West Road
PRIMARY ACADEMY

Calculation Policy

Updated January 2023

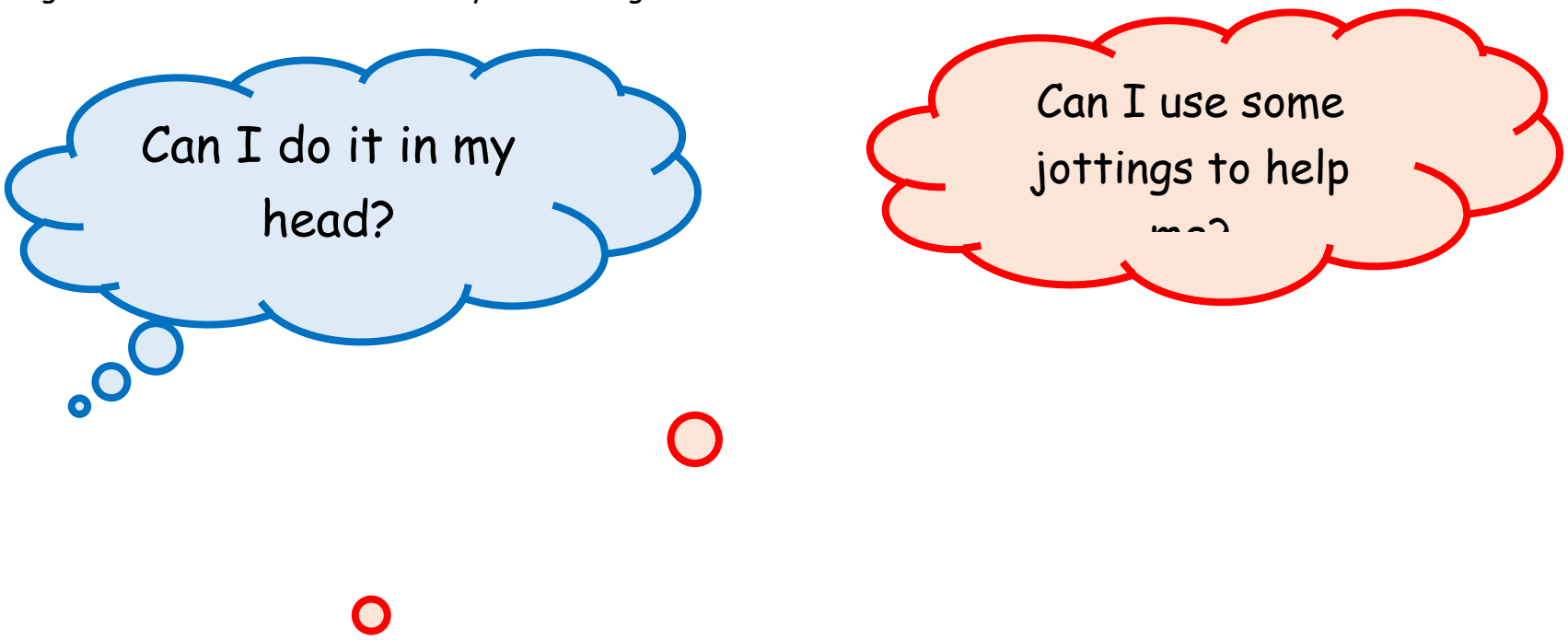
CALCULATION GUIDANCE: Addition

This policy has been written to ensure consistency in the mathematical written methods and approaches to calculation across years 1-6 and EYFS through Early Learning Goals.

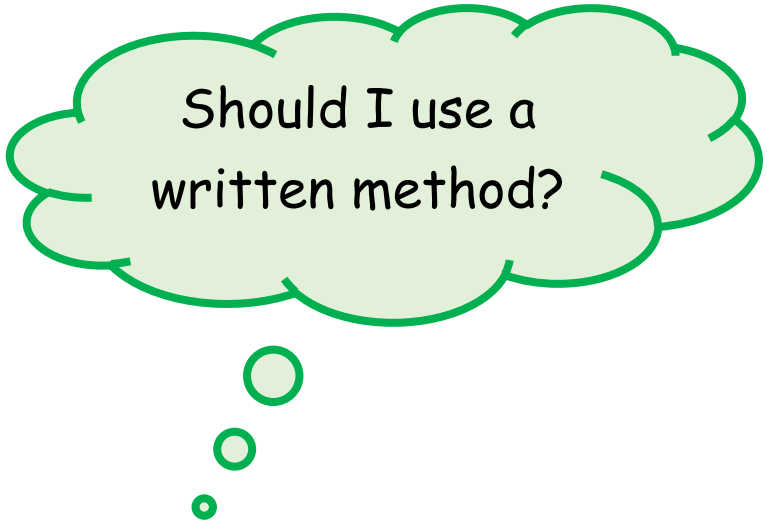
The 2014 national curriculum for mathematics aims to ensure that all pupils are to become fluent in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately.

