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BCJ Calculation Policy 2022

Our aim at Blue Coat (CE) Junior School is to ensure that all our pupils can:

- Become **fluent** in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately.
- Can **reason** mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language.
- Can **solve problems** by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into series of simpler steps and persevering in seeking solutions.

This policy has been adapted from both the White Rose Maths Hub Calculation Policy, the NCETM Calculation Policy and the Ready to Progress Criteria to be used alongside the schools teaching of White Rose Maths. This allows us to support and challenge our children's individual mathematical needs.

All these methods are taught to the children as laid out in the White Rose Maths program. These methods aim to develop children's fluency when working out calculations by providing them with a range of strategies that they can use to embed a concept by showing it in various ways; this is when a child is considered to have mastered a concept. Children who grasp concepts quickly are challenged at each stage to ensure that they have mastered the skill, questioning to develop their reasoning skills and effective assessment for learning to identify and address misconceptions.

We believe that **every** child can master an understanding and love of Maths with quality first teaching and scaffolding, and that is what we aim to achieve.

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Intent

Our aims are to ensure that;

- ✓ We develop a positive attitude to mathematics as a subject in which all children gain success and pleasure.
- ✓ We deliver a high quality maths curriculum that is both challenging and enjoyable (White Rose, NRICH, NCETM).
- ✓ Our planning builds upon previous learning and consolidation to ensure all learning is embedded (Rosenshine's Principles of Instruction).
- ✓ All children are provided with a variety of mathematical manipulatives in order to allow all children to experience hands-on learning (CPA approach).
- ✓ Children are confident mathematicians who are not afraid to take risks (I do, you do, we do approach).
- ✓ Develop an ability to express themselves fluently. To talk about the subject with assurance using rich mathematical language and vocabulary (BCJ maths progression document).
- ✓ Develop mathematical fluency and knowledge and rapid recall of number facts (TTRockstars, Firstclass at number).
- ✓ Children have an efficient, reliable, compact written method of calculation for each operation that children can apply with confidence when undertaking calculations that they cannot carry out mentally (in line with the calculation policy). They will do this by always asking themselves: Can I make it? Can I draw a picture? Can I do it in my head? Do I need a jotting? Do I need a written method?
- ✓ Children can use their knowledge of numbers and use them effectively to solve problems and deepen their understanding. They can reason mathematically and justify with increasing sophistication, including breaking down problems into series of simpler steps and persevere in seeking solutions.

Implementation

We apply the Concrete, Pictorial and Abstract (CPA) approach At Blue Coat C E Junior School. We recognise as a team that this approach is highly effective in the teaching of Maths to develop children's conceptual understanding. Lessons are engaging and follow a cycle of planning, to ensure that we can evidence progress over short and long periods of time . All pupils, when introduced to a key new concept, will have the opportunity to build competency in the skill by taking this approach. Pupils are encouraged to physically represent mathematical concepts. Objects (manipulatives) and pictures are used to demonstrate and visualise abstract ideas, alongside numbers and symbols. This approach will vary between year groups and the individual abilities of children within each class.

- ✓ Manipulatives (objects), pictorial representations, rich vocabulary, number formation and symbols will be used in all lessons and displayed on working walls. These will be accessed and used daily to support and guide children in their learning.
- ✓ The mastery approach (reasoning and problem solving) will be incorporated in all lessons to help children explore and demonstrate mathematical ideas, enrich their learning experience and deepen their understanding.
- ✓ Using prior knowledge as a starting point for all future planning and revisiting previous topics regularly to ensure all learning is consolidated.
- ✓ Embed the use and status of TTRockstars to develop children's fluency of number facts including rapid recall of times tables.
- ✓ Effective feedback is in line with our marking policy. Read and Responds are given, allowing the children to consolidate, deepen or address misconceptions from their learning.

All of the above will be monitored though effective assessment and discussed with governors, FLT and staff regularly.

Impact

- ✓ Children have a positive and inquisitive attitude to mathematics as an interesting and attractive subject in which they all gain success and pleasure.
- ✓ Children have the confidence and belief that they can achieve their goals regardless of their ability and the knowledge that maths underpins most of our daily lives.
- ✓ Children can recall number facts effectively using strategies taught.
- ✓ Children have the flexibility and fluidity to move between different contexts and representations of number.
- ✓ Children to be able to show that the concept or skill taught has been mastered (by showing it in multiple ways, using the mathematical language to explain their ideas, and can independently apply the concept to new problems in unfamiliar situations).
- ✓ Children show a high level of pride in the presentation and understanding of the work.
- ✓ Staff have secure subject knowledge of maths and are able to deliver high quality teaching, ensuring all children make good or accelerated progress.

