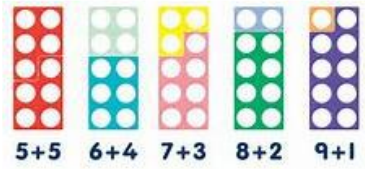
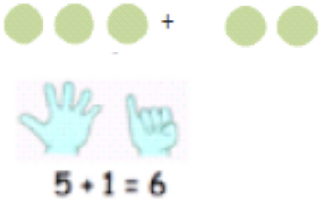
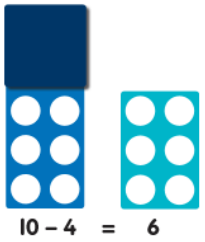
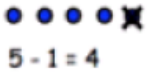
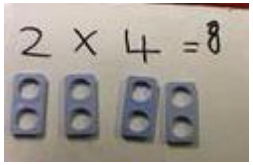
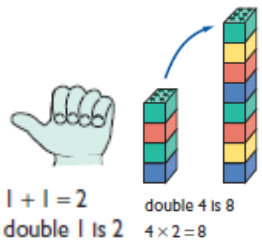
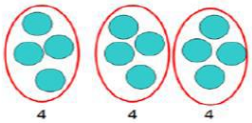
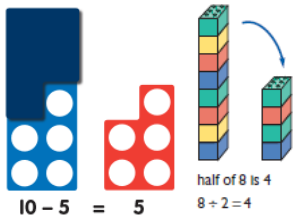
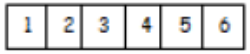
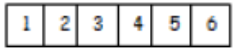
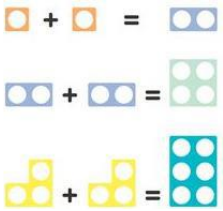
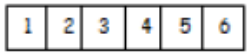
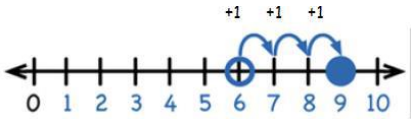
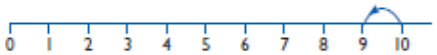
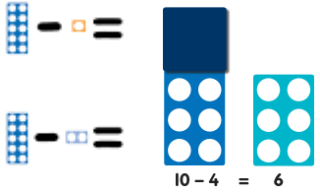
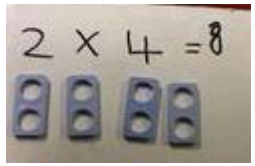
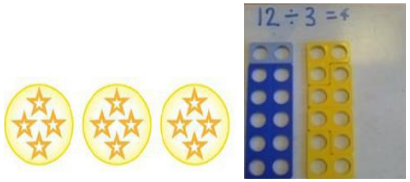
Calculation Policy

Waddesdon Village Primary School – *a Pathway to Excellence*

Approved by:	Laura Forchione	**Date:**	January 2022
Last reviewed on:	September 2023		
Next review due by:	September 2024		

Year	Addition	Subtraction	Multiplication	Division
EYFS	**Using pictures and jottings** Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They develop ways of recording calculations. The teacher will represent number in a variety of different ways. **Numicon** Numicon shapes are introduced and can be used to; • Identify 1 less/ 1 more • Combine pieces to add • Find number bonds Children can record their work by printing or drawing around Numicon pieces  **Counting and Addition** Children begin to count or combine groups of objects using concrete apparatus or fingers.  **Number tracks/ number-lines**	**Using pictures and jottings** Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They develop ways of recording calculations. The teacher will represent number in a variety of different ways. **Numicon** Numicon can be used to illustrate the concept of subtraction, using overlays.  Children can record their work by printing or drawing around Numicon pieces **Counting and Subtraction** Children begin to count or take away groups of objects using concrete apparatus or fingers.  **Number tracks/ number-lines** Number tracks/ lines can be introduced and modelled as a	**Counting** Using blank counting sticks, the teacher will model counting in 1s, 2s and 10s. Chn should understand that by doing this, they are adding 1, 2, 5 and 10 each time. The teacher will represent number in a variety of different ways.  **Grouping** Children will experience making equal groups of objects. They will work on practical problem solving activities involving equal sets or groups.  **Doubling** Children will use Numicon, mirrors and a range of objects to develop the concept of doubling 2 equal groups of the same number  	**Counting** Using blank counting sticks, the teacher will model counting in 1s, 2s and 10s. Chn should understand that by doing this, they are adding 1, 2, 5 and 10 each time. The teacher will represent number in a variety of different ways.  **Grouping and Sharing** Children will understand how to make equal groups and share items out in role-play and problem solving.  **Halving** Children will use Numicon and a range of objects to develop the concept of halving as making 2 equal groups from 1 number. 

