Calculation and representation policy

Norton CEVC Primary School

Written Calculation

The overall aim is that when children leave our schools they:

• have a secure knowledge of number facts and a good understanding of the four operations;

• are able to use this knowledge and understanding to carry out calculations mentally and to apply general strategies when using one-digit and two-digit numbers and particular strategies to special cases involving bigger numbers;

• make use of diagrams and informal notes to help record steps and part answers when using mental methods that generate more information than can be kept in their heads;

• have an efficient, reliable, written method of calculation for each operation that children can apply with confidence when undertaking calculations that they cannot carry out mentally;

• use a calculator effectively, using their mental skills to monitor the process, check the steps involved and decide if the numbers displayed make sense.

Progression towards a standard written method of calculation

INTRODUCTION

In Norton we use structured and systematic approach to teaching number.
There is a considerable emphasis on teaching mental calculation strategies. Up to the age of 7 (Year 2) informal written recording should take place regularly and is an important part of learning and understanding. More formal written methods should follow only when the child is able to use a wide range of mental calculation strategies.

REASONS FOR USING WRITTEN METHODS:

- To aid mental calculation by writing down some of the numbers and answers involved
- To make clear a mental procedure for the pupil
- To help communicate methods and solutions
- To provide a record of work to be done
- To aid calculation when the problem is too difficult to be done mentally
- To develop and refine a set of rules for calculation

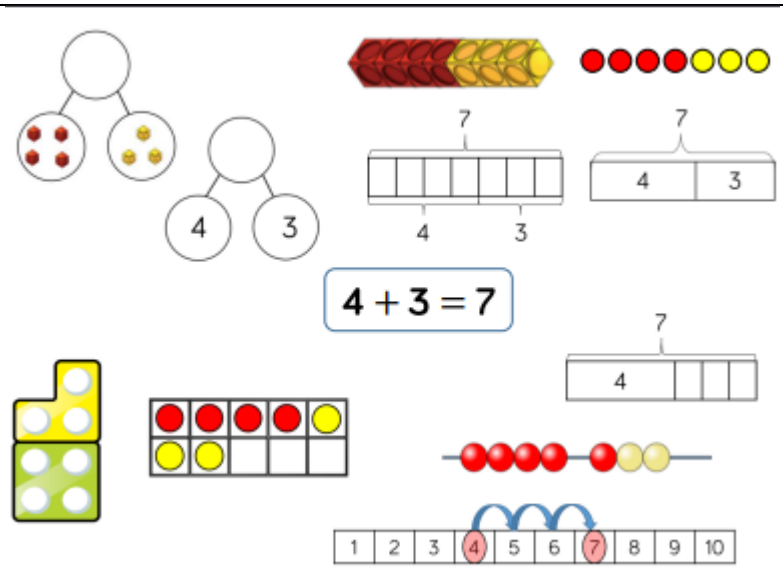
STANDARD VOCABULARY FOR EACH OPERATION

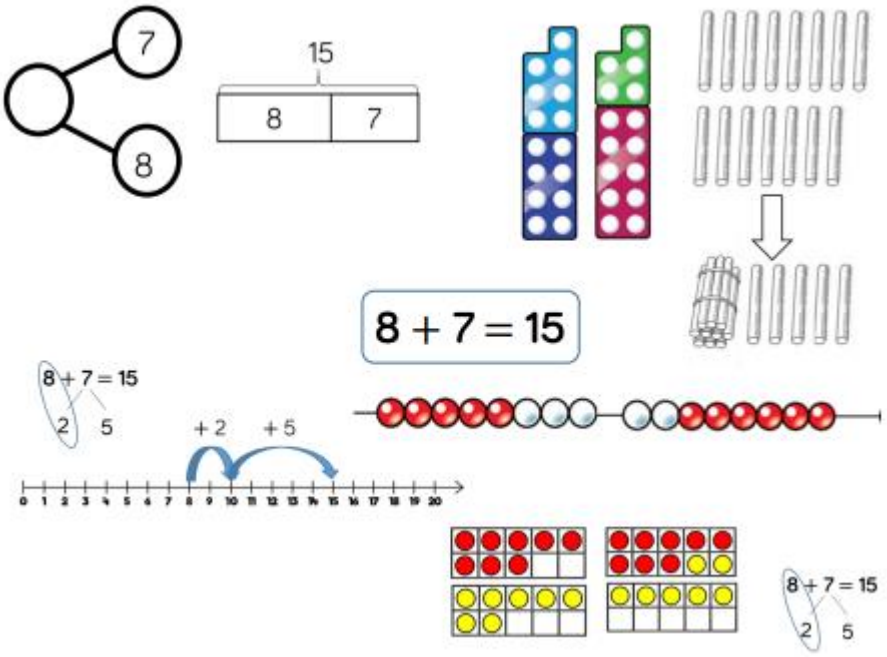
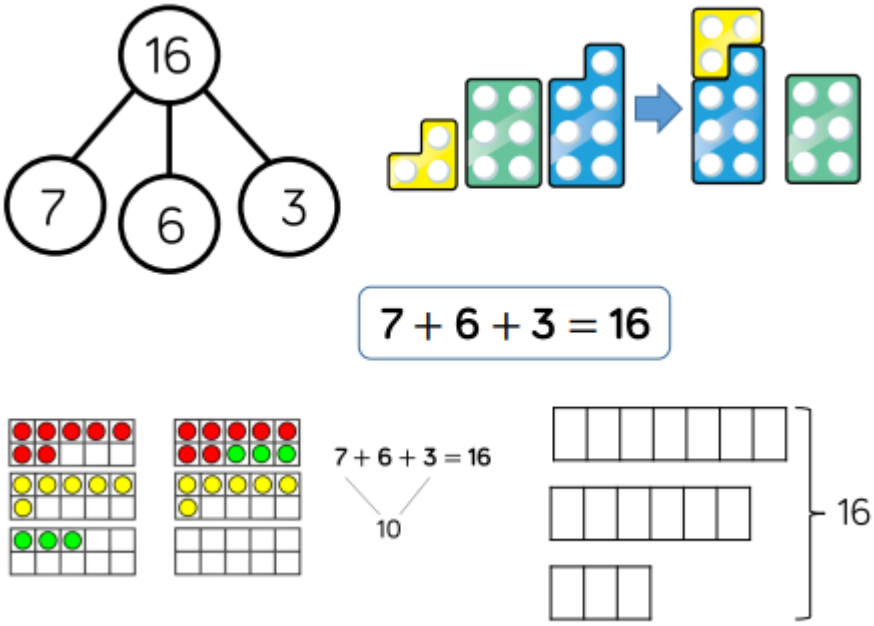
+	-
Get some more, real story, maths story, same value different appearance, tens, units, hundreds, thousands, place value, digit, value, combine, sum, total, add, addition, more, plus, increase, sum, total, altogether, score, double, near double, how many more to make…?, equals, sign, regroup, tens boundary, hundreds boundary, units boundary, tenths boundary, inverse, fair swap	Get ready to take away, real story, maths story subtract, take away, minus, decrease, leave, how many are left/left over? difference between, half, halve, how many more/fewer is.. than…?, how much more/less is…?, equals, sign, tens boundary, hundreds boundary, units boundary, tenths boundary, inverse, regroup, fair swap, same value different appearance
x	**÷**
Lots of, groups of, times, product, multiply, multiplied by, multiple of, once, twice, three times, four times, five times… ten times, repeated addition, array, row, column, double, regroup, fair swap, inverse, same value different appearance	Halve, share, share equally, one each, two each, three each…, group in pairs, threes… tens, equal groups of, divide, divided by, divided into, divisible by, remainder, factor, quotient, inverse, regroup, fair swap, inverse, same value different appearance

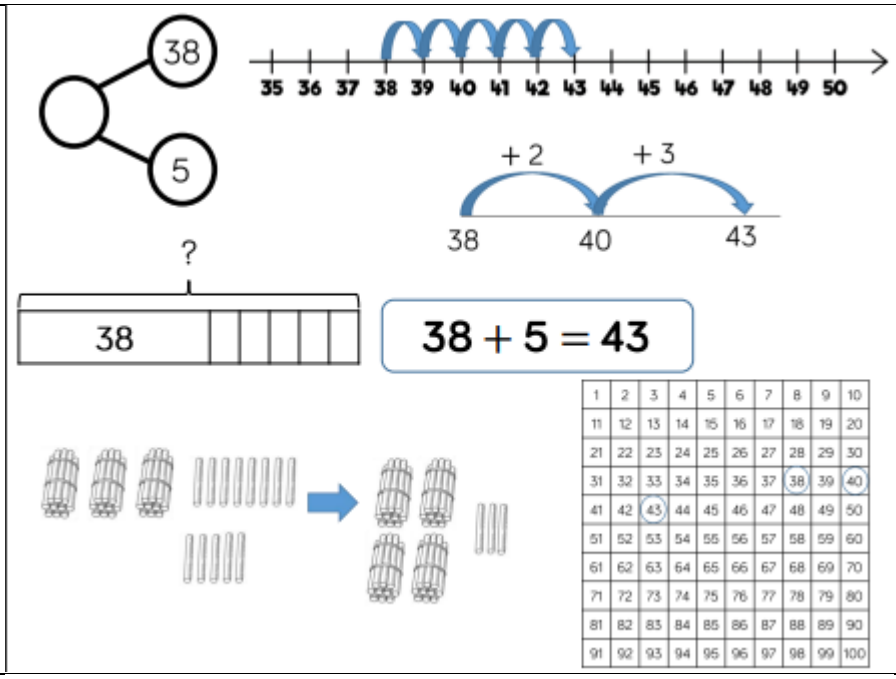
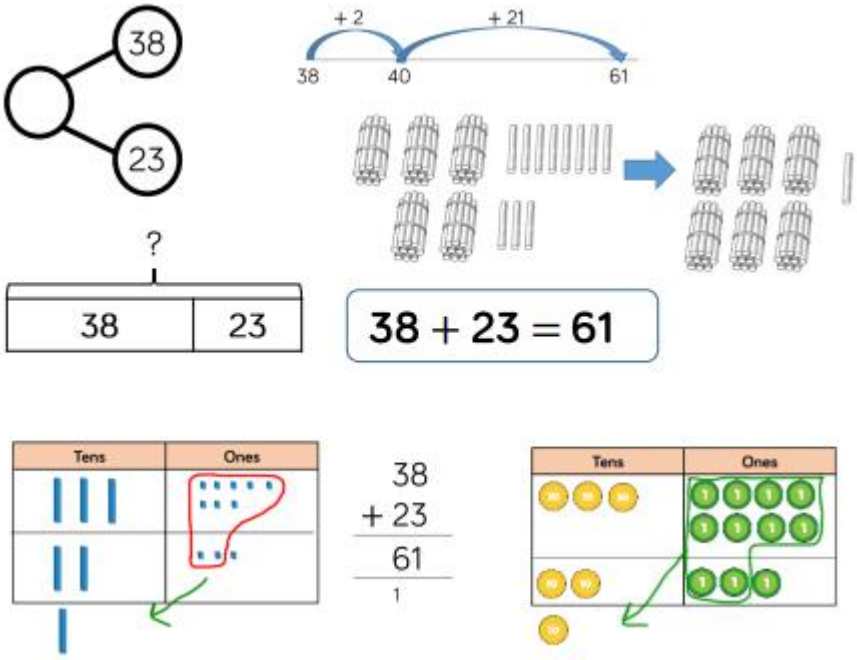
Below details the representations and calculation policy we follow when teaching key calculation concepts. Not all representations will be used during a lesson; teachers use their professional judgement to select representations which best suit the needs of their class and follow through the sequence of lessons.