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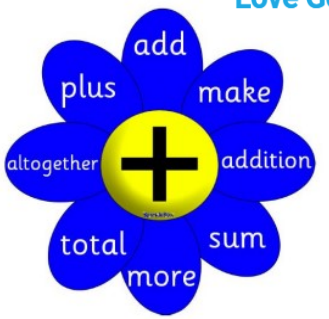
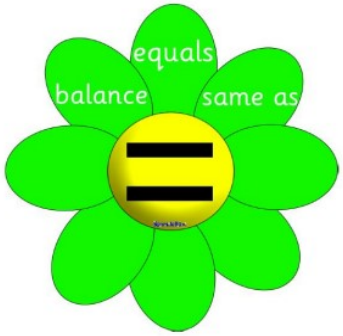
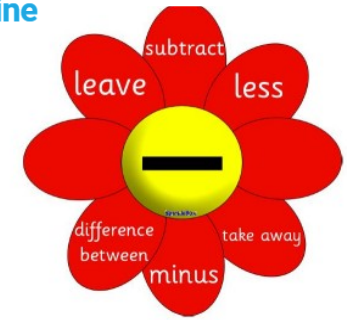
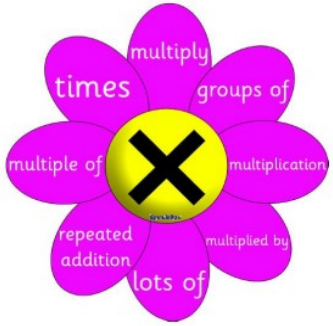


Operations that make numbers bigger.

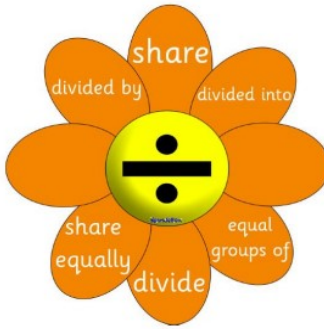




Operations that make numbers smaller.



In order that children don't become confused, it is important to use the correct mathematical vocabulary. There are many ways of saying the same thing as is illustrated here. **It is important to note that a sum is an addition calculation.**



Language focus

"To find $\frac{1}{5}$ of 15, we divide 15 into 5 equal parts."

"15 divided by 5 is equal to 3, so $\frac{1}{5}$ of 15 is equal to 3."

Language focus

"This is a line of symmetry because it splits the shape into two equal parts which are mirror images."

Language focus

"The previous whole number is 8. The next whole number is 9."

"The previous multiple of 0.1 is 8.6. The next multiple of 0.1 is 8.7."

Language focus

"1,000,000 is 10 times the size of 100,000."

"100,000 is one-tenth times the size of 1,000,000."

At Blue Coat C E Junior school we believe teaching and learning the language of Mathematics is vital for the development of Mathematical proficiency. We explicitly teach (tier two and three) maths vocabulary as well as supporting the children to use it through providing sentence stems to deepen their understanding of concepts, make links between concepts and develop their reasoning skills. We use both White Rose and the Ready to Progress documents to identify key language focus' that are embedded throughout our curriculum.

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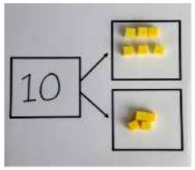
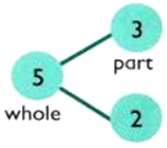
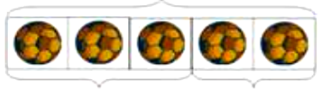
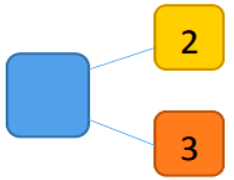
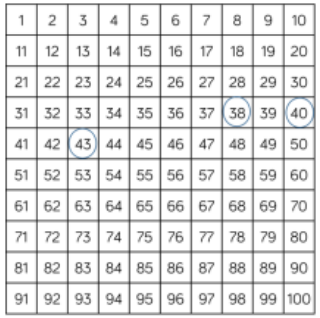
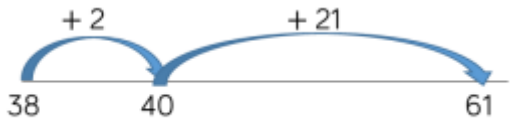
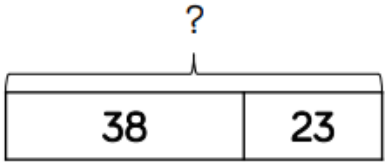
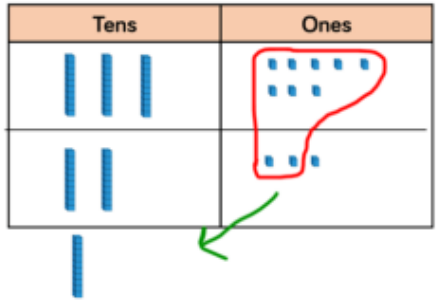
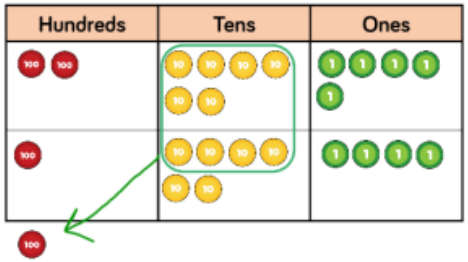
Addition - Year 3

Objective/ Strategy	Concrete	Pictorial	Abstract
Combining two parts to make a whole: part-whole model	 Use part part whole model. Use cubes to add two numbers together as a group or in a bar.	  Use pictures to add two numbers together as a group or in a bar.	2 + 3 = 5 3 + 2 = 5 5 = 3 + 2 5 = 2 + 3  Use the part-part-whole diagram as shown above to move into the abstract.
Counting in multiples (jumps of 10)	 Hundred squares can support children to find the number bond to 10 then count in multiples of 10.	 A blank number line to jump to find the next number bond and then jumps in multiples or groups of 10, encouraging the children to be efficient with their jumps.	 **38 + 23 = 61**
Formal column method			265 + 164 429 1 **265 + 164 = 429**