	Number tracks/ lines can be introduced and modelled as a practical resource to support calculations, including 1 more/less and solving simple word problems 	practical resource to support calculations, including 1 more/less and solving simple word problems 		 2 – 1 = 1 half of 2 is 1
Year 1	**Addition of 1 and 2-digit numbers to 20** Use numbered number line and number tracks to add, by counting on in ones. Encourage children to start with the **larger** number and count on.   **Numicon** Used to illustrate addition including ***bridging through ten*** by counting on 2 then counting on 3. This builds on from prior learning of adding by combining two sets of objects into one group in Early Years.	**Subtraction of 1 and 2-digit numbers to 20** Children consolidate understanding of subtraction practically, showing subtraction on bead strings, using cubes, on 100 squares, and in familiar contexts. They are introduced to more formal recording using number lines as below:  **Numicon** If necessary pupils can continue to use numicon as a concrete resource to consolidate subtraction, using overlays. 	**Counting** Using blank counting sticks, the teacher will model counting in 1s, 2s, 10s and 5s. Children should understand that by doing this, they are adding 1, 2, 5 and 10 each time.  **Multiply with concrete objects, arrays and pictorial representations** Children make connections between arrays, number patterns, and counting in twos, fives and tens, using practical apparatus.  **Grouping**	**Counting** They will count in 1s, 2s, 5s and 10s. **Grouping and sharing** Children will understand how to make equal groups, using practical apparatus e.g. Numicon and share items out in role play and problem solving. **Grouping** How many groups of 4 can be made with 12 stars? 3  **Sharing** What is 12 sweets shared between 3 children? 4

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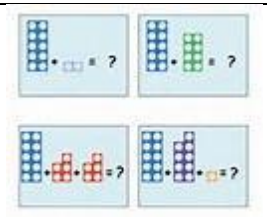
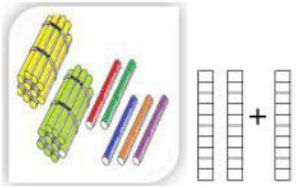
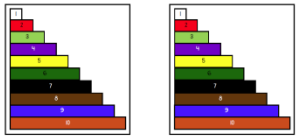
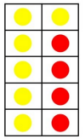


Straw bundles/ Cuisenaire/ Dienes apparatus
Model addition of 1 and 2-digit numbers, allowing pupils to use these as concrete apparatus to support calculation within lessons.




Cuisenaire Rods- Student Desk Cards

Number Bonds
Children memorise and reason with number bonds to 10 and 20 in several forms


They discuss and solve problems in familiar practical contexts, including using quantities.
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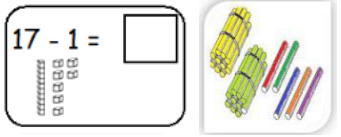
Straw bundles/
Cuisenaire/ Dienes apparatus
Model subtraction of 1 and 2-digit numbers, allowing pupils to use these as concrete apparatus to support calculation within lessons.