Times Tables/number facts Recall:
West Road has subscribed to Times Tables Rockstars and Mathshed as resource tools to support and challenge our pupils with the recall of their times tables and improve number knowledge. By the end of Year 4, pupils should be able to recall multiplication facts up to 12x12 at speed.

As part of a child's learning in calculation, they need to be taught how to select the best method according to the numbers. The hierarchy of thinking should be:



CALCULATION GUIDANCE: Addition



Rationale for KS1

Children in Years 1 and 2 will be given a really solid foundation in the basic building blocks of mental and written arithmetic. Through being taught **place value**, they will develop an understanding of how numbers work, so that they are confident in 2-digit numbers and beginning to read and say numbers above 100. A focus on **number bonds**, first via practical hands-on experiences and subsequently using memorisation techniques, enables a good grounding in these crucial facts, and ensures that all children leave Y2 knowing the pairs of numbers which make all the numbers up to 10 at least. They will also have experienced and been taught pairs to 20. Their knowledge of number facts enables them to **add several single-digit numbers**, and to **add/subtract a single digit number to/from a 2-digit number**. Another important conceptual tool is their ability to **add/subtract 1 or 10**, and to **understand which digit changes and why**. This understanding is extended to enable children to **add and subtract multiples of ten** to and from any 2-digit number. The most important application of this knowledge is their ability to **add or subtract any pair of 2-digit numbers using column addition/subtraction.** Children will be taught to **count in 2s, 3s, 5s and 10s**, and will have related this skill to repeated addition. They will have met and begun to learn the associated **2x, 3x, 5x and 10x tables**. Engaging in a practical way with the concept of repeated addition and the **use of arrays** enables children

CALCULATION GUIDANCE: Addition

to develop a preliminary understanding of multiplication, and asking them to consider how many groups of a given number make a total will introduce them to the idea of division. They will also be taught to **double and halve numbers**, and will thus experience scaling up or down as a further aspect of multiplication and division. Fractions will be introduced; **halves, quarters and thirds.**

Rationale for Lower KS2

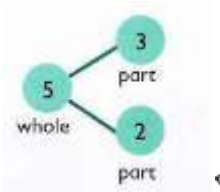
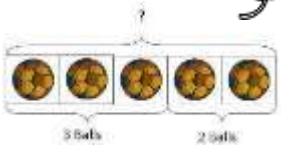
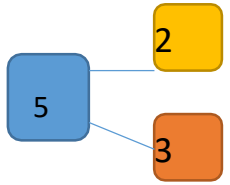
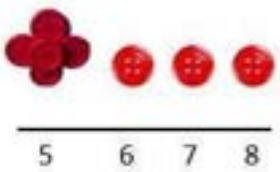
In lower key stage 2, children build on the concrete and conceptual understandings they have gained in key stage 1 to develop a real mathematical understanding of the four operations, in particular developing **arithmetical competence in relation to larger numbers**. In addition and subtraction, they are taught to use place value and number facts to add and subtract numbers mentally and will develop a range of strategies. In particular, they will learn to add and subtract multiples and near multiples of 10, 100 and 1000, and will become fluent in **complementary addition** as an accurate means of achieving fast and accurate answers to 3-digit subtractions. Standard written methods for adding larger numbers are taught, learned and consolidated. This key stage is also the period during which **all the multiplication and division facts** are thoroughly memorised, including all facts up to the 12 x 12 table. Efficient written methods for multiplying or dividing a 2-digit or 3-digit number by as single-digit number are taught, as are mental strategies for multiplication or division with large but friendly numbers, e.g. when dividing by 5 or multiplying by 20. Children will develop their understanding of fractions, learning to **reduce a fraction to its simplest form** as well as **finding non-unit fractions of amounts** and quantities. The concept of a decimal number is introduced and children consolidate a firm understanding of **one-place decimals**, **multiplying and dividing whole numbers by 10 and 100**.