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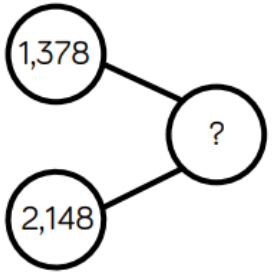
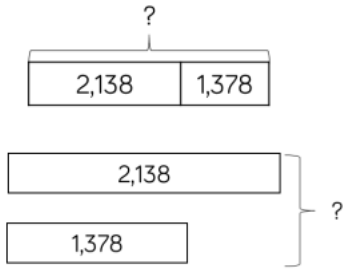
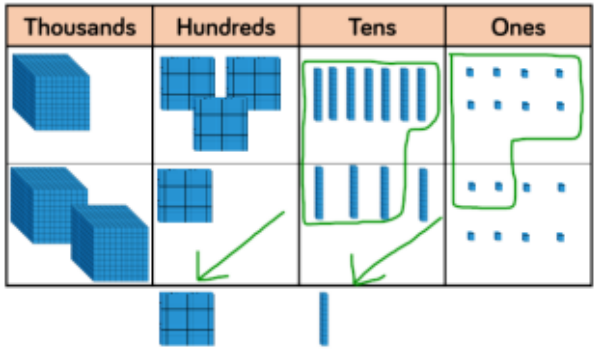
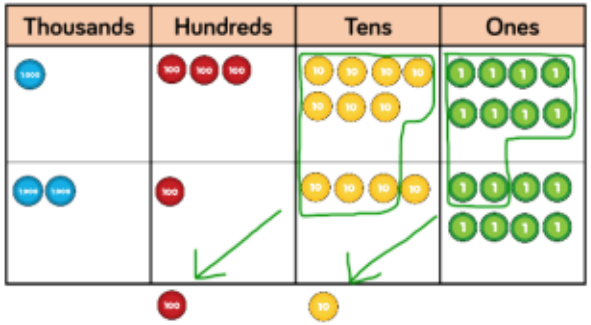
Addition - Year 4

Objective	Concrete	Pictorial	Abstract
Part-whole and bar models			
Formal column method	 Children use Base 10 and place value counters alongside concrete resources to make the links clear.	 Plain counters or an empty place value grid can support.	1,378 + 2,148 = 3,526 1 3 7 8 + 2 1 4 8 3 5 2 6 1 1

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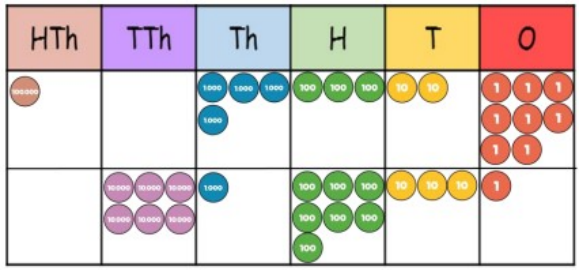
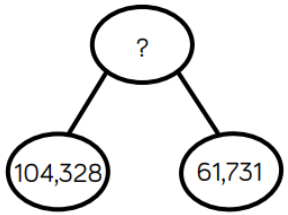
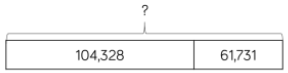
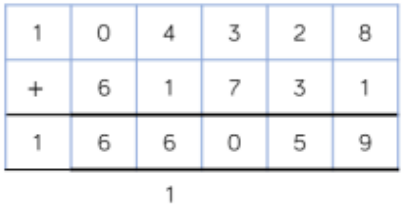
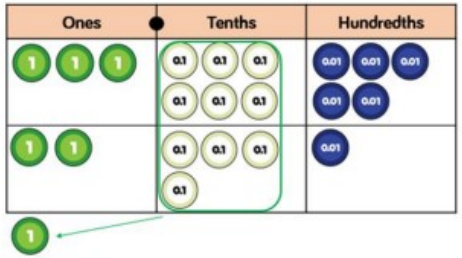
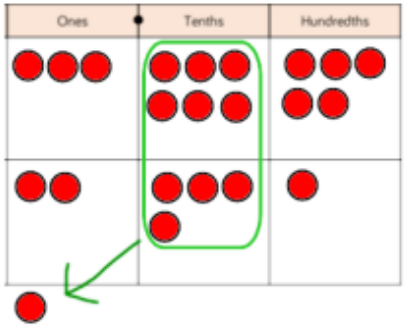
Addition - Year 5/6

Objective	Concrete	Pictorial	Abstract
Adding numbers with more than 4 digits		Children encouraged to draw the place value grid to aid with their calculation. Other representations may help them to identify the correct calculation.  	At this stage, children should be encouraged to work in the abstract, using the column method to add larger number efficiently. 
Adding decimals up to 3 d.p	 Counters and Base 10 help to solidify the concept of 'a tenth of the size'	 Children encouraged to draw/label the place value columns, with the decimal point or use/ draw blank p.v counters	3.65 + 2.41 6.06 1 Children to have varied experience of adding decimals in context such as money and measures.