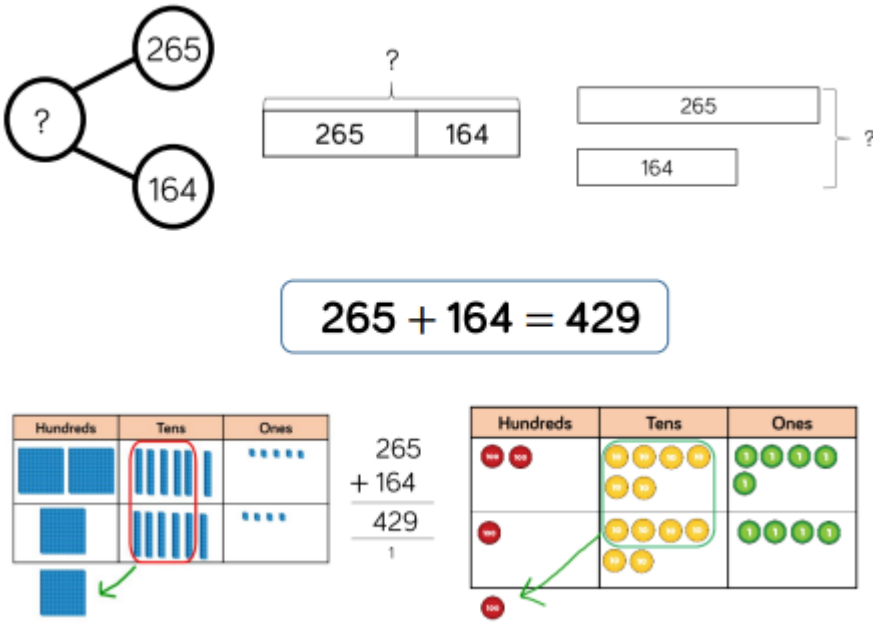
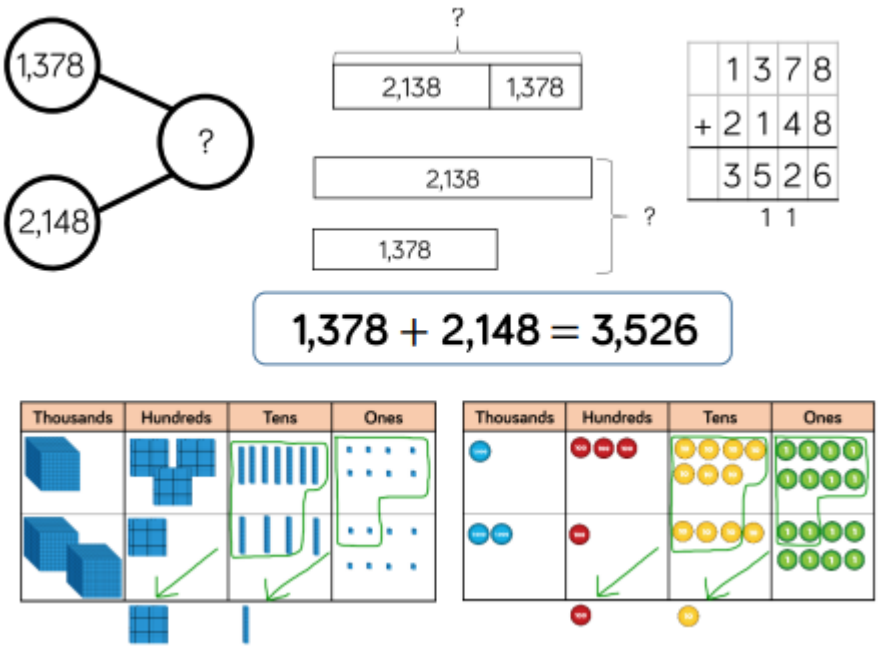
The representations and progression are in line with the White Rose scheme of work.

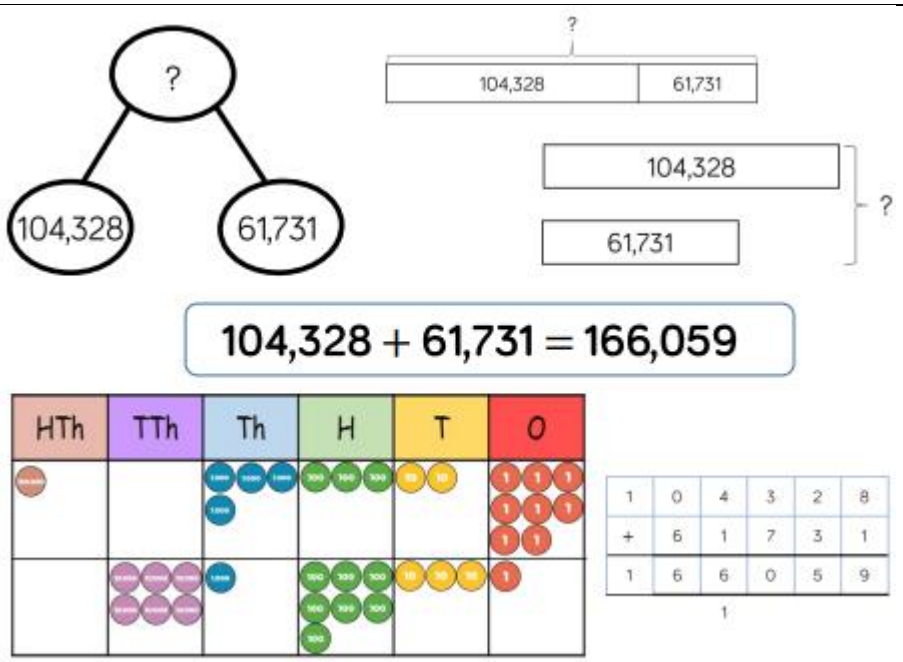
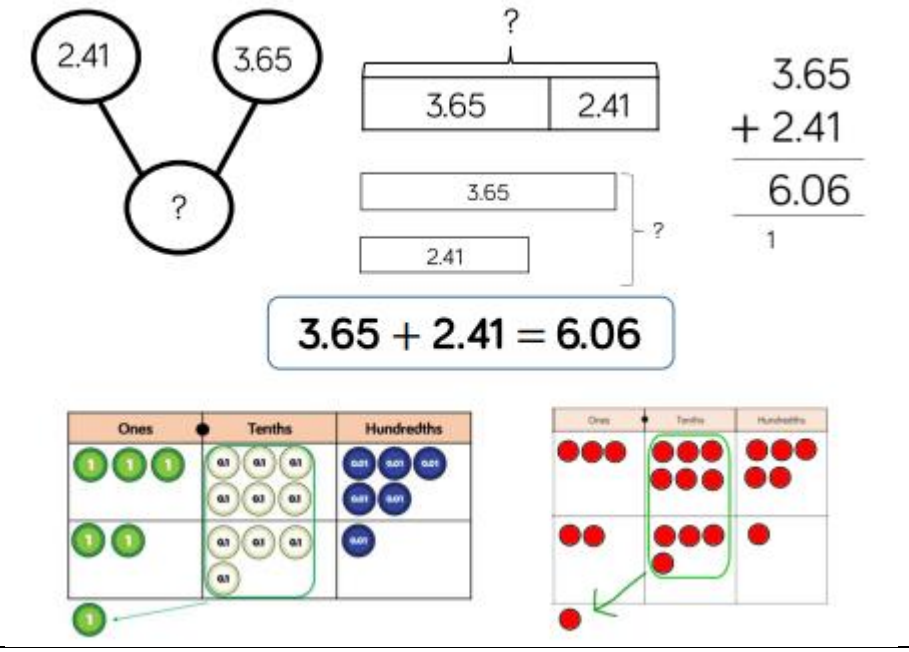
Addition

Year 1	Add 1-digit numbers within 10		When adding numbers to 10 children can explore both aggregation and augmentation.

