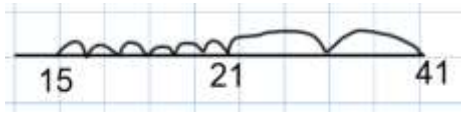
Number lines may also be used.

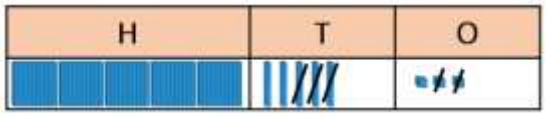
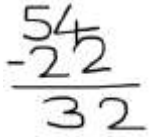
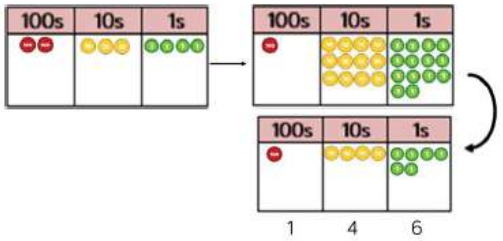
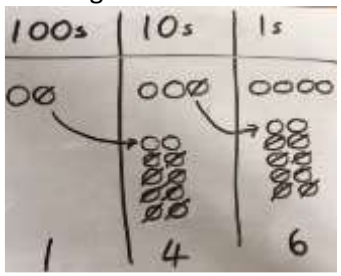
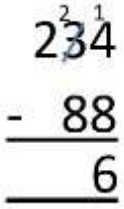
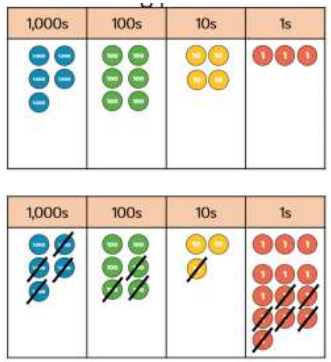
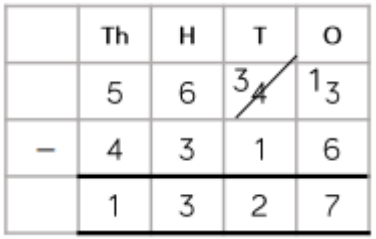
Represent the base 10 pictorially, remembering to show the exchange.

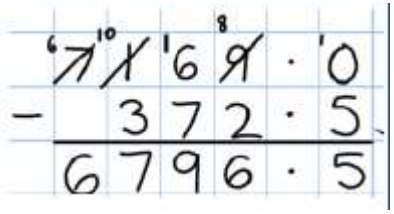
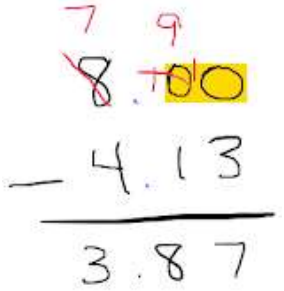


Formal column method. Children must understand that when they have exchanged the 10 they still have 41 because 41 = 30 + 11.

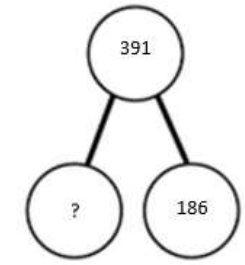
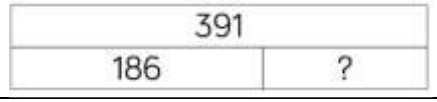
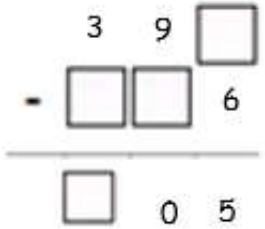