Number Bonds
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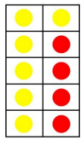

They discuss and solve problems in familiar practical contexts,
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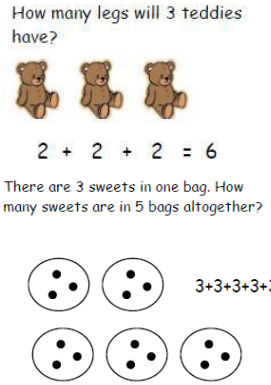
Children will experience making equal groups of objects using a range of apparatus, including Numicon



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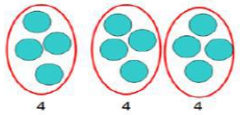

Pupils should also be able to find a half and a quarter of a group of objects by sharing into 2 and 4 equal groups.
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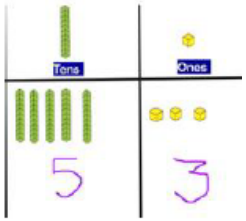
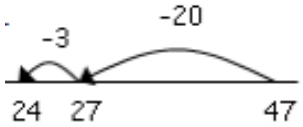
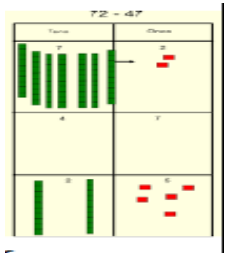
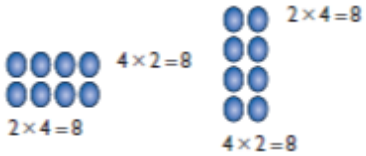
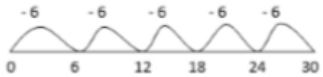
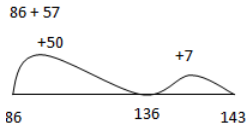
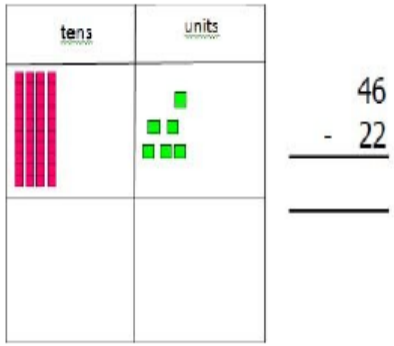
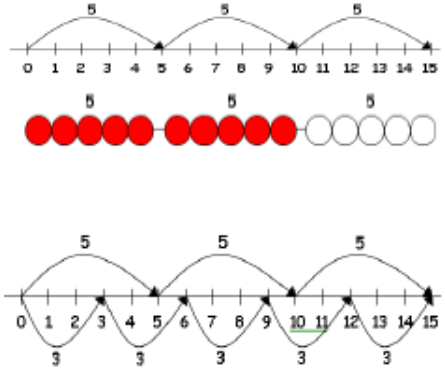
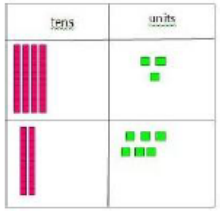
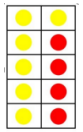
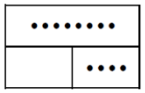
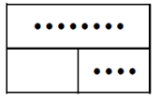
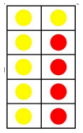
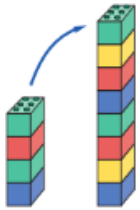
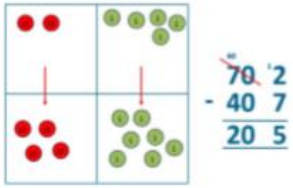
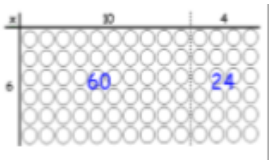
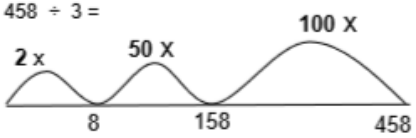
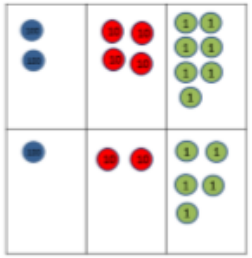
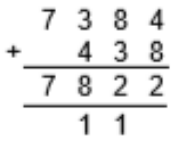
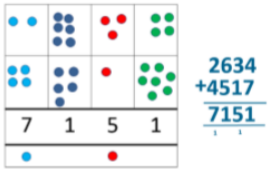
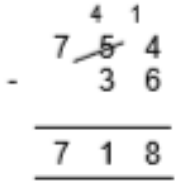
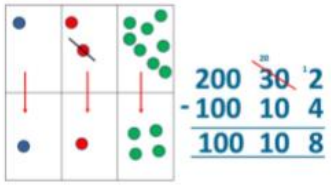
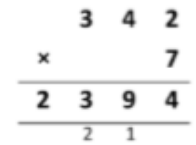
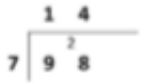
Year 2	**Ensure children are secure with Year 1 methods, and then:** **Commutativity** Children should understand that addition of two numbers can be done in any order, and it is more efficient to add the largest number first. **Addition of numbers with up to 2-digits** **Dienes apparatus** Children will continue to use dienes apparatus for the addition of numbers. They should draw the rods and cubes to show a deep understanding of the place value of each number.  **Empty number lines** When encouraging pupils to develop mental methods of subtraction, number lines can be referred to, in order to give a mental image. The process would be as follows: 1. First counting on in tens and ones. 2. Become more efficient by adding the units in one jump.	