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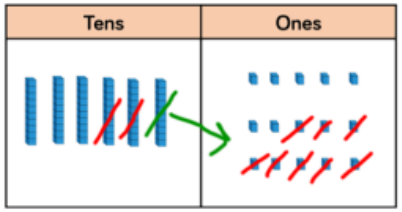
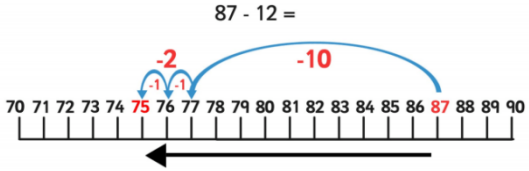
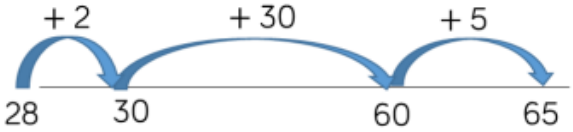
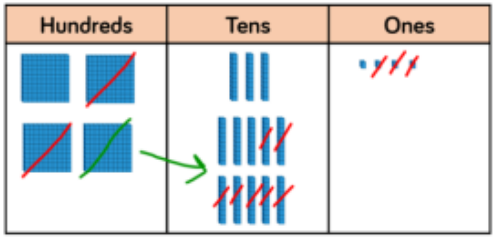
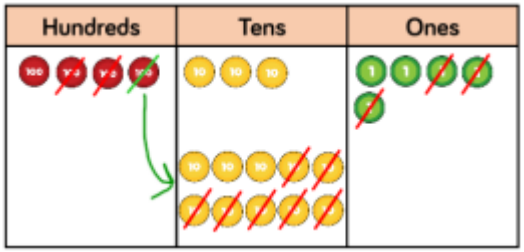
Subtraction - Year 3

Objective	Concrete	Pictorial	Abstract
Counting back to find the difference.		 Children encouraged to jump in multiples of 10 to become more efficient.	65 − 28 = 37
Counting on to find the difference	Children to make the smaller number and see how many 'more' they need to find out the difference.		28 + 37 = 65 65—37 = 28 65—28 = 37 Children to recognise the links and relationships with other calculations. *If...then...*
Subtract numbers with up to 3 digits.		 Plain counters or an empty place value grid can support.	3 1 4 3 5 − 2 7 3 1 6 2 Ensure children write out their calculation alongside any concrete resources so they can see the links to the written column method.

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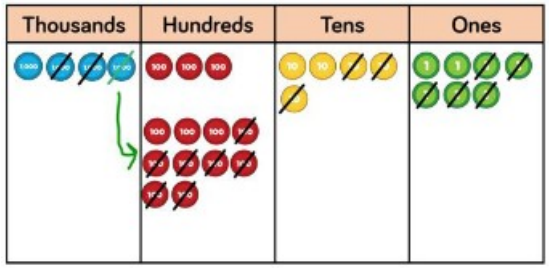
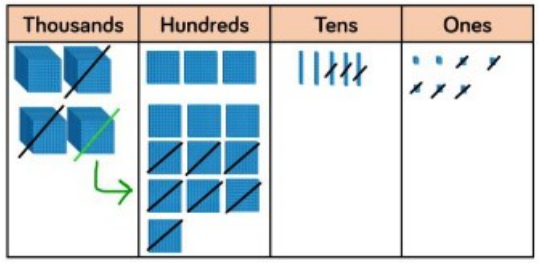
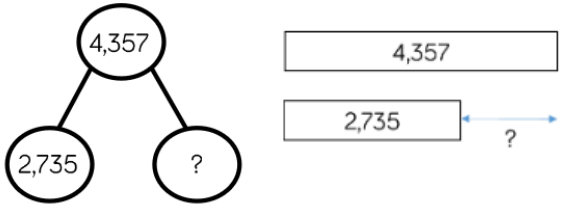
Subtraction - Year 4

Objective	Concrete	Pictorial	Abstract
Subtracting numbers up to 4 digits			$4{,}357 - 2{,}735 = 1{,}622$ $\begin{array}{r} {}^{3}\not{4}\,{}^{1}357 \\ -\ 2735 \\ \hline 1622 \end{array}$
	Ensure children write out their calculation alongside any concrete resources so they can see the links to the written column method.	Plain counters or a plain place value grid could be used to help, the children can also be encouraged to draw/label the columns for their calculation.	 Other representations used to help understand the question and/or deepen thinking.