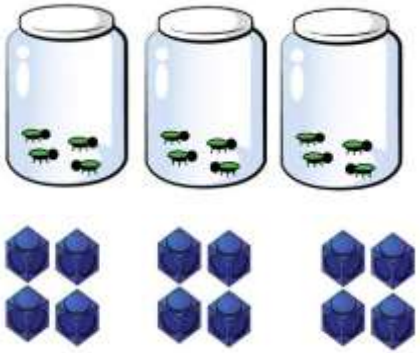
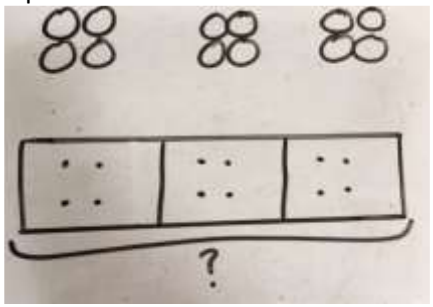
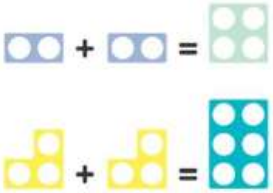
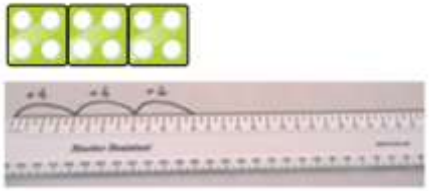
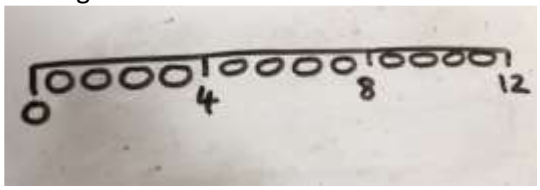


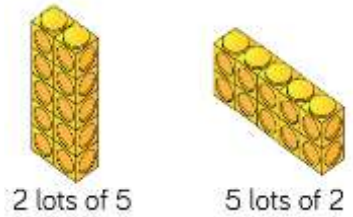
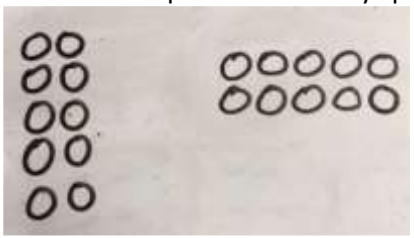
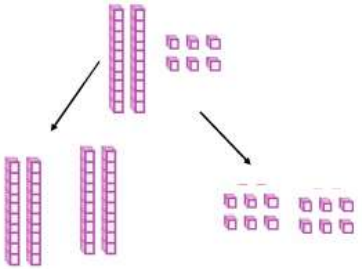
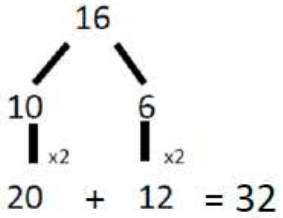
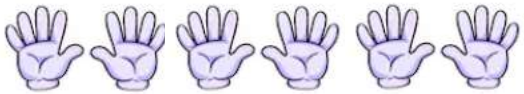
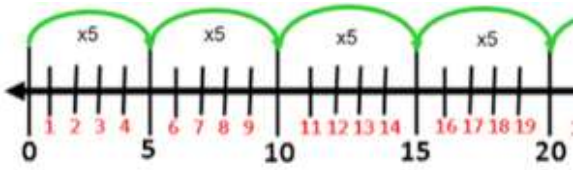
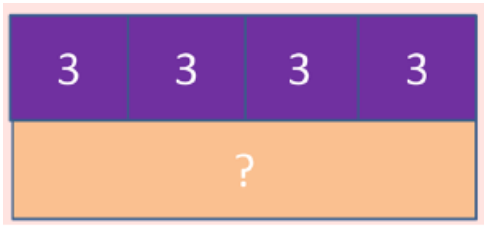
<table>
<tr><td rowspan="3">Subtraction</td><td>Year 3</td><td>HTU-TU: no regrouping
Model with Dienes
 
</td><td>Draw representation as Year 2</td><td> 
</td></tr>
<tr><td></td><td>HTU-TU: with regrouping
Column method using place value counters to exchange.
234 – 88
 
</td><td>Represent the place value 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>Year 4</td><td>Subtracting tens and ones
Up to 4 digits.
 