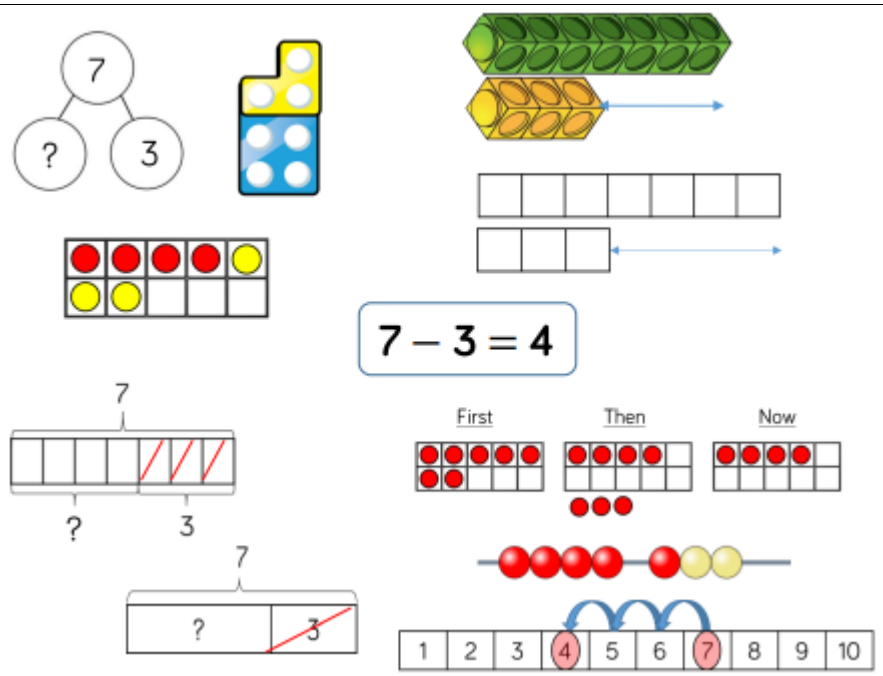
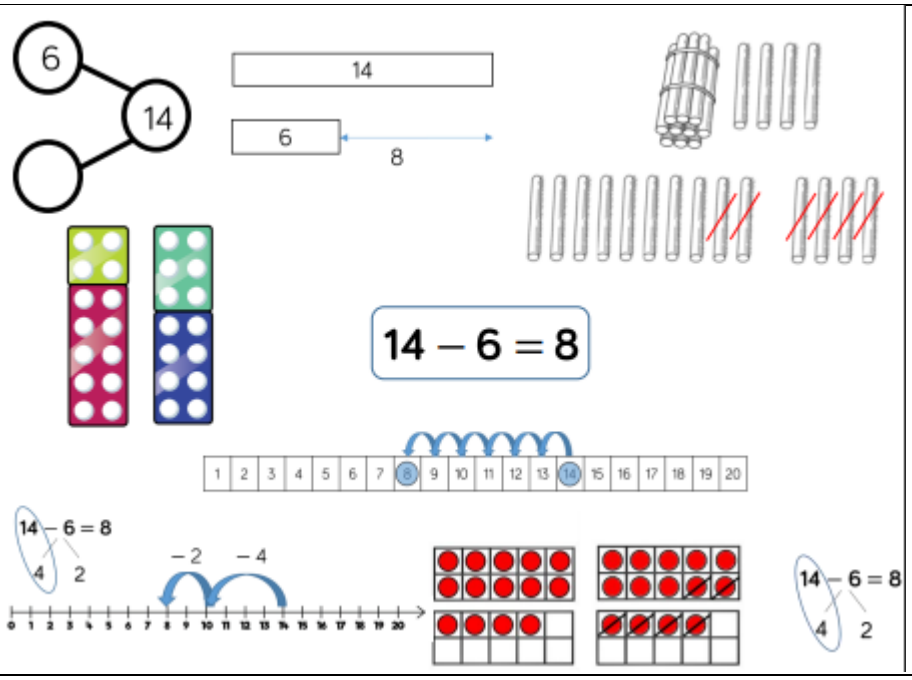
Year 1/2	Add 1 and 2-digit numbers to 20.		When adding one-digit numbers that cross 10, it is important to highlight the importance of ten ones equalling one ten/
Year 2	Add three 1-digit numbers		Children should look for bonds to 10 to add the numbers more efficiently. This helps children to understand commutativity.

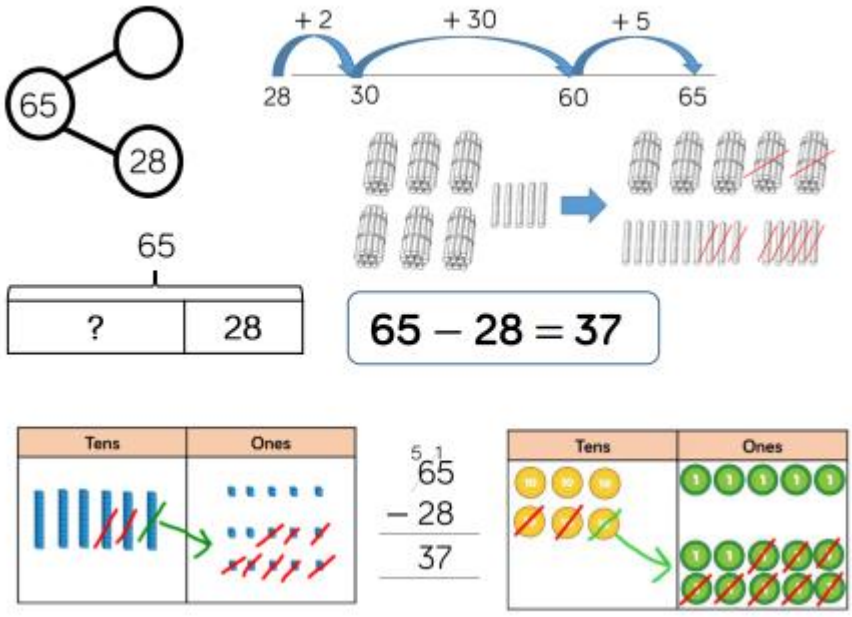
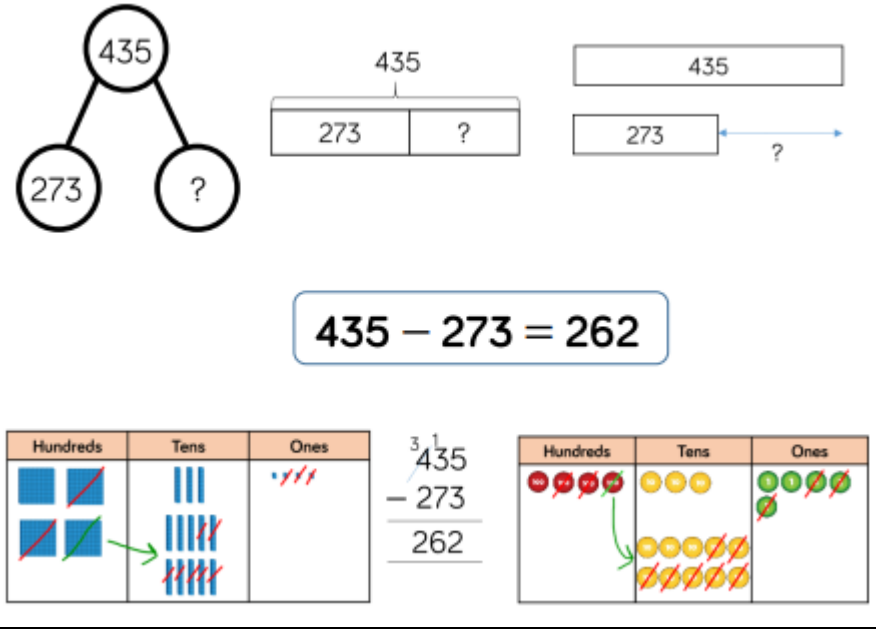
Year 2	Add 1-didigt and 2-diigit numbers to 100.		Children should be encouraged to count on from the larger number. They should be able to apply their prior knowledge of numbers bonds. Straw bindles and 100 squares can support children to find the bond to 10.
Year 2	Add two 2-digit numbers to 100.		Children do not yet use a formal column method but use concrete resources and pictorial representations.

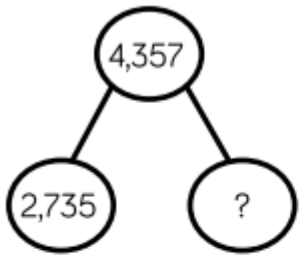
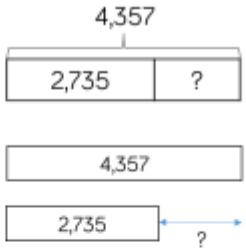
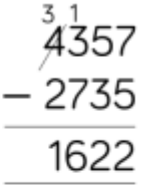
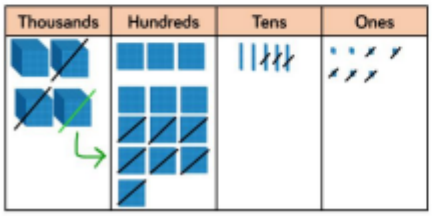
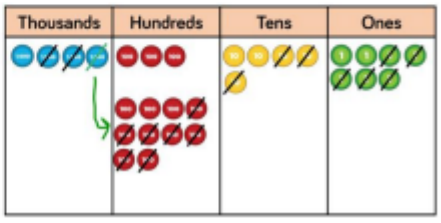
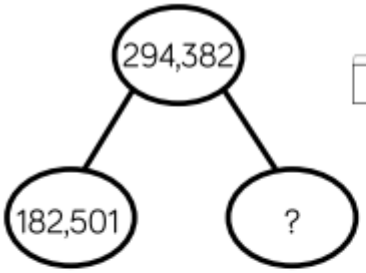
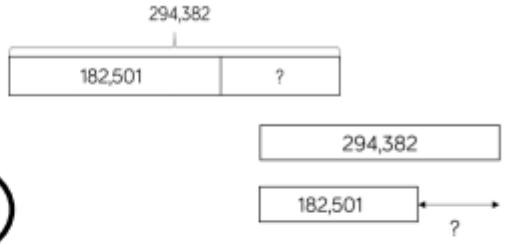
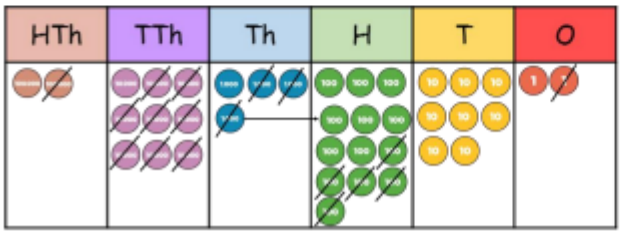
Year 3	Add numbers with up to 3 digits.		Base 10 and counters are the most effective manipulatives as the starting point. Ensure children start to write out their calculation alongside the concrete resources so they can see links to the written column method.
Year 4	Add numbers with up to 4-digits.		Base 10 and counters are the most effective manipulatives as the starting point. Ensure children start to write out their calculation alongside the concrete resources so they can see links to the written column method.

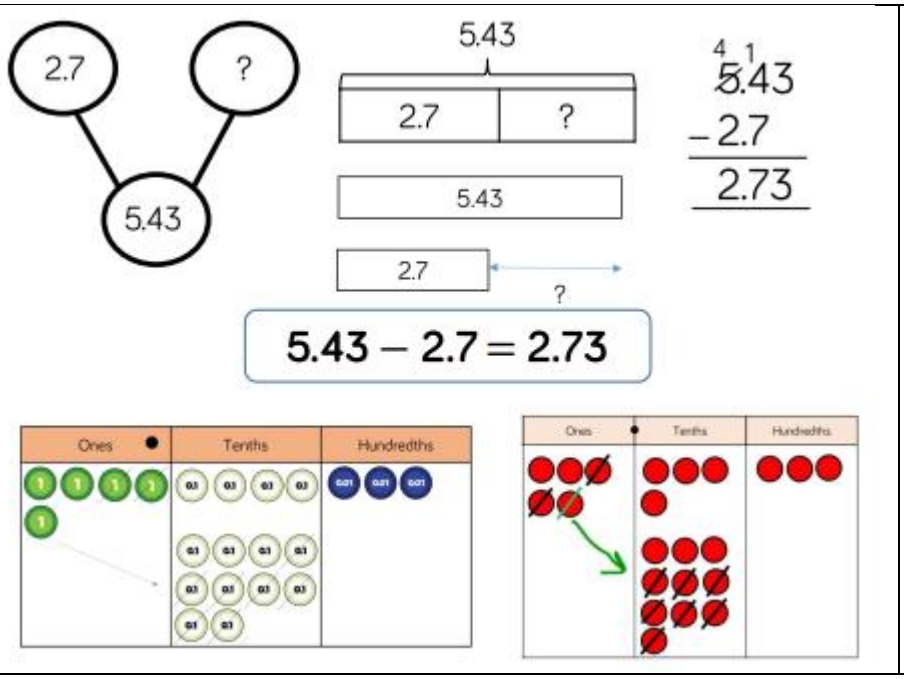
Year 5/6	Add numbers with more than 4 digits.		Place value counters are the most effective concrete resource used on a place value grid. Children should be encouraged to work in the abstract, using the column method to add larger numbers efficiently.
Year 5	Add with up to 3 decimal places		Ensure children have experience of adding decimals with a variety of decimals places. This includes putting this into context when adding money and other measure.