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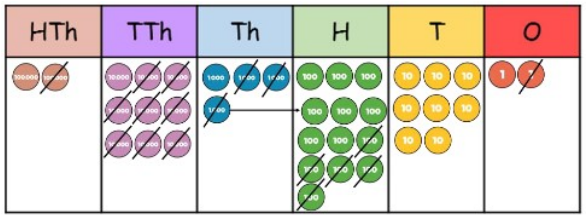
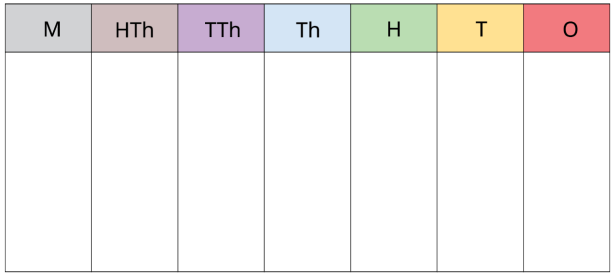
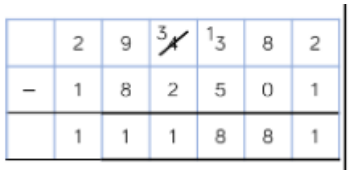
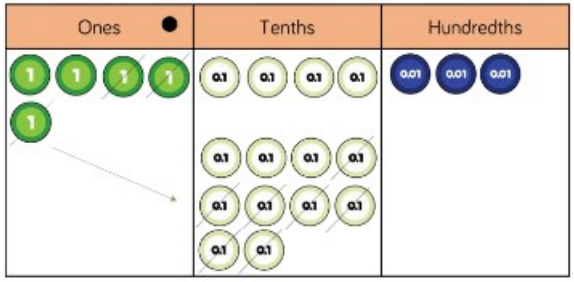
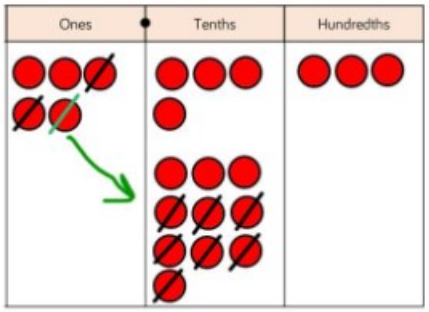
Subtraction - Year 5/6

Objective	Concrete	Pictorial	Abstract
Subtracting with more than 4 digits		 Plain counters or an empty place value grid can support.	
Subtract with up to 3 d.p			$\begin{array}{r} {}^{4}\not{5}.{}^{1}43 \\ -\ 2.7 \\ \hline 2.73 \end{array}$ Children to have varied experience of sub-tracting decimals with a range of decimal places and in context such as money and measures.

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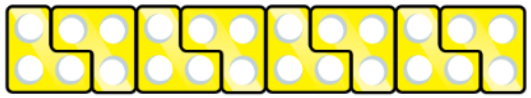
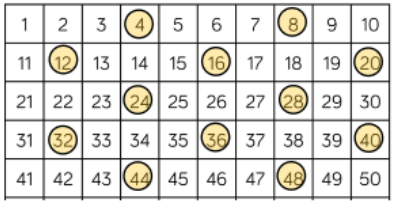
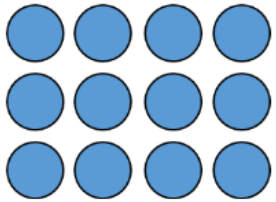
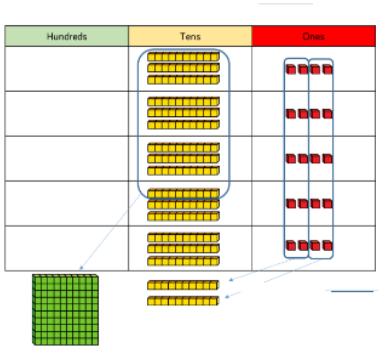
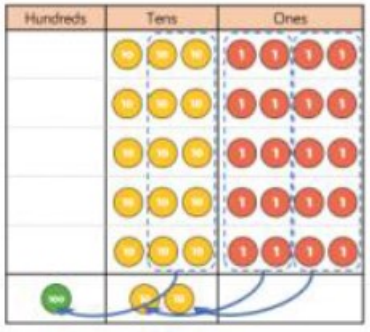
Multiplication - Year 3/4

Objective	Concrete	Pictorial	Abstract
Recall and use multiplication and division facts for 4 x table, 8 x table, 3 x table 6 x table.	  1 2 3 **4** 5 6 7 **8** 9 10 11 **12** 13 14 15 **16** 17 18 19 **20** 21 22 23 **24** 25 26 27 **28** 29 30 31 **32** 33 34 35 **36** 37 38 39 **40** 41 42 43 **44** 45 46 47 **48** 49 50	 Children encouraged to draw arrays to represent multiples or number lines/hundred squares.	Regular counting in multiples forwards and backwards. Making links with other times tables. Noticing patterns to aid calculation. Learning the related division facts: *4 times 5 is 20, so 20 divided by5 is 4*
Multiply 2 digit by 1 digit numbers **Expanded column method**	 	 	**Multiply the ones, then multiply by the tens.** H T O 3 4 × 5 2 0 (5 × 4) + 1 5 0 (5 × 30) 1 7 0
Multiply 2 digit by 1 digit numbers **Short, compact method**		Place value counters to be used to aid the understanding of the method and the reinforcement of place value concepts. Children encouraged to use times table knowledge for calculation.	H T O 3 4 × 5 1 7 0 1 2

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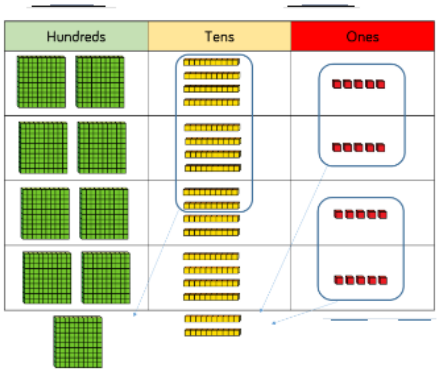
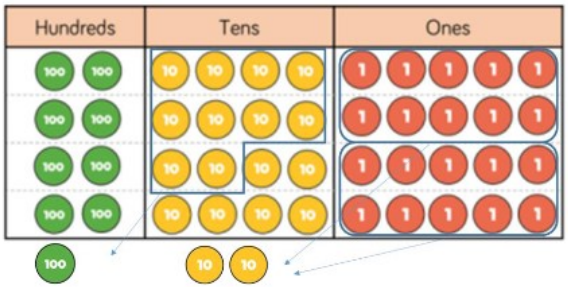
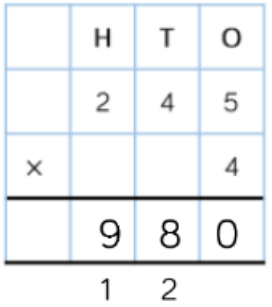
Multiplication - Year 3/4