</td><td>Represent the place value counters as above; remembering to show what has been exchanged.</td><td> 
</td></tr>
</table>

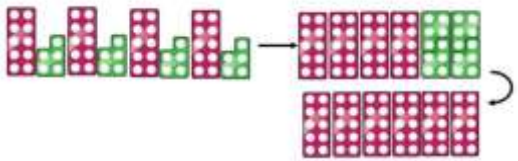
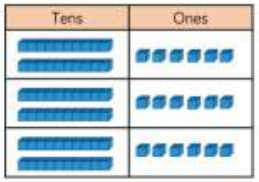
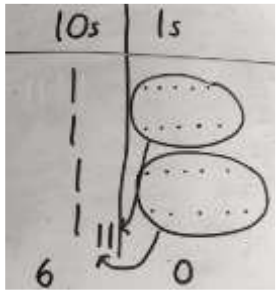
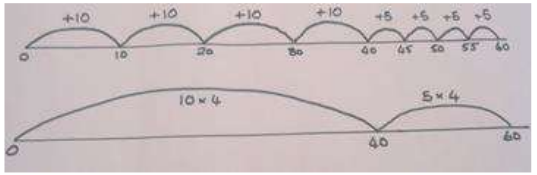
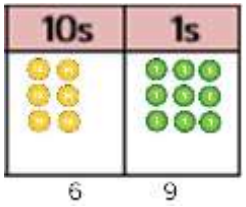
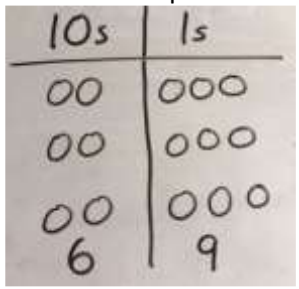
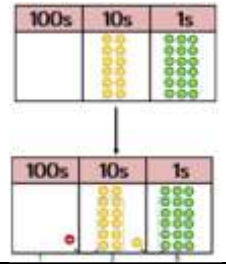
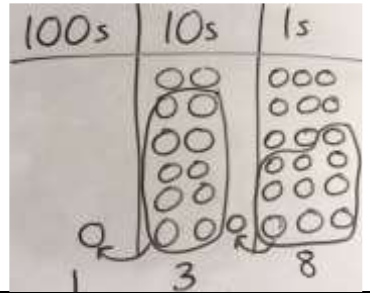
	Year 5	**Subtracting numbers with at least 4 digits** Extending place value chart from Year 4 Introducing decimal subtraction with money and measures calculations.	Represent the place value counters as above; remembering to show what has been exchanged.	Line up the decimal point; use zero for place holder 
	Year 6	**Subtracting increasingly complex numbers and decimals**		 Use zero as a place holder

Conceptual variation; different ways to ask children to solve 391 - 186

  	Raj spent £391, Timmy spent £186. How much more did Raj spend? Calculate the difference between 391 and 186.	___ = 391 – 186 391 -186 ____ What is 186 less than 391?	Missing digit calculations. 

Multiplication	Year 1	Concrete	Pictorial	Abstract
		Repeated grouping/repeated addition 4 × 3 4 + 4 + 4 There are 4 in 3 equal groups. 	Children to represent the practical resources in a picture and use a bar model. 	Written calculations 4 × 3 = 12 12 = 4 x 3 4 + 4 + 4 = 12 12 = 4 + 4 + 4
		Doubling Use a variety of resources including cubes and Numicon Double 4: 	Children draw pictures of doubles 	2 x 4 = 8
		Number lines to show repeated groups- 4 x 3 	Represent this pictorially alongside a number line e.g. 	Abstract number line showing three jumps of four. 4 x 3 = 12 

Multiplication	Year 2	**Use arrays to illustrate commutativity** Counters and other objects can also be used. 2 × 5 = 5 × 2  	Children to represent the arrays pictorially. 	Children to be able to use an array to write a range of calculations e.g. 2 x 5 = 10 or 10 = 2 × 5 5 × 2 = 10 or 10 = 5 x 2 2 + 2 + 2 + 2 + 2 = 10 10 = 5 + 5
		Doubling Use Dienes and place value counters Double 26: 	Children draw representations of materials	Doubling 2-digit numbers: Partition and double each part, recombine 
		Counting in Multiples of 2, 3, 4, 5, 10 Groups of objects/fingers used for skip counting 	Number lines, counting sticks, bar models   	Count in 2s etc verbally Write sequences of multiples 0, 2, 4, 6, 8.. 0, 5, 10, 15,…