Subtraction

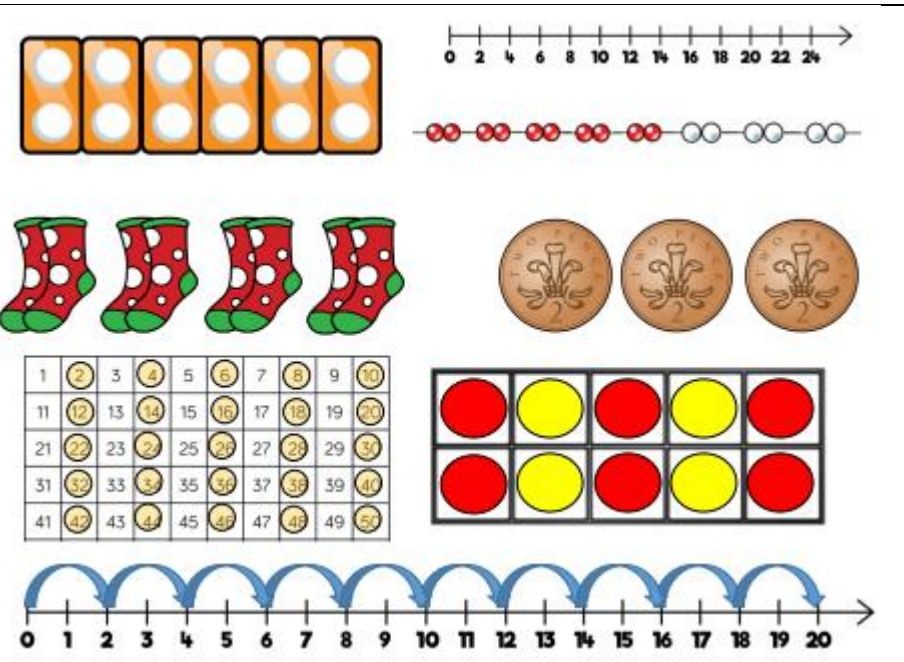
Year 1	Subtract 1-didigt numbers within 10		Part whole models, bar models and ten frames support partitioning. Tens frames, number tracks, single bar models and bead string support reduction. Cubes and bar models with two bars can support finding the difference.
Year 1/2	Subtract 1 and 2-digit numbers to 20		When subtracting one-digit numbers that cross 10, it is important to highlight the importance of ten ones equalling one ten. Children should be encouraged to find the number bond to 10 when partitioning the subtracted number.

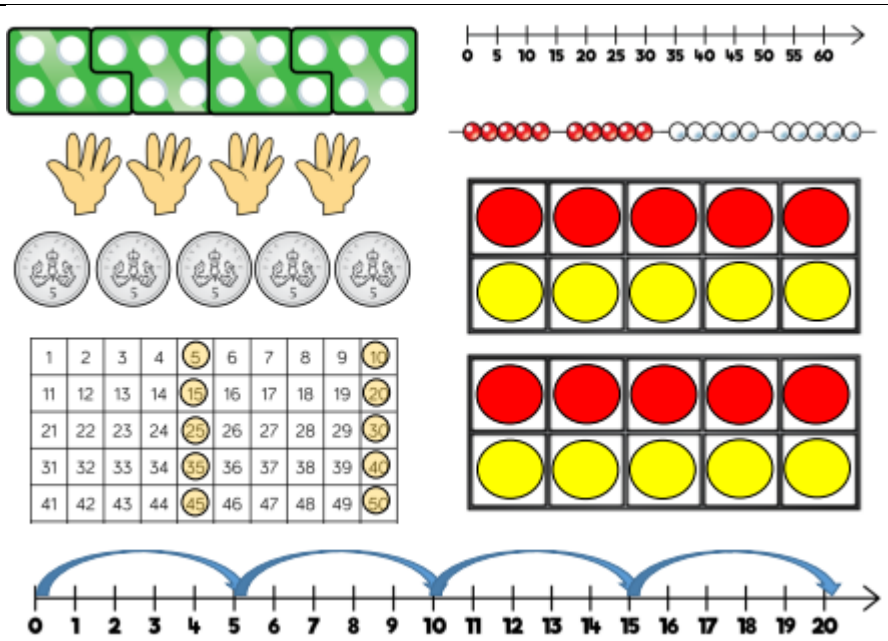
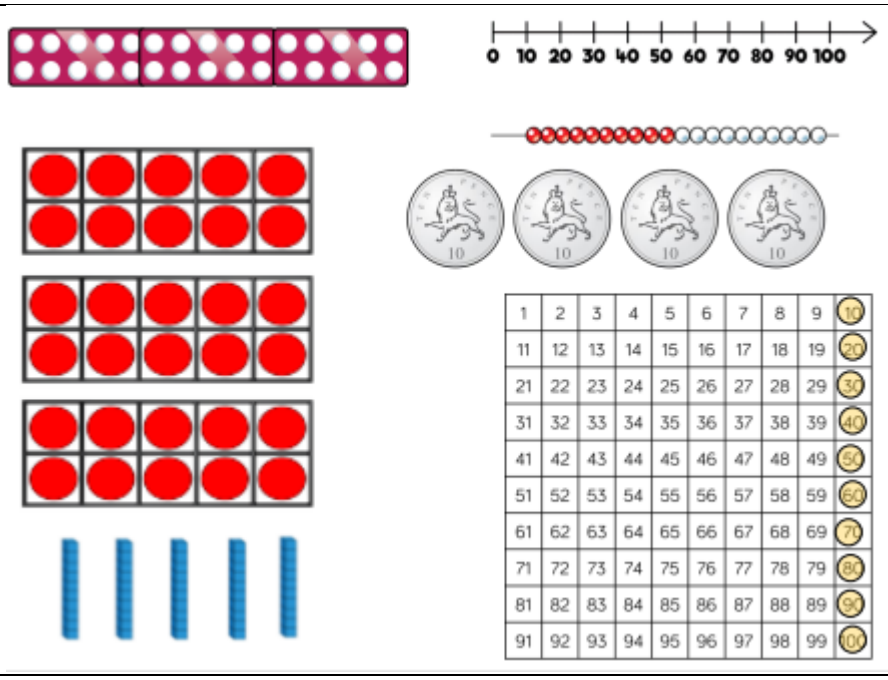
Year 2	Subtract 1 and 2-digit numbers to 100		Children will work mostly practically. The formal method can be introduced alongside the concrete resources but not in isolation.
Year 3	Subtract numbers with up to 3-digits		Base 10 and place value counters are the most effective manipulatives. Ensure children write out their calculation alongside any concrete resources so they can see the links to the written column method.

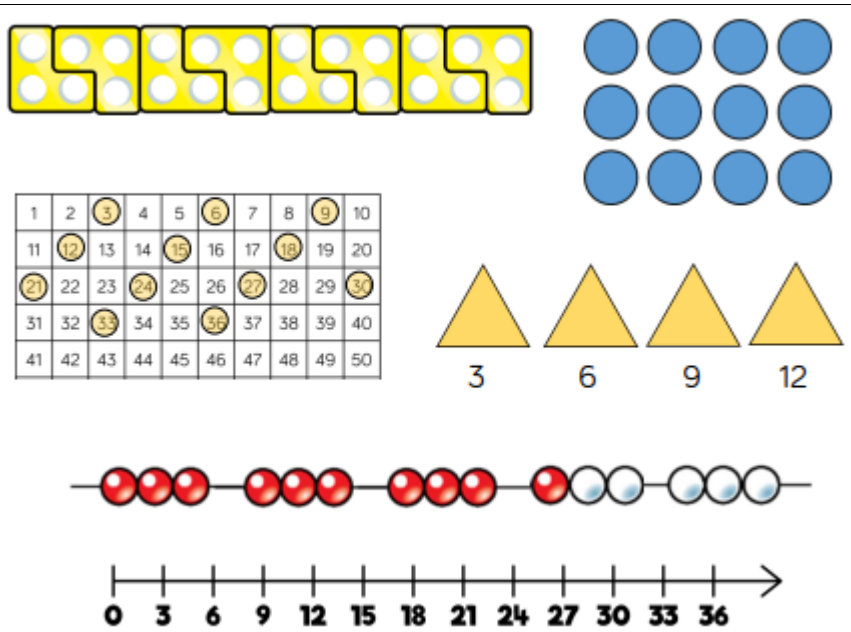
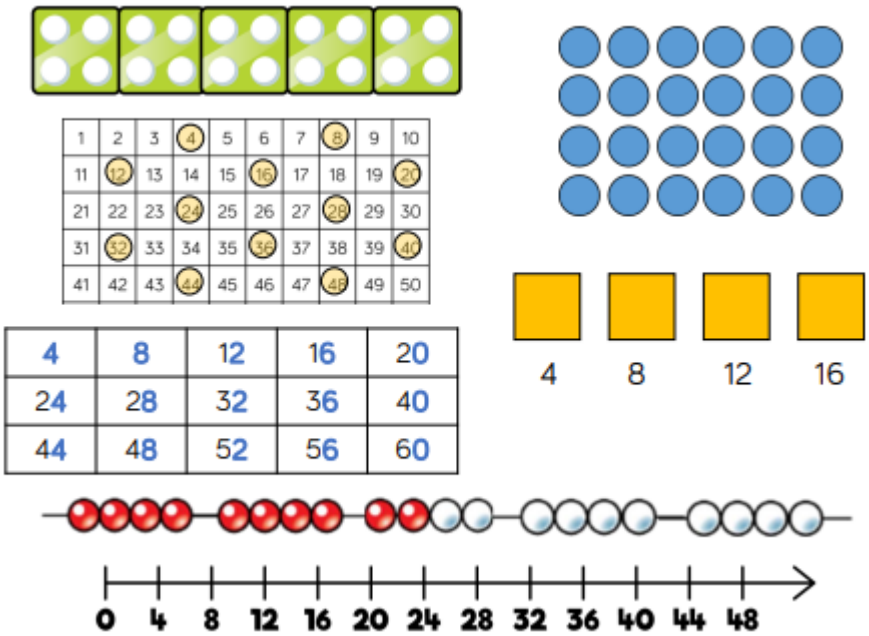
Year 4	Subtract numbers with up to 4 digits	   4,357 – 2,735 = 1,622  	Base 10 and place value counters are the most effective manipulatives. Ensure children write out their calculation alongside any concrete resources so they can see the links to the written column method.
Year 5/6	Subtract numbers with more than 4 digits	  294,382 – 182,501 = 111,881  	Place value counters are the most effective concrete resource used on a place value grid. Children should be encouraged to work in the abstract, using the column method to subtract larger numbers efficiently.