CALCULATION GUIDANCE: Addition

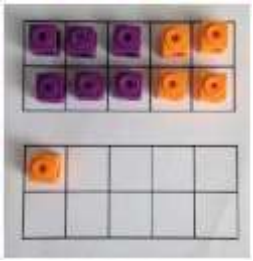
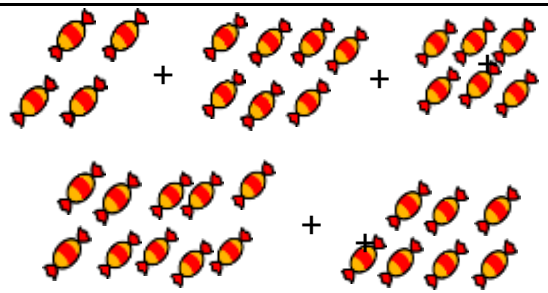
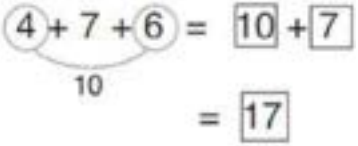
Rationale for UKS2

Children move on from dealing mainly with whole numbers to performing arithmetic operations with both **decimals and fractions**. They will consolidate their use of written procedures in adding and subtracting whole numbers with **up to 6 digits** and also decimal numbers with **up to two decimal places**. Mental strategies for adding and subtracting increasingly large numbers will also be taught. These will draw upon children's robust understanding of place value and knowledge of number facts. Efficient and flexible strategies for mental multiplication and division are taught and practised, so that children can perform appropriate calculations even when the numbers are large, such as 40,000 x 6 or 40,000 ÷ 8. **Fractions and decimals are also added, subtracted, divided and multiplied**, within the bounds of children's understanding of these more complicated numbers, and they will also calculate simple **percentages and ratios**. **Negative numbers** will be added and subtracted.

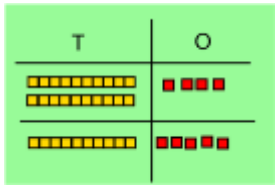
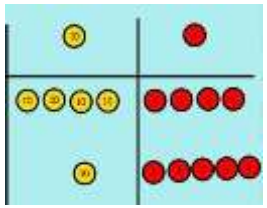
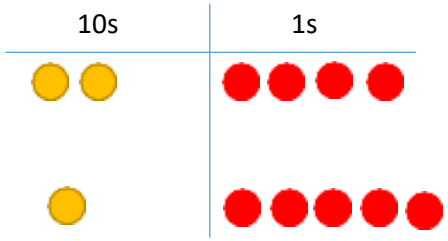
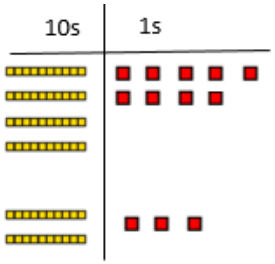
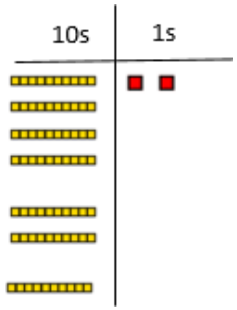
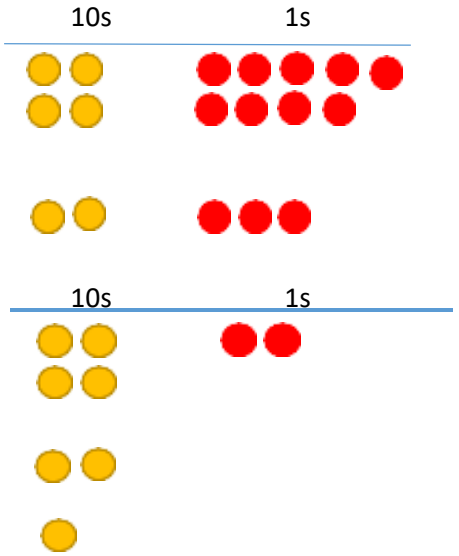
CALCULATION GUIDANCE: Addition

	Objective	Concrete	Pictorial	Abstract
Year 1	Number bonds of 5, 6, 7, 8, 9 and 10	 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	 Start with the larger number on the bead string and then count on to the smaller number 1 by 1 to find the answer. 	Use a number line to count on in ones. 	5 + 3 = 8