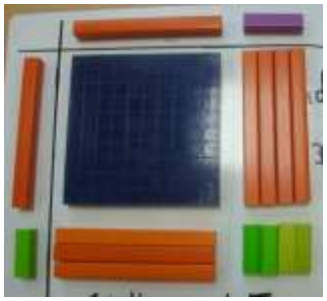
	Year 3	**U x TU: Partitioning** Partition to multiply using Numicon or dienes 4 × 15  Relating to place value chart  3 x 26	Children to represent the concrete manipulatives pictorially.  4 x 15	Children to be encouraged to show the steps they have taken. 4 x 15 10 5 10 x 4 = 40 5 x 4 = 20 40 + 20 = 60 A number line can also be used 
	Year 4	**U x TU: Formal column method** Place value counters or dienes. No exchanging. 3 × 23 	Children to represent the counters pictorially. 	Children to record what it is they are doing to show understanding. 3 x 23 20 3 3 x 20 = 60 3 x 3 = 9 60 + 9 = 69 23 x 3 69
		U x TU: Formal column method Formal column method with place value counters. With an exchange, crossing 10.  6 x 23	Children to represent the counters/base 10, pictorially e.g. the image below.  23 x 6:	Formal written method 6 x 23 = 23 x 6 138 1 1

Multiplication

Year 5

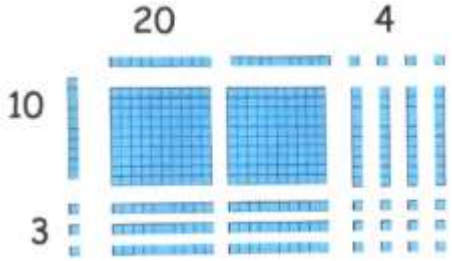
Grid method

Place value counters or dienes, partitioning numbers, multiplying separate parts, then combining.



14 x 13

Representations of Dienes



Recording grid, with addition alongside

x	300	20	7
4	1200	80	28

327 x 4

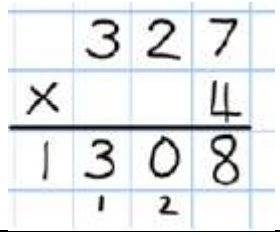
28

80

1200

1308

Leading to compact method



Year 5-6

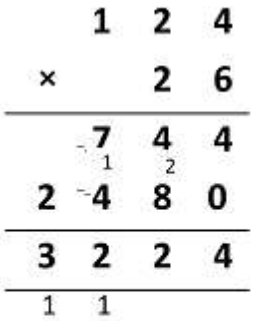
Column multiplication up to 4 digits x 2 digits and 3 digits x 3 digits

Children must be confident with the abstract calculations HTU x U and HTU x T

Concrete materials can still be used.