Objective	Concrete	Pictorial	Abstract
Multiply 3 digit by 1 digit numbers **Short, compact method**			 **Short, formal written method encouraged. Practical/ visual for understanding of 'carried' numbers.**

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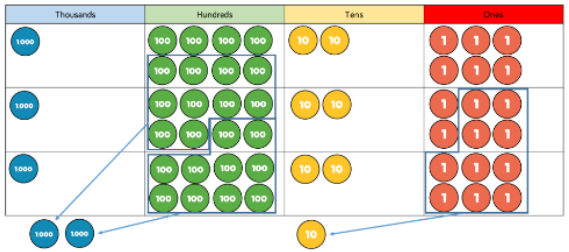
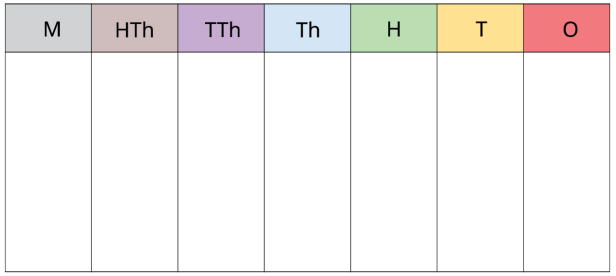
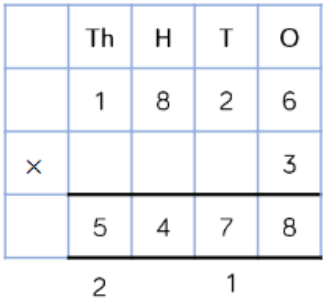
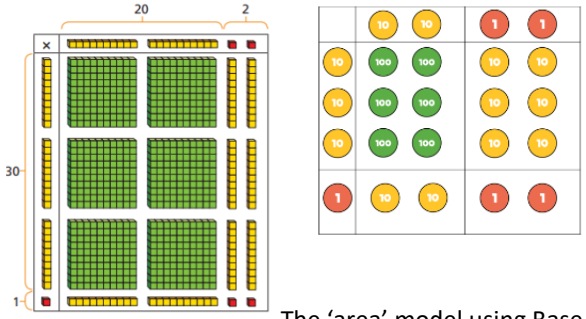
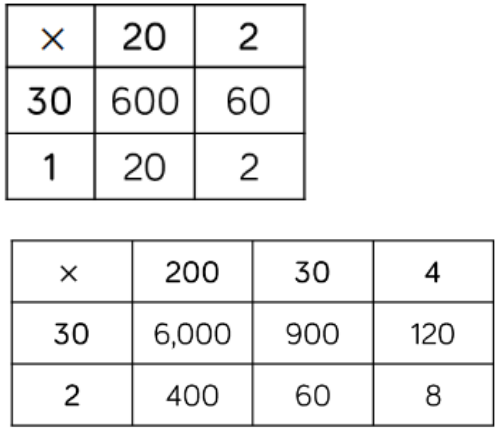
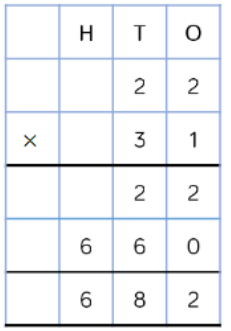
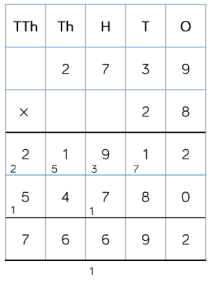
Multiplication - Year 5/6

Objective	Concrete	Pictorial	Abstract
Multiply 4 digit by 1 digit numbers **Short, compact method**		 Empty p.v or labelling columns encouraged.	
Multiply 2 digit by 2 digit numbers **Multiply 3 digit by 2 digit numbers** **'Area' or 'grid' method.**	 The 'area' model using Base 10 makes links with shape and 'grid' helps with the concept of scale and place value of the numbers.		 Children encouraged think about the most efficient method and draw links between the grid method and the more abstract column method.
Multiply 4 digit by 2 digit.		Children should become confident in the written method. Consider where the exchanged digits are placed and their size and ensure it is consistent.	