**Ensure children are secure with Year 1 methods, and then:** **Empty number lines** When encouraging pupils to develop mental methods of subtraction, number lines can be referred to, in order to give a mental image. The process would be as follows: 1. First counting back in tens and ones. 2. Becoming more efficient by subtracting the units in one jump (by using the known fact 7 – 3 = 4). 3. Subtracting the tens in one jump and the units in one jump.  **Subtraction of numbers with up to 2-digits:** **Dienes apparatus** Children will continue to use dienes apparatus for the subtraction of numbers. They should draw the rods and cubes to show a deep understanding of the place value of each number.  **Formal Written Methods**	**Ensure children are secure with Year 1 methods, and then:** Children will develop their understanding of multiplication and use jottings to support calculation. **Counting** They will continue to count daily in 1s, 2s, 3s, 5s and 10s, modelled by teacher on a counting stick. **Multiplication of 2-digit numbers by a single digit** Teacher should model arrays and children should be able to model a multiplication calculation using an array. This knowledge will support with the development of the grid method and demonstrate that multiplication of two numbers can be done in any order (commutativity).  Give problems such as **2 x__=8** **Repeated addition** 3 times 5 is 5 + 5 + 5 = 15 or 3 lots of 5 or 5 x3 Repeated addition can be shown easily on a number line or bead string:	**Ensure children are secure with Year 1 methods, and then:** **Children will develop their understanding of division and use jottings to support calculation** **Grouping** Children should continue to understand division as making groups of a number. Model this using a blank counting stick when counting in 2s, 5s, and 10s. Children can then move on to making groups practically, using cubes or coins, or using Numicon. **Division as repeated subtraction** Using a numbered number line to introduce, until children are confident without. 30 ÷6  15÷5=3 Children should understand this number sentence as 'How many groups of 5 make 15?' And on a bead string  **Division of a 2-digit number by a 1digit number involving remainders** Children should move onto calculations involving remainders. 13 ÷ 4= 3r1