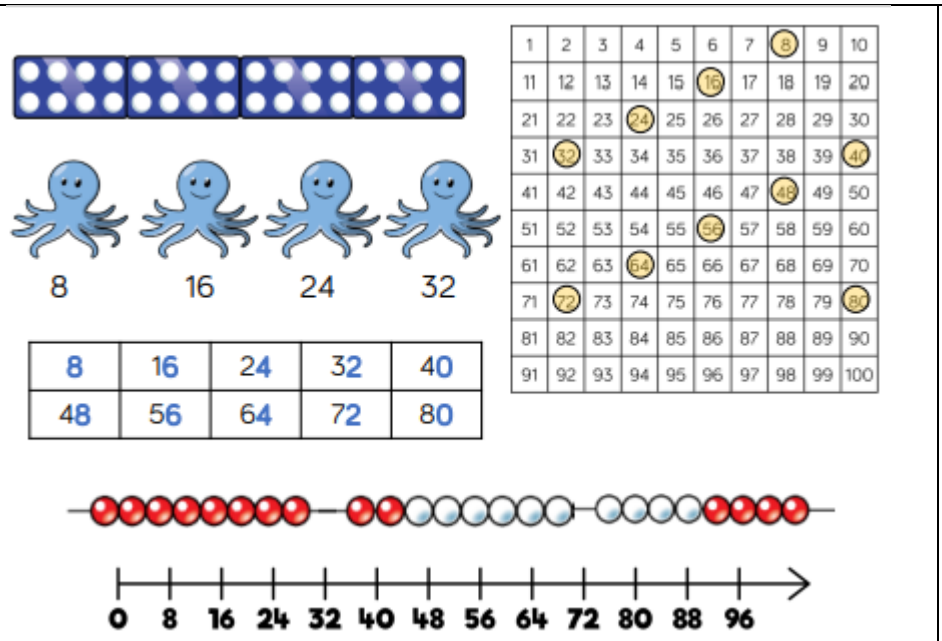
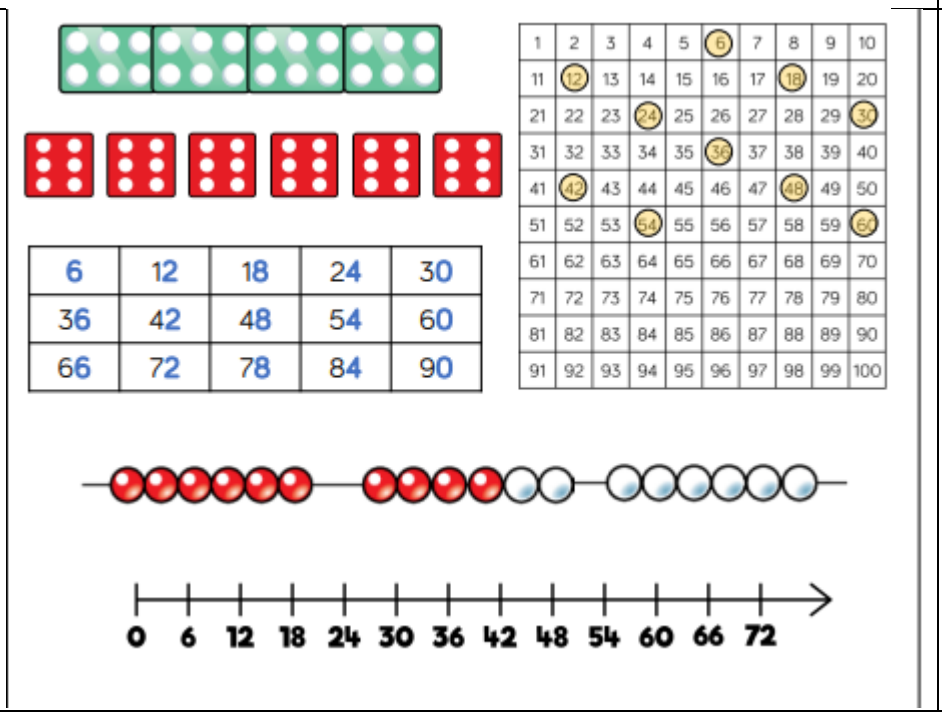
Year 5	Subtract with up to 3 decimal places		Place value counters and plain counters on a place value grid are the most effective manipulating subtracting decimals/

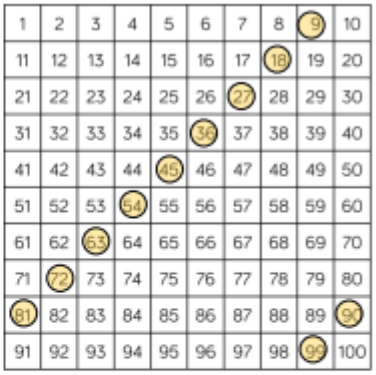
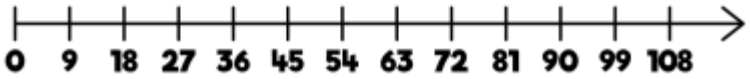
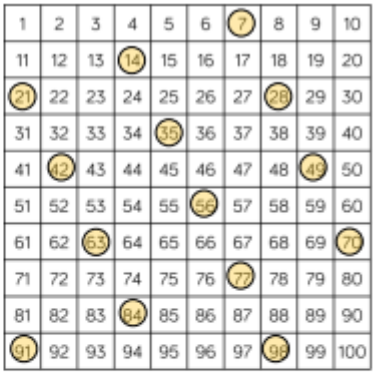
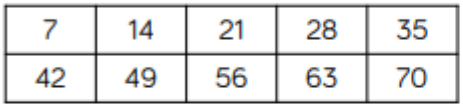
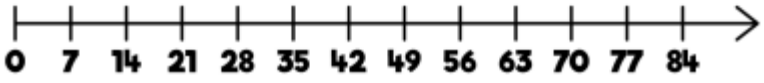
Multiplication – times tables

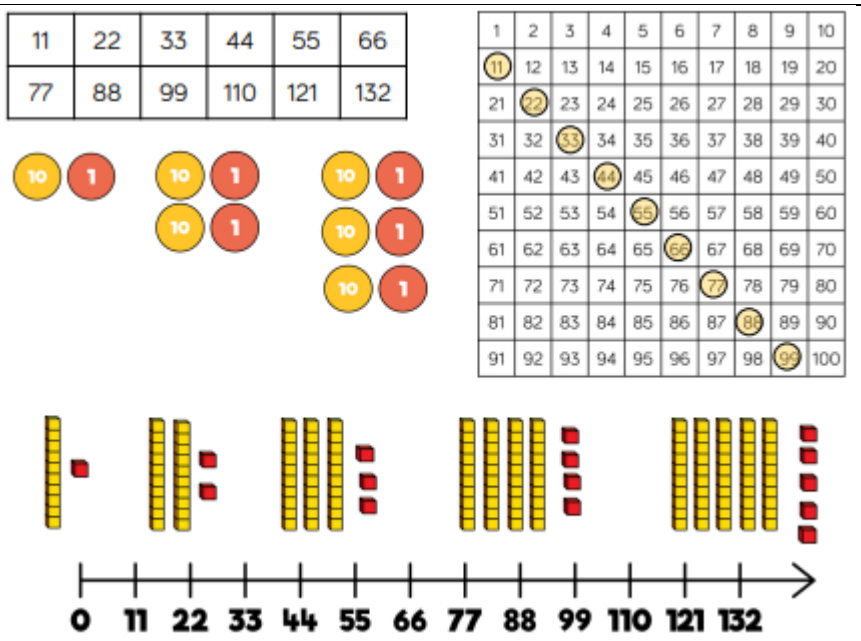
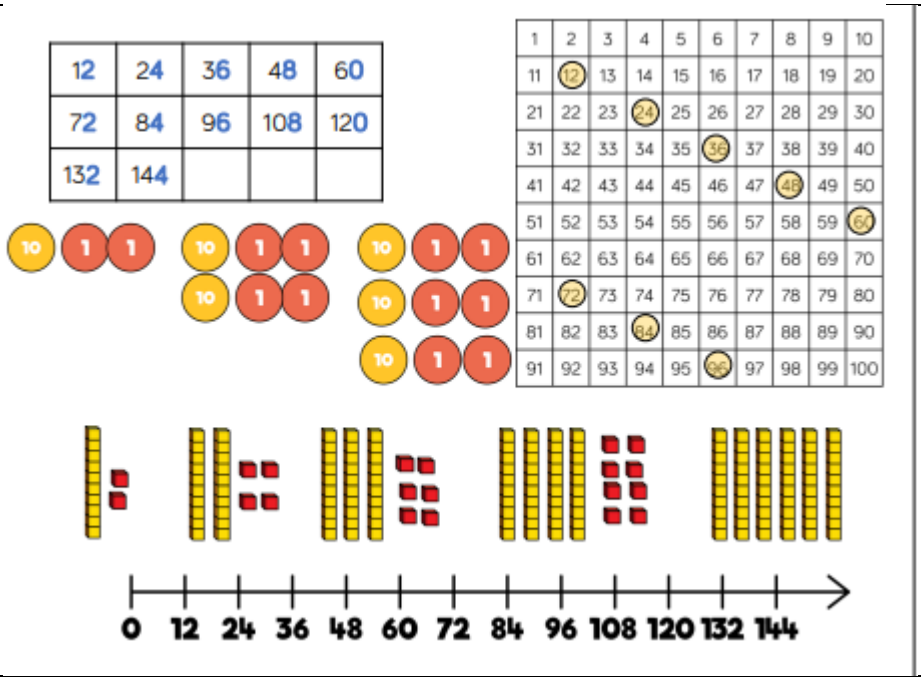
2 times tables		