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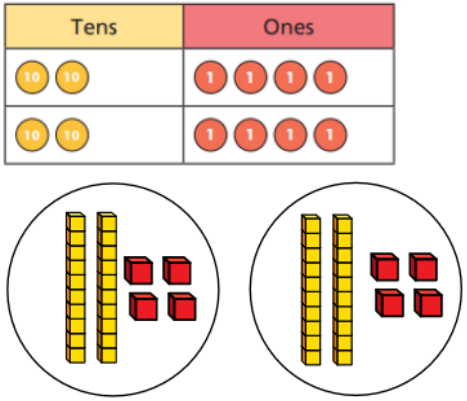
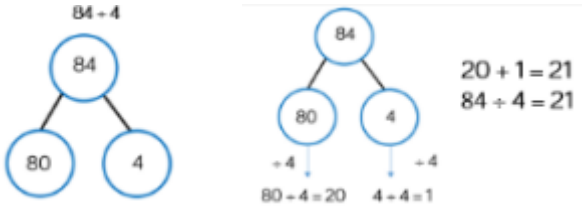
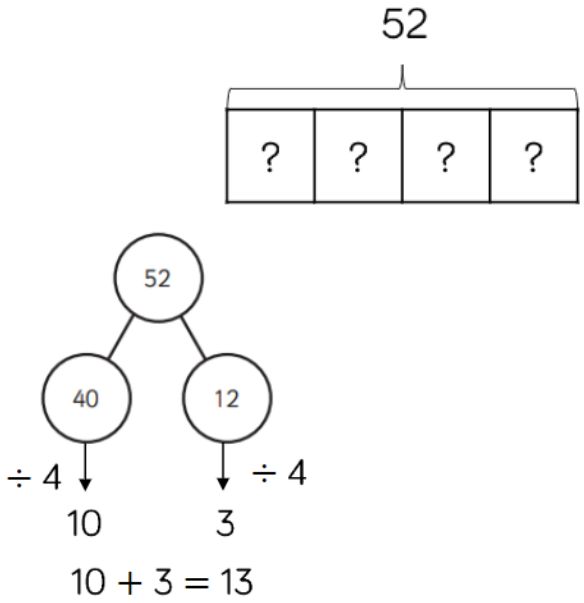
Division - Year 3

Objective	Concrete	Pictorial	Abstract
Divide 2 digits by 1 digit (no exchange)		 Build the number, share the tens, share the ones.	Children dividing numbers where the tens and the ones are divisible by the divisor 96 ÷ 3 = 84 ÷ 4 =
Divide 2 digits by 1 digit (sharing with exchange)	 Children to start with the equipment outside of the p.v grid before sharing the tens and ones equally. Making links clear when exchanging one ten for ten ones.		Children encouraged to partition flexibly. Identifying patterns and facts such as that there will be a remainder as all multiples of 4 are even.

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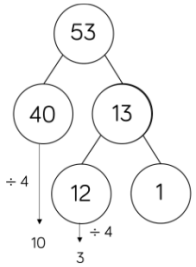
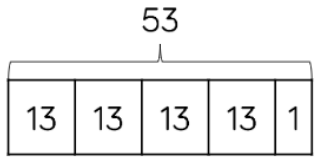
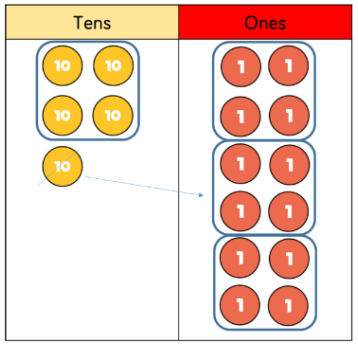
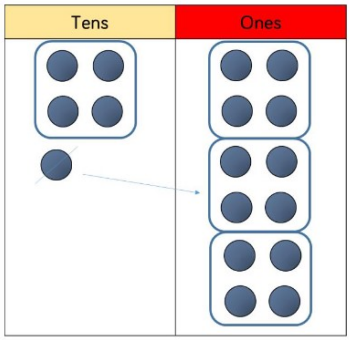
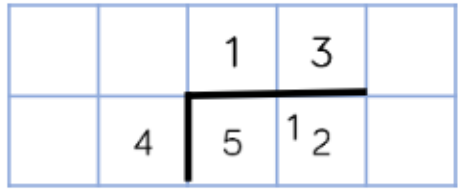
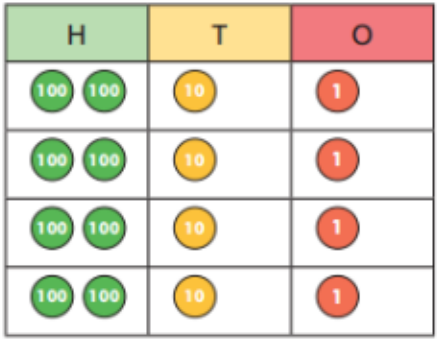
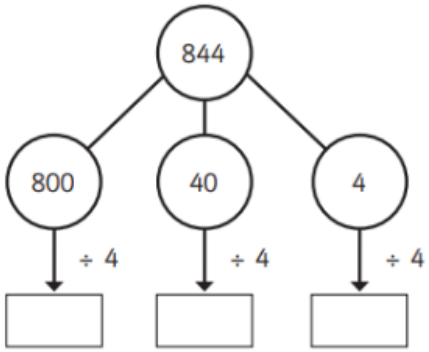
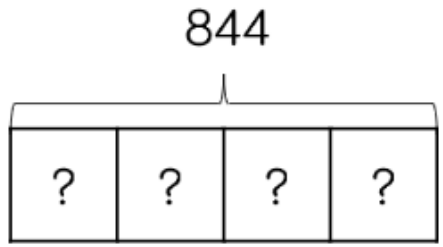
Division - Year 4