	3. Followed by adding the tens in one jump and the units in one jump.  **Formal Written Methods** It is essential that the children are not moved onto this next stage until they have demonstrated full understanding of previous methods. Children may continue to use partitioning to add on a number line. **Addition of numbers with up to 2 digits using expanded method** Partitioned numbers are written underneath each other, in columns. Only provide examples *that do not cross the tens boundary,* at this stage. 70 + 10 = 80 2 + 4 = 6 80 + 6 = 86	Pupils should not be moved onto this stage until they have demonstrated full understanding of previous methods. **Expanded Method** **Subtraction of numbers with up to 2 digits using expanded method** Introduce exchanging through practical subtraction. Make the larger number with Dienes, and then subtract 47 from it. At this stage, pupils should not be introduced to exchanging. 89 = 80 + 9 - 57 = 50 + 7 = 30 + 2 =32  46 - 22 Concrete and a range of visual representations of number should continue to be used to improve pupil's fluency and understanding of number. This may include the bar model.	 **Expressing multiplication as a number sentence using x** **Using understanding of the inverse and practical resources to solve missing number problems.** 7 x 2 = □ □ = 2 x 7 7 x □ = 14 14 = □ x 7 □ x 2 = 14 14 = 2 x □ □ x ◯ = 14 14 = □ x ◯ Doubling numbers up to 10 + 10. Link with understanding scaling. Linking known doubles to working out double 2-digit numbers (double 15 = double 10 + double 5)	 **Commutativity** Children must understand that, unlike multiplication, division of one number by another must be done in the correct order.

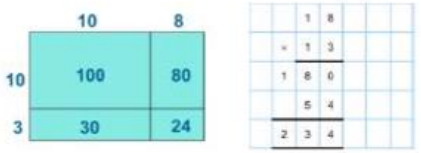
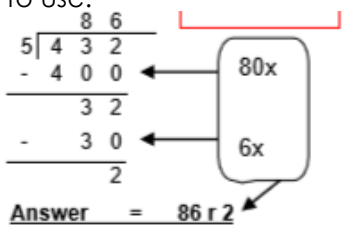
	42 = 40 + 2 + 36 30 + 6 70 + 8 =78  43 + 26 _____ Concrete and a range of visual representations of number should continue to be used to improve pupil's fluency and understanding of number. This may include the bar model.  60 + 40 = 100   	    100-40 = 60	 double 4 is 8 4 × 2 = 8 **Times Tables** Children should be introduced to times tables and practise becoming fluent in 2, 5 and 10 times tables	

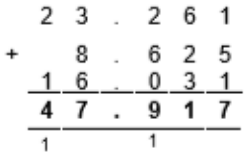
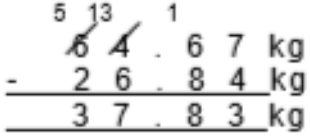
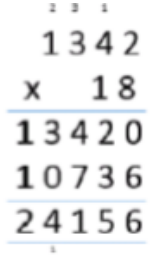
Year 3	**Ensure children are secure with Year 2 methods, and then:** **Addition of numbers with up to 2 digits using expanded method** Move on to addition of numbers that cross the tens boundary 47 = 40 + 7 + 76 = 70 + 6 110 + 13 =123 **Addition of numbers with up to 2 digits using expanded column method** Show the addition of the tens to the tens and the units to the units separately. Children should add the units first, in preparation for the compact method. **67+24=** 67 + 24 11 80 91 **Addition of numbers with up to 3 digits using expanded column method** **267+185=** 267 + 185 12 140 300 452 Pupils can continue to use Dienes or can be introduced to	**Ensure children are secure with Year 2 methods, and then:** **Subtraction of numbers with up to 2 digits using expanded method to exchange** Introduce exchanging through practical subtraction. Make the larger number with Dienes or place value counters, and then subtract 47 from it. Ensure the correct language of 'exchange' is used, rather than 'borrow'. 72 - 47  70 + 2 40 + 7 20 + 5 = 25  70 2 - 40 7 20 5 Once pupils are secure with the understanding of 'exchanging', they can use the partitioned column method to subtract any 2 and 3-digit **Subtraction of numbers with up to 3 digits using expanded column method**	**Ensure children are secure with Year 2 methods, and then:** **Counting** They will continue to count daily in 2s, 3s, 5s and 10s, modelled by teacher on a counting stick. Moving on to counting in multiples of 4, 8, 50 and 100. **Repeated addition on a number line** Children will continue to use empty number lines with increasingly large numbers, to support mental methods. **Formal Written Methods** It is essential that the children are not moved onto this stage until they have demonstrated full understanding of previous methods. **Multiplication of 2 digits by a 1-digit number** Introduce the grid method with children physically making an array to represent the calculation. (6 x 10) + (6 x 4) 60 + 24 = 84  Then translate this to grid method format: 10 4 6 | 60 | 24 60 + 24 = 84	**Ensure children are secure with Year 2 methods, and then:** **Division of a 2-digit by a 1-digit number** Children will continue to use empty number lines with increasingly large numbers, to support mental methods. 458 ÷ 3 =  100 + 50 + 2 = 152 remainder 2 **Formal Written Methods** It is essential that the children are not moved onto this stage until they have demonstrated full understanding of previous methods. **Short division of a 2-digit number by a single digit** Start by introducing the layout of short division by comparing it to an array. 32 3 | 96 Remind children of correct place value, that 96 is equal to 90 and 6, but in short division, pose: • How many 3s in 9? = 3, and record it above the 9 tens. • How many 3s in 6? = 2, and record it above the 6 ones