Pictorial representations as above

Formal written method



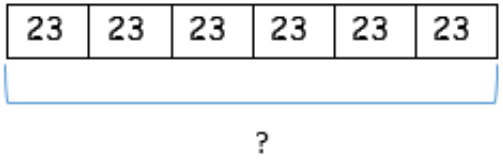
Year 6

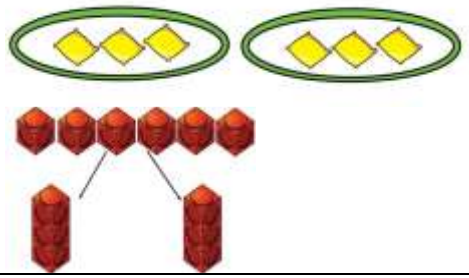
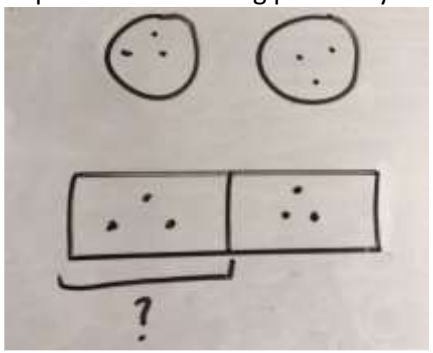
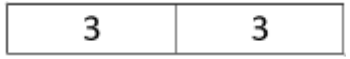
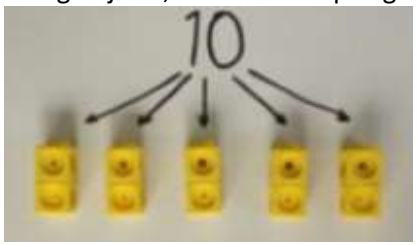
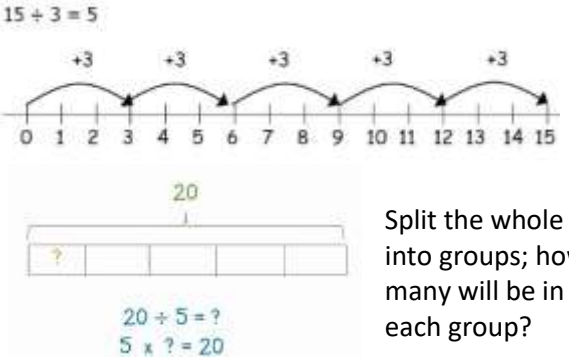
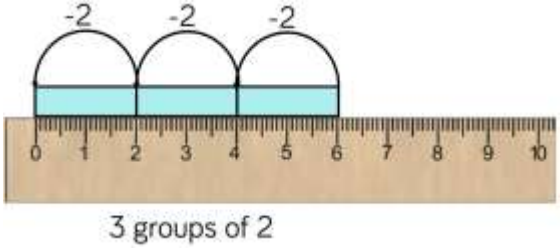
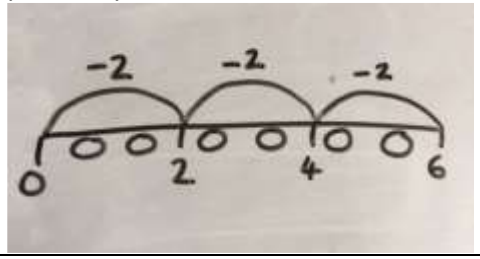
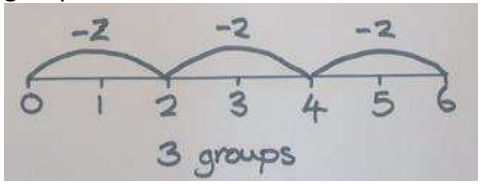
Multiplication of decimals

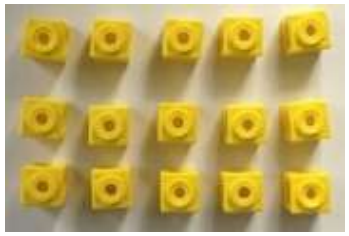
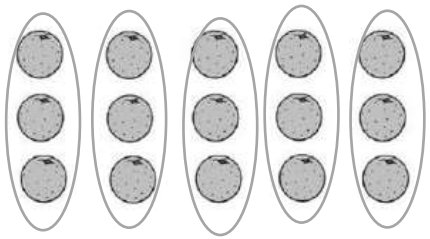
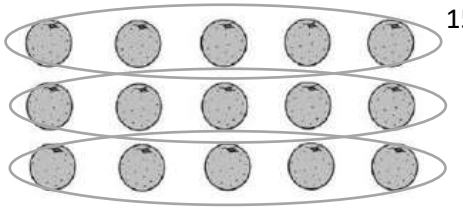
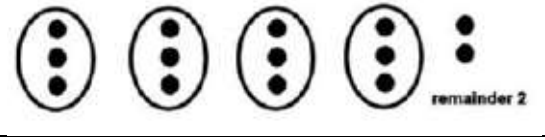
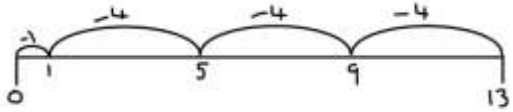
Formal written method