5 times tables		
10 times tables		

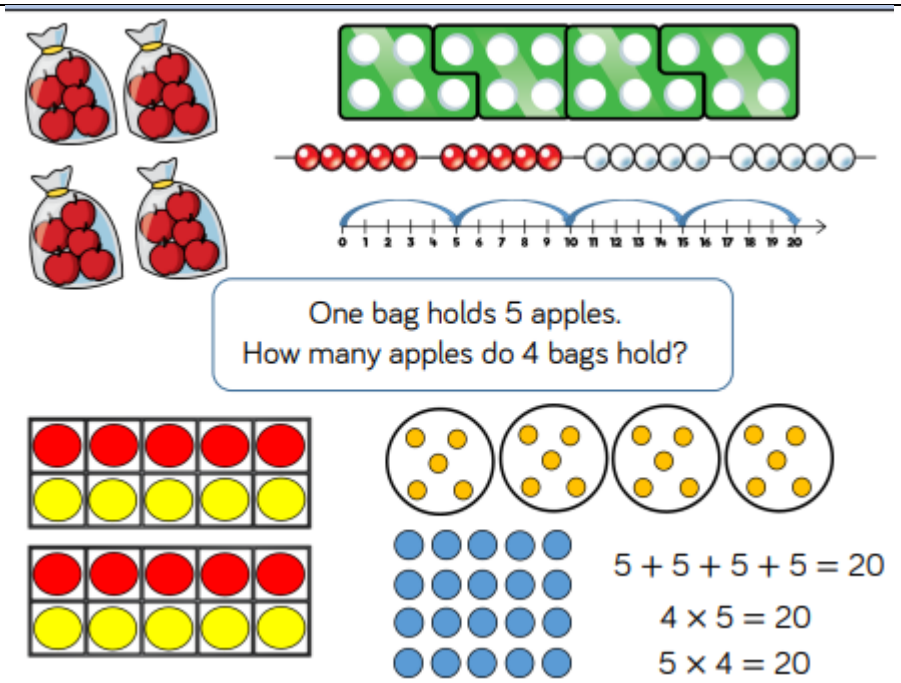
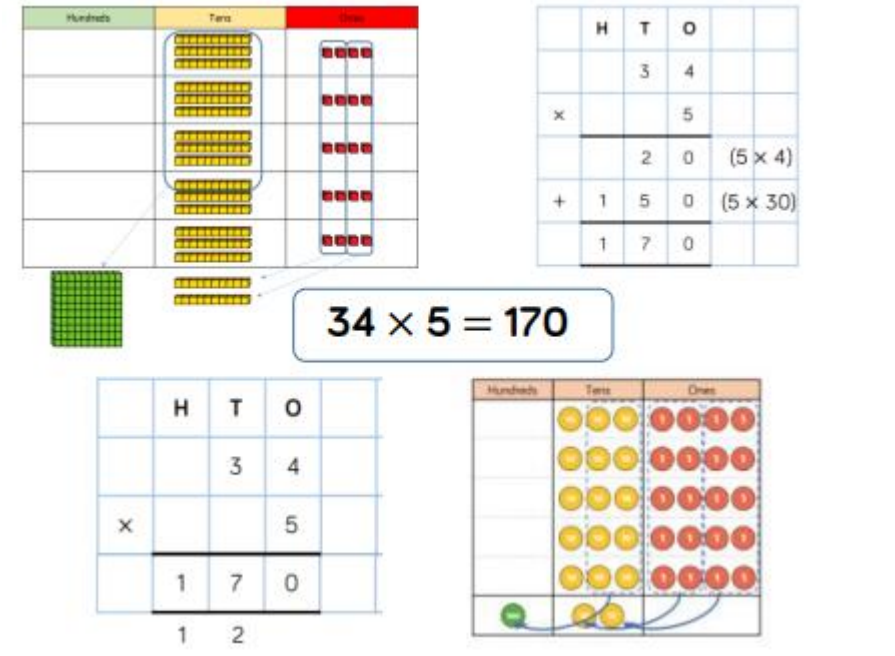
3 times tables		
4 times tables		

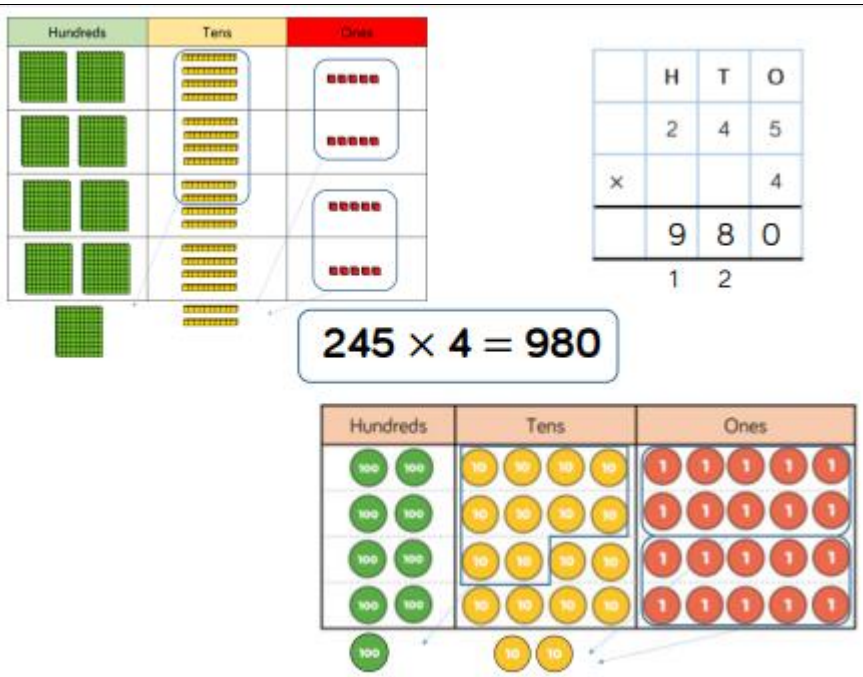
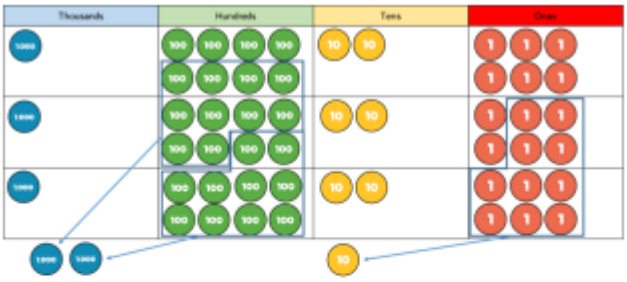
8 times tables	 8 16 24 32 40 48 56 64 72 80 	
6 times tables		

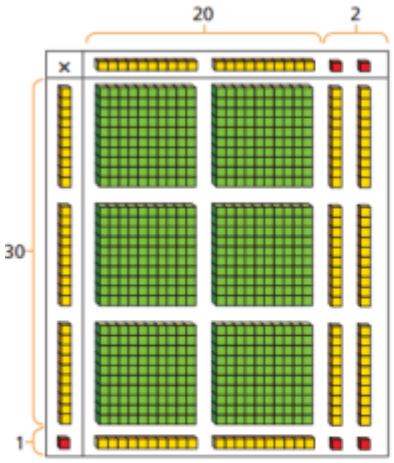
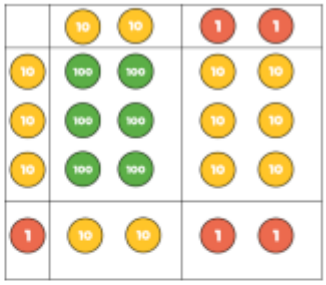
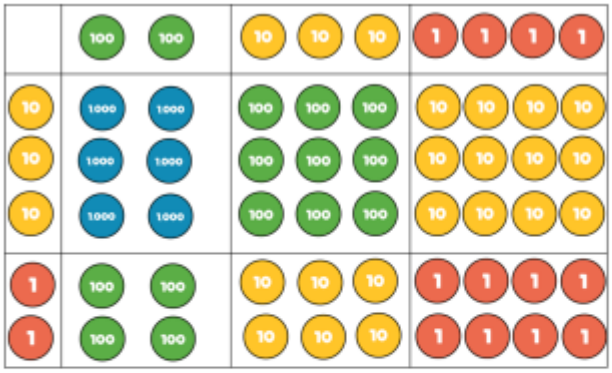
9 times tables	    	
7 times tables	    	