	place value counters to help their understanding of number.  -	754-36= 4 1 7 ~~5~~ 4 - 3 6 8 1 0 7 0 0 7 1 8		
Year 4	**Ensure children are very secure with Year 3 methods, and then:** **Addition of numbers up to 3 digits using compact column method** Children who are very secure and confident with 3-digit expanded column addition should be moved onto the compact column addition method, being introduced to "carrying" for the first time. 625+48= 6 2 5 + 4 8 6 7 3 1 **Addition of numbers with up to 4digits using compact method** 7384+438=	**Ensure children are very secure with Year 3 methods, and then:** **Subtraction of numbers with up to 4 digits using expanded method** 1754-236= 4 1 1 7 ~~5~~ 4 - 2 3 6 8 1 0 5 0 0 1 0 0 0 1 5 1 8 **Subtraction of numbers with up to 3 digits using the compact column method** To introduce the compact method, ask children to perform a subtraction calculation with the familiar partitioned column	**Ensure children are very secure with Year 3 methods, and then:** **Counting** They will continue to count daily in 2s, 3s, 4s, 5s, 6s, 7s and 10s, modelled by teacher on a counting stick. Moving on to counting in 8s, and 9s. **Short Multiplication of 2 and 3 digits by a 1-digit number** 300 40 2 7 | 2100 | 280 | 14 **Developing the grid method 346 x 9** Children will approximate first: 346 x 9 is approximately 350 x 10 = 3500	**Ensure children are very secure with Year 3 methods, and then:** **Division of a 2-digit by a 1-digit number by repeated subtraction (without remainders)** Subtraction of x10, then remaining units. Link to previous method of repeated subtraction on a number line. 72 ÷ 3= 3 | 7 2 - 3 0 ← X 10 4 2 - 3 0 ← x 10 1 2 - 6 ← x 2 6 - 6 ← x 2 0 Answer = 24 Progressing to short division when children are confident.

	 Children will use and apply this method to money and measurement values. If necessary, pupils can continue to use place value counters to help their understanding of number.  	subtraction then display the compact version for the calculation they have done. Ask pupils to consider how it relates to the method they know, what is similar and what is different, to develop an understanding of it. 754-36  Once pupils are secure with the understanding of "exchanging", they can use the partitioned column method to subtract any 2 and 3-digit. If necessary, pupils can continue to use place value counters to help their understanding of number.  	342 x 7 becomes  Answer: 2394 Pupils could be asked to work out a given calculation using the grid, and then compare it to the column method. What are the similarities and differences? Unpick the steps and show how it reduces the steps. **Times Tables** Children should have a securer knowledge of their times tables up to 12x12.	Limit numbers to NO remainders in the final answer, but with remainders occurring within the number being divided into.  Answer: 14 If needed, children should use the number line to work out individual division facts that occur which they are not yet able to recall mentally.