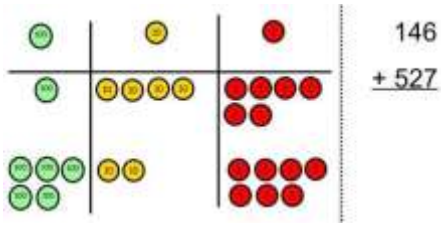
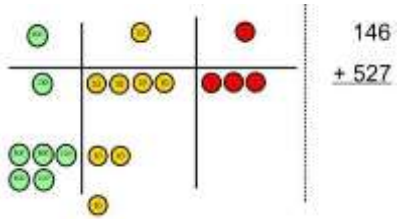
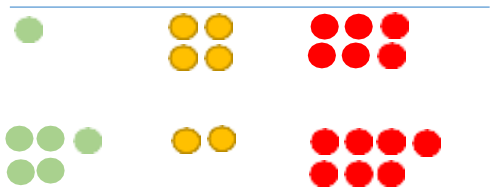
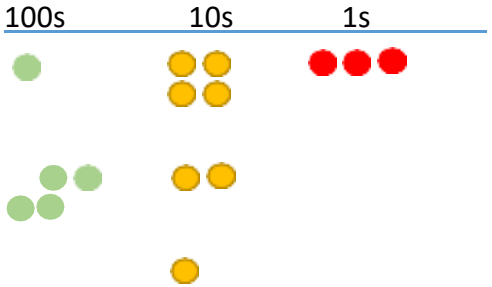
CALCULATION GUIDANCE: Addition

	Objective	Concrete	Pictorial	Abstract
Year 1	Regrouping to make 10	  6 + 5 = 11 Start with the bigger number and use the smaller number to make 10.	 6 + 5 = 11 4 1 6 + 4 =10 10 + 1 = 11	6 + 5 = 11
Year 2	Adding 3 single digit numbers	4 + 7 + 6= 17 Put 4 and 6 together to make 10. Add on 7.  Following on from making 10, make 10 with 2 of the digits (if possible) then add on the third digit.	 Add together three groups of objects. Draw a picture to recombine the groups to make 10.	 Combine the two numbers that make 10 and then add on the remainder.

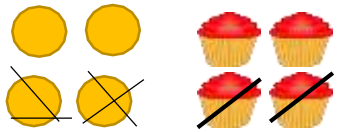
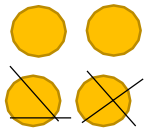
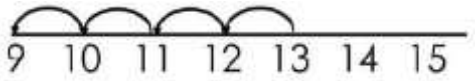
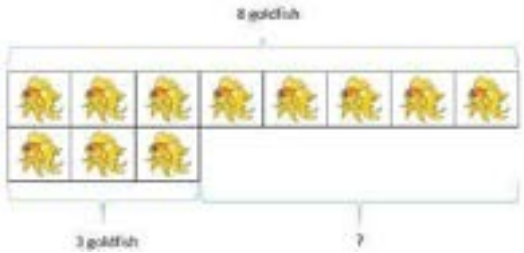
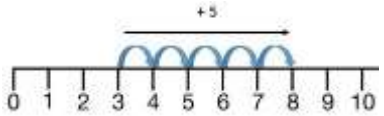
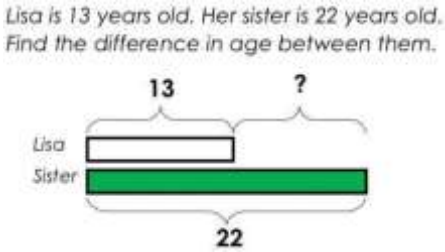
CALCULATION GUIDANCE: Addition

	Objective	Concrete	Pictorial	Abstract
Year 2	Column method without regrouping	Add together the ones first, then add the tens. Use the Base 10 blocks first before moving onto place value counters. 24 + 15 =  44 + 15 = 	After physically using the base 10 blocks and place value counters, children can draw the counters to help them to solve additions.  	24 + 15 = 39 24 <u>+ 15</u> 39
	Column method with regrouping	Make both numbers on a place value grid.  Add up the units and exchange 10 ones for 1 ten.  	Using place value counters, children can draw the counters to help them to solve additions.  	40 + 9 <u>20 + 3</u> 60 + 12 = 72

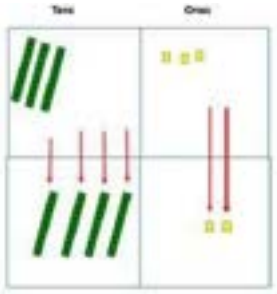
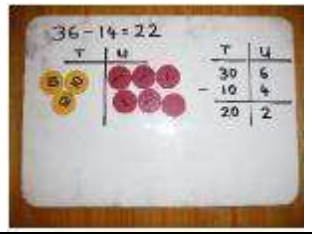