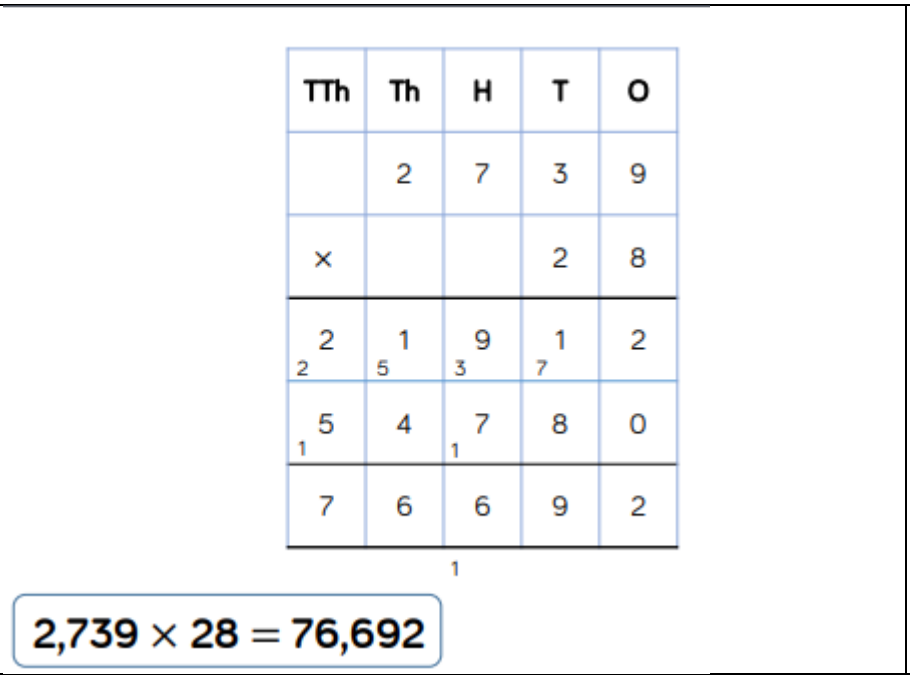
11 times tables		
12 times tables		

Multiplication

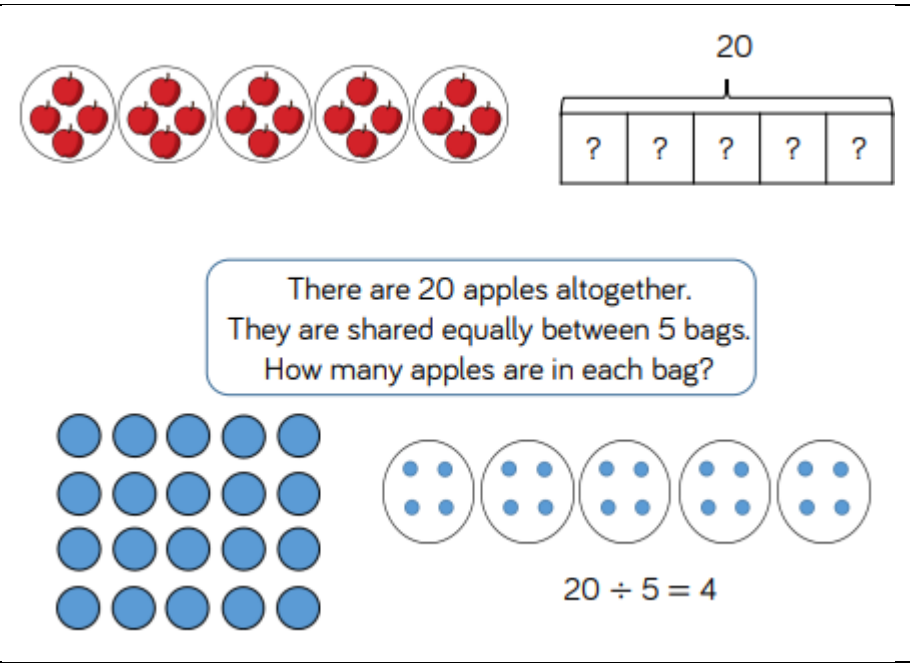
Year 1/2	Solve 1-step problems using multiplication		Children represent this as repeated addition in many different ways. Year 1 – concrete and pictorial representations – children are not expected to record formally. Year 2 – children are introduced to the x symbol.
Year 3/4	Multiply 2-digit numbers by 1-digit numbers		Year 3 - Informal methods and the expanded method are used. Place value counters should support the method rather than working out times tables. Year 4 – Short multiplication method.

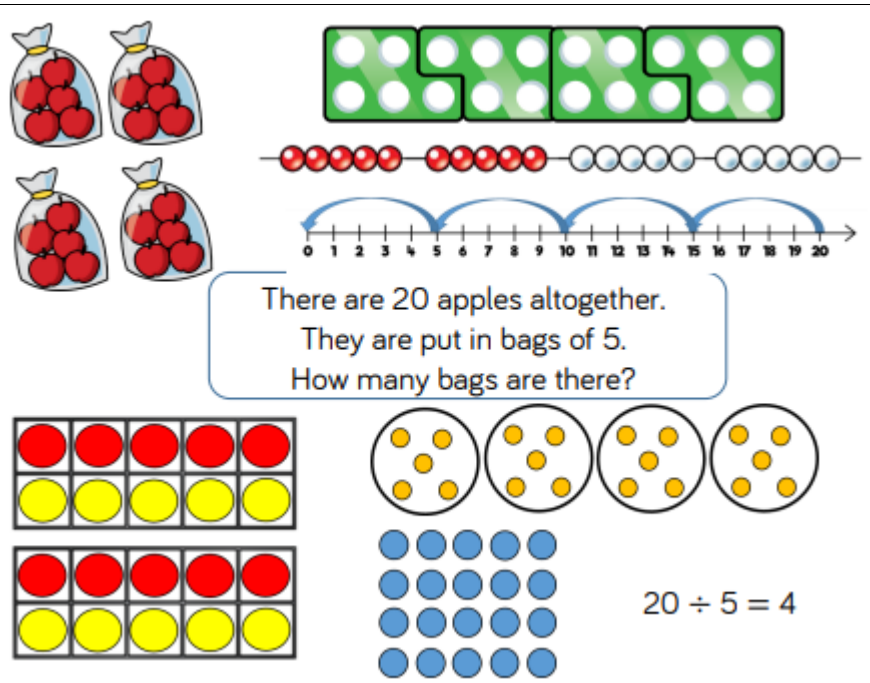
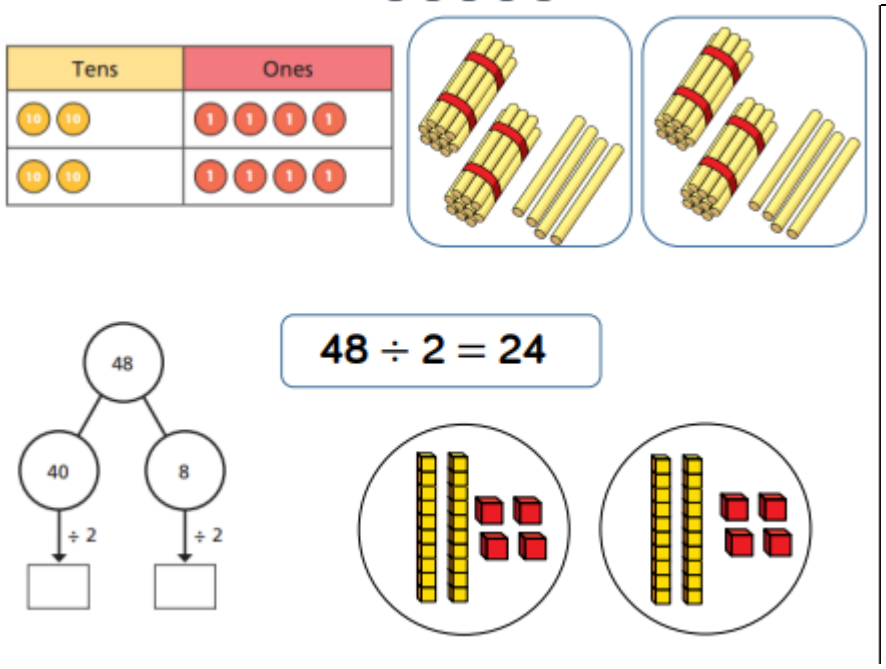
Year 4	Multiply 3-digit numbers by 1-digit numbers	 H T O 2 4 5 × 4 9 8 0 1 2	Encourage children to move towards, short, formal written method. Base 10 and place value counters continue to support the understanding of the written method. Encourage the use of multiplication grids so the focus isn't on the times table but the method.
Year 5	Multiply 4-digit numbers by 1-digit numbers	 1,826 × 3 = 5,478 Th H T O 1 8 2 6 × 3 5 4 7 8 2 1	Place value counters are the best manipulative to understanding the formal written method. Encourage the use of multiplication grids so the focus isn't on the times table but the method.

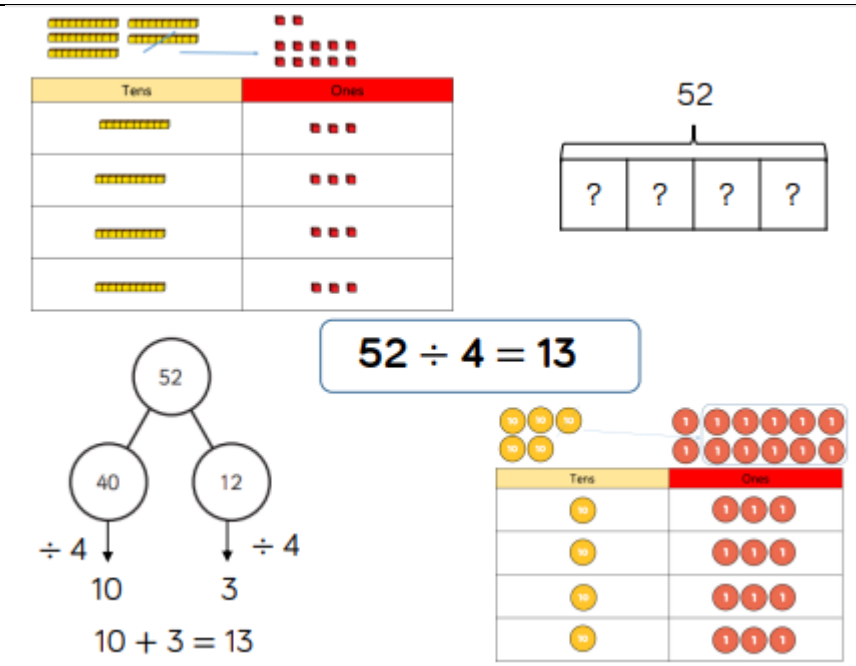
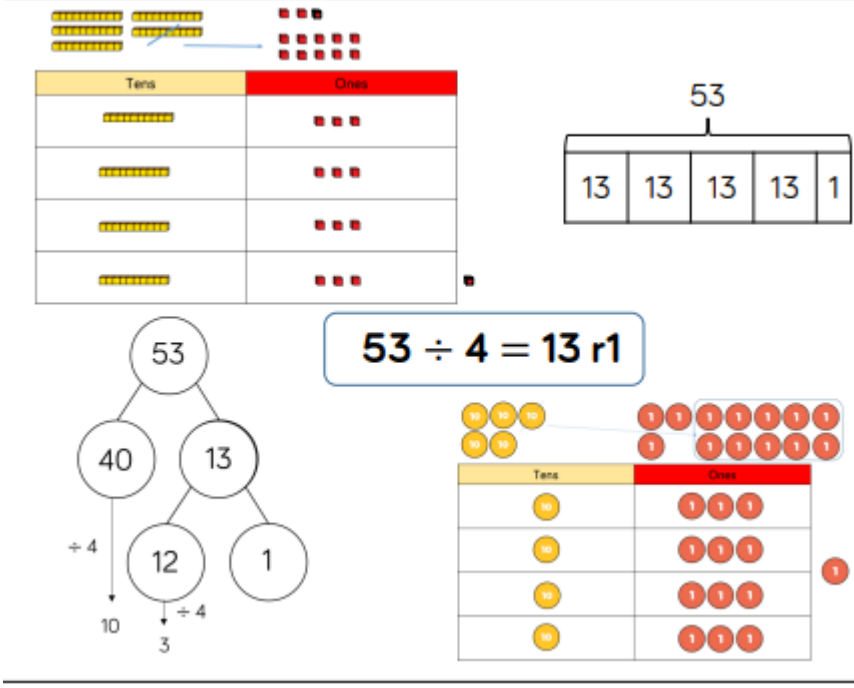
Year 5	Multiply 2-digit numbers by 2-digit numbers	  × | 20 | 2 30 | 600 | 60 1 | 20 | 2 | | H | T | O | | | | 2 | 2 | × | | 3 | 1 | | | 2 | 2 | | 6 | 6 | 0 | | 6 | 8 | 2 | $22 \times 31 = 682$	Use the area model to help children understand the size of the numbers. This links to finding the area of a rectangle by finding the space covered by the base 10. The grid method matches this model before moving on to a the formal written method.
Year 5	Multiply 3-digit numbers by 2-digit numbers	 | Th | H | T | O | | | 2 | 3 | 4 | × | | 3 | 2 | | | 4 | 6 | 8 | | $^{1}7$ | $^{1}0$ | 2 | 0 | | 7 | 4 | 8 | 8 | × | 200 | 30 | 4 30 | 6,000 | 900 | 120 2 | 400 | 60 | 8 $234 \times 32 = 7{,}488$	Place value counters become a more efficient resources. Children should make links between the grid method and formal written method.