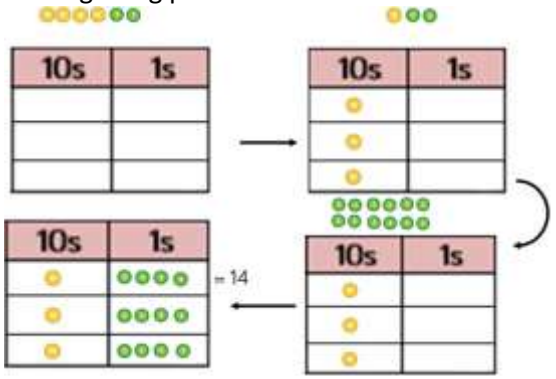
Ensure the answer has the same number of decimal places as the question

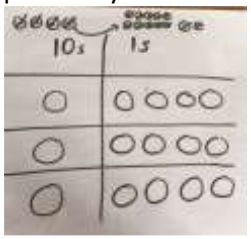
Conceptual variation; different ways to ask children to solve 6 × 23

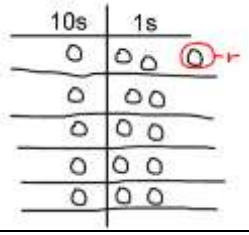
	Mai had to swim 23 lengths, 6 times a week. How many lengths did she swim in one week? With the counters, prove that 6 x 23 = 138	Find the product of 6 and 23 6 × 23 = __ = 6 × 23 6 × 23 23 × 6	What is the calculation? What is the product? 

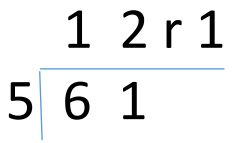
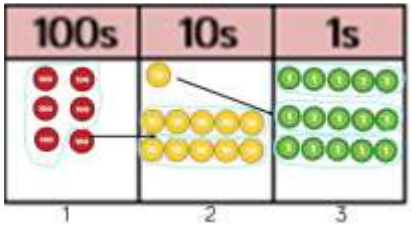
Division		Concrete	Pictorial	Abstract
	Year 1	**Division as Sharing** Using a range of objects. 6 ÷ 2 	Represent the sharing pictorially. 	6 ÷ 2 = 3  Children should also be encouraged to use their 2 times tables facts.
	Year 2	**Division as Grouping** Using objects, divide into equal groups 	Using number lines and bar models  Split the whole into groups; how many will be in each group?	20 ÷ 5 = 4 Divide 20 into 5 groups. How many are in each group?
		Repeated subtraction using Cuisenaire rods above a ruler. 6 ÷ 2 	Children to represent repeated subtraction pictorially. 	Abstract number line to represent the equal groups that have been subtracted. 

	Year 3	**Division with Arrays** Link division with multiplication by creating an array and finding the related number sentences 	Draw arrays and split into groups 15 ÷ 5 = 3  15 ÷ 3 = 5 	Find the linking number sentences 15 ÷ 5 = 3 15 ÷ 3 = 5 5 x 3 = 15 3 x 5 = 15
		TU ÷ U with remainders Using objects or lollipop sticks. Cuisenaire rods, above a ruler can also be used. 13 ÷ 4  Use of lollipop sticks to form wholes- squares are made because we are dividing by 4. There are 3 whole squares, with 1 left over.	Children to represent the lollipop sticks pictorially.  There are 3 whole squares, with 1 left over. Draw dots and group them, clearly showing the remainder 	Written: 13 ÷ 4 – 3 remainder 1 Children should be encouraged to use their times table facts; they could also represent repeated addition on a number line. '3 groups of 4, with 1 left over' 

<table>
<tr>
<td rowspan="2">Division</td>
<td></td>
<td>TU ÷ U
Sharing using place value counters. 42 ÷ 3 = 14
 

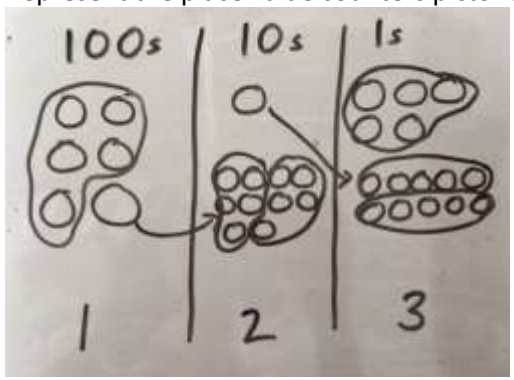
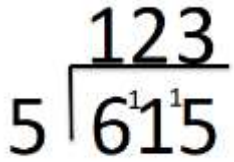
Repeat with remainders e.g. 61 ÷ 5 =</td>
<td>Children to represent the place value counters pictorially.
 