Objective	Concrete	Pictorial	Abstract
Divide 2 digits by 1 digit (sharing with remainders) **(3)**		Children to identify efficient ways to partition the number, finding the biggest group that can be divided. 	
Divide 2 digtis by 1 digit (grouping) **Short division/ bus stop method**	 Starting with the largest place value they group by the divisor—they will need to exchange one ten for ten ones.		 Use of existing number facts and mental maths also encouraged.
Divide 3 digits by 1 digit (sharing with exchange)			

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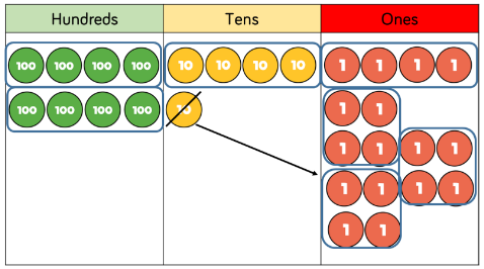
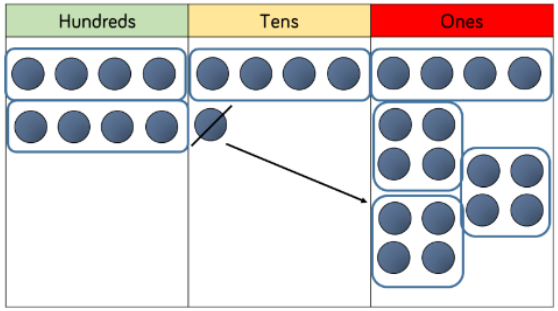
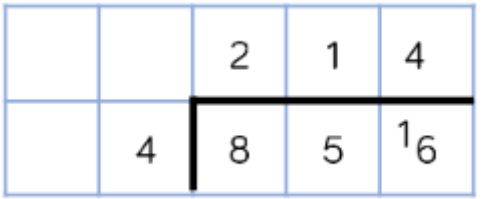
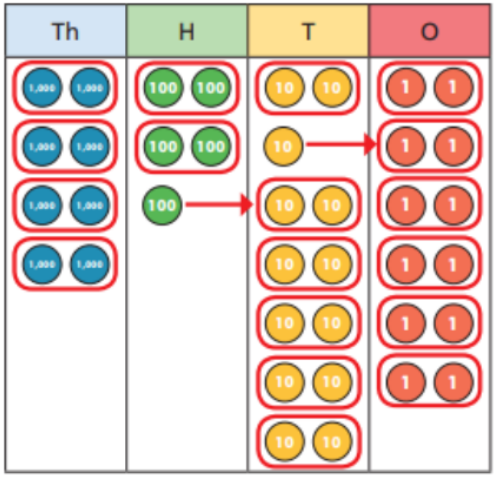
Division - Year 5/6

Objective	Concrete	Pictorial	Abstract
Divide 3 digits by 1 digit (grouping) **Short division/ bus stop method**		 Drawing their own counters and grouping them.	
Divide 4 digits by 1 digit (grouping) **Short division/ bus stop method**		When needing multiple exchanges, encourage children to use the abstract method.	 Also starting children with divisors that they are comfortable with to begin to build confidence with the method. Using estimation to consider the accuracy of their answer (8532 will be divisible by 2 as it is an even number therefore will have no remainders.)

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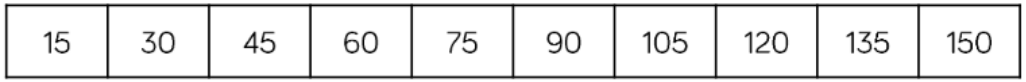
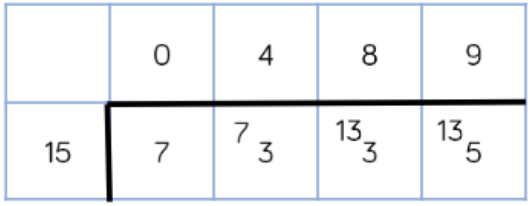
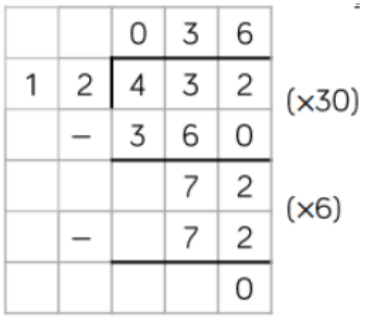
Division - Year 6

Objective	Concrete	Pictorial	Abstract
Divide multi digits by 2 digits **Short division**	 When children are dividing up to 4 digits by 2 digits, written methods become the more accurate and effective. Children to be given strategies of how to calculate times table that they will not know e.g 15x table, such as doubling and doubling again (4th multiple).		
Divide multi digits by 2 digits **Long division (chunking)**	Children can write out multiples to support calculation and to spot for larger remainders. Children also given these in problem solving contexts where the quotient needs to be rounded appropriately or represented as a fraction.	$12 \times 1 = 12$ $12 \times 2 = 24$ $12 \times 3 = 36$ $12 \times 4 = 48$ $12 \times 5 = 60$ $12 \times 6 = 72$ $12 \times 7 = 84$ $12 \times 8 = 96$ $12 \times 7 = 108$ $12 \times 10 = 120$	
Divide multi digits by 2 digits **Factor method**		Children can be encouraged to draw factor bugs to find appropriate factors to use as divisors.	**372** ÷ 12 =31 372 ÷ 4 = 93 93 ÷ 3 = 31