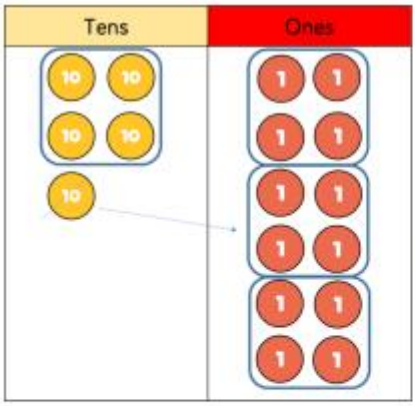
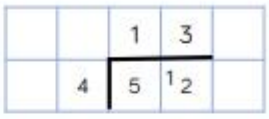
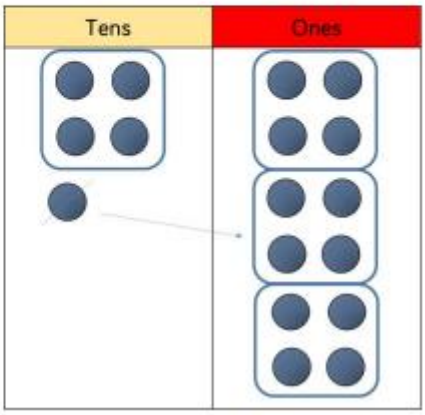
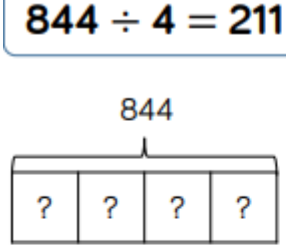
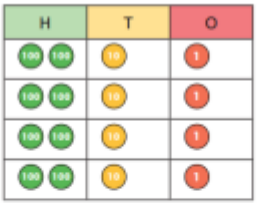
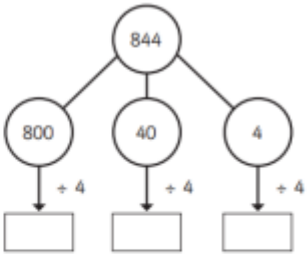
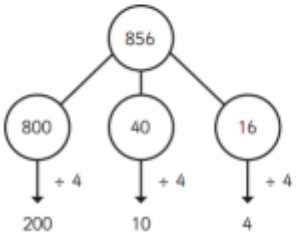
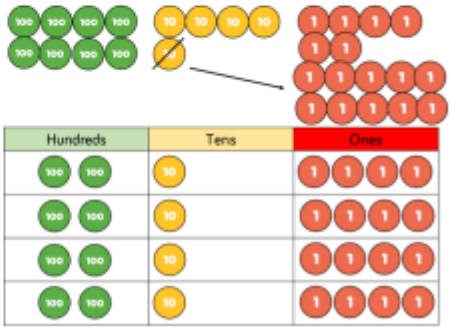
Year 5/6	Multiply 4-didigt by 2-digit numbers		Provide multiplication grids to support so children focus on using the method.

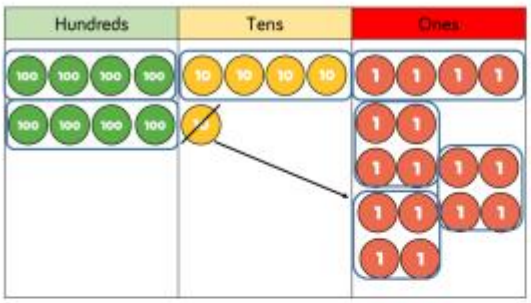
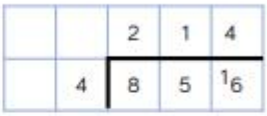
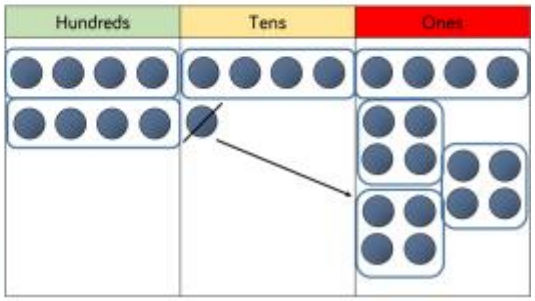
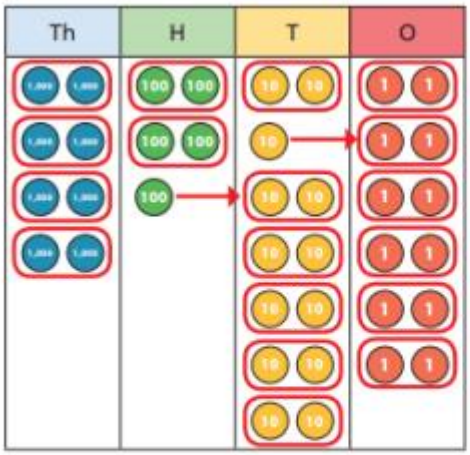
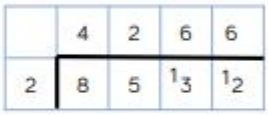
Division

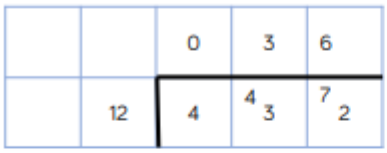
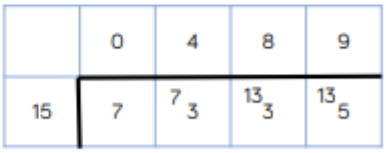
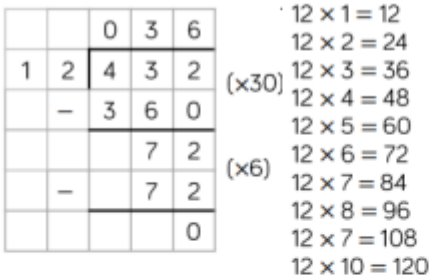
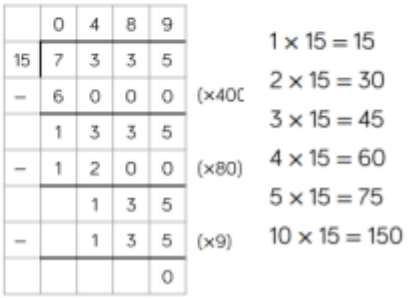
Year 1/2	Solve 1-step problems using multiplication (sharing)		Children solve problems by sharing amounts into equal groups. Year 1 – concrete and pictorial (formal division is not expected) Year 2 – introduction to the division symbol

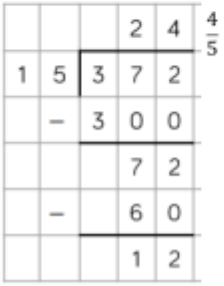
Year 1/2	Solve 1-step problems using division (grouping)		Children group and count the number of groups.
Year 3	Divide 2-digits by 1-digit (sharing with no exchange)		Children should use manipulatives to allow them to partition into tens and ones. Part whole models can provide children with the start of a clear written method that matches the concrete representation.

Year 3/4	Divide 2-digits by 1-digit (sharing with exchange)		Children should use base 10 and place value counters to exchange. Children should start with the equipment outside of the place value grid before sharing the tens and ones equally between rows. Flexible partitioning is supported by the part whole model.
Year 3/4	Divide 2-digits by 1-digit (sharing with remainders)		Children should use base 10 and place value counters to exchange. Starting with equipment outside of the place value grid will highlight the remainders as they will be left outside the grid once the equal groups have been made.

Year 4	Divide 2-digit by 1-digit (grouping)	   52 ÷ 4 = 13	When using the short division method children should use grouping. Starting with the largest place value, they group by the divisor. Children should consider 'How many groups of 4 tens can we make?', 'How many groups of 4 ones can we make?'
Year 4	Divide 3-digits by 1-digit (sharing)	844 ÷ 4 = 211    856 ÷ 4 = 214  	Children should continue to use place value counters to share 3-digit numbers into equal groups.

Year 5	Divide 3-digit by 1-digit (grouping)	   856 ÷ 4 = 214	Children continue to use their grouping to support understanding of short division. Place value counters are used for a concrete representation. Children can draw counters and group these through a pictorial method.
Year 5	Divide 4-digits by 1-digit (grouping)	  8,532 ÷ 2 = 4,266	Place value counters are used to support children. Children can draw counters through a more pictorial method. Children should be encouraged to move from concrete to pictorial to a formal method when dividing numbers with multiple exchanges.

Year 6	Divide multi digits by 2-digits (short division)	 **432 ÷ 12 = 36**  **7,335 ÷ 15 = 489** 15 30 45 60 75 90 105 120 135 150	Children can write out multiples to support their calculations. At this stage concrete and pictorial representation become less effective.
Year 6	Divide multi-digits by 2-digits (long division)	 12 × 1 = 12 12 × 2 = 24 12 × 3 = 36 12 × 4 = 48 12 × 5 = 60 12 × 6 = 72 12 × 7 = 84 12 × 8 = 96 12 × 7 = 108 12 × 10 = 120 **432 ÷ 12 = 36**  **7,335 ÷ 15 = 489**	Children can write out multiples to support their calculations. Children will solve problems with remainders.

Year 6	Divide multi digits by 2-digits (long division)	$372 \div 15 = 24\ r12$  $1 \times 15 = 15$ $2 \times 15 = 30$ $3 \times 15 = 45$ $4 \times 15 = 60$ $5 \times 15 = 75$ $10 \times 15 = 150$  $372 \div 15 = 24\frac{4}{5}$	A remainder can be left as a numeral or can covert it to a fraction.