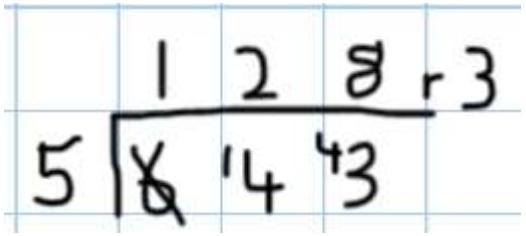

</td>
<td>Record in short division ‘bus stop’ format

61 ÷ 5
 
</td>
</tr>
<tr>
<td>Year 4-5</td>
<td>HTU ÷ U
Short division using place value counters to group.
615 ÷ 5
 

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?

Repeat with remainders e.g. 643 ÷ 5 =

Year 5 extend to ThHTU ÷ U</td>
<td>Represent the place value counters pictorially.
 
</td>
<td>Children to write the calculation using the short division scaffold.
 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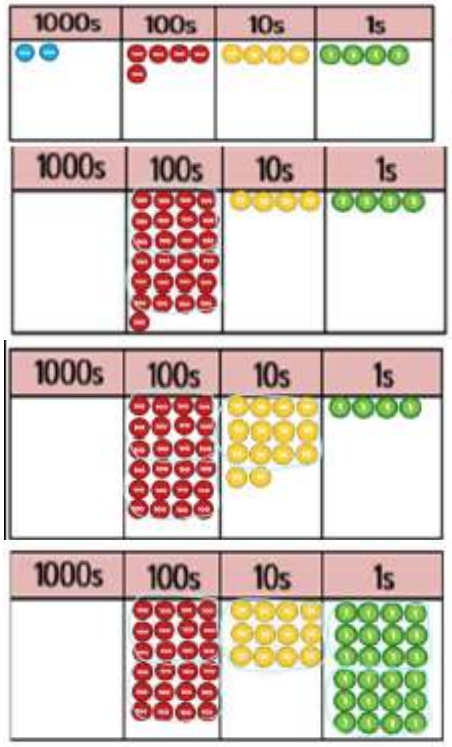
Division

Year 6

HTU ÷ TU Long division

Using place value counters

2544 ÷ 12



We can't group 2 thousands into groups of 12, so we exchange them for 20 hundred counters

2 groups of 12, which leaves 1 hundred. We exchange this for 10 ten counters

1 group of 12 in the tens column leaves 2 tens. We exchange them for 20 ones

Group the 24 ones into 2 groups of 12, with noremainder

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

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

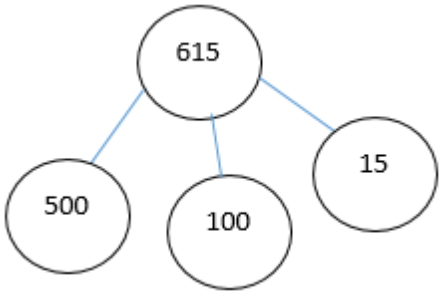
After exchanging the hundred, we have 14 tens. We can group 12 tens into a group of 12, which leaves 2 tens.

$$\begin{array}{r} 021 \\ 12\overline{)2544} \\ \underline{24} \\ 14 \\ \underline{12} \\ 2 \end{array}$$

After exchanging the 2 tens, we have 24 ones. We can group 24 ones into 2 group of 12, which leaves no remainder.

$$\begin{array}{r} 0212 \\ 12\overline{)2544} \\ \underline{24} \\ 14 \\ \underline{12} \\ 24 \\ \underline{24} \\ 0 \end{array}$$

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 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?