In Year 5 and 6 pupils continue to move towards more formal methods of calculation, however concrete and pictorial manipulations should still be used to secure pupils conceptual understanding as well as procedural understanding. Concrete and pictorial representations may include: place value counters, dienes, part-part-whole model, the bar model etc…

Year 5	**Ensure children are secure with Year 4 methods, and then:** **Addition of numbers with more than 4-digits using compact method Including money, measures and decimals with different numbers of decimal places.** £23.59+£4.38= £ 2 3 . 5 9 + 4 . 3 8 2 7 . 9 7 1 The decimal point should be aligned in the same way as other place value columns, and must be in the same column in the answer. **67454+4239=** 6 7 4 5 4 + 4 2 3 9 6 1 6 8 3 1 1	**Ensure children are secure with Year 4 methods, and then:** **Subtraction of numbers with up to 4 digits using the compact column method** **3754-286=** 6 14 1 3 7 5 4 - 2 8 6 3 4 6 8 Including using decimal values: **13.24-7.01=** 1 3 . 2 4 - 7 . 0 1 6 . 0 3	**Ensure children are secure with Year 4 methods, and then:** Continue to teach the grid method alongside short multiplication until children are confident. **Short Multiplication of up to 4 digits by a 1-digit number** **2741x6=** x 2000 700 40 1 6 12000 4200 240 6 2741 × 6 becomes 2 7 4 1 × 6 1 6 4 4 6 4 2 Answer: 16 446 **Progressing to long multiplication** Children to explore how the grid method supports an understanding of long multiplication (for 2d x 2d)  Pupils could also use place value counters to support further.	**Ensure children are secure with Year 4 methods, and then:** **Division of a 3-digit by a 1-digit number using the chunking method** Children will continue to use more formal written methods for division. They can begin to subtract larger multiples of the divisor. Teach pupils to write a 'useful list' first at the side that will help them decide what chunks to use.  Any remainders should be shown as integers. Children need to be able to round up or down in the correct context. **Progressing to short division** 

Year 6	**Ensure children are very secure with Year 5 methods, and then:** **Compact Method - addition of numbers of increasing complexity and decimal values** 23.261+8.625+16.031=  	**Ensure children are very secure with Year 5 methods, and then:** **Compact Method - subtraction of numbers of increasing complexity and decimal values** 64.67kg+26.84kg= Using the compact column method to subtract money and measures, including decimals with different numbers of decimal places.  	**Ensure children are very secure with Year 5 methods, and then:** Pupils continue to practice their fluency skills using short and long multiplication. Pupils should only progress to long multiplication when securer.  **Multiplication of numbers with up to 2 d.p.** Woking from right to left, but reminding children that the single digit belongs in the ones column.	**Ensure children are very secure with Year 5 methods, and then:** **Long division of up to 4 digit numbers, with remainders expressed as integers, fractions and decimals** Real life problem solving contexts need to be the starting point, where pupils have to consider the most appropriate way to express the remainder.

			3 . 1 9 x 8 2 5 . 1 2 1 7 This can be introduced in the context of money (£ and p)	432 ÷ 15 becomes 2 8 r 12 1 5 | 4 3 2 3 0 0 1 3 2 1 2 0 1 2 Answer: 28 r12 432 ÷ 15 becomes 2 8 1 5 | 4 3 2 3 0 0 15×20 1 3 2 1 2 0 15×8 1 2 $\frac{12}{15} = \frac{4}{5}$ Answer: $28\frac{4}{5}$ 432 ÷ 15 becomes 2 8 · 8 1 5 | 4 3 2 · 0 3 0 1 3 2 1 2 0 1 2 0 1 2 0 0 Answer: 28·8

Each class is provided with their own Maths tool box that contains the day-to-day concrete resources that are required to teach a mastery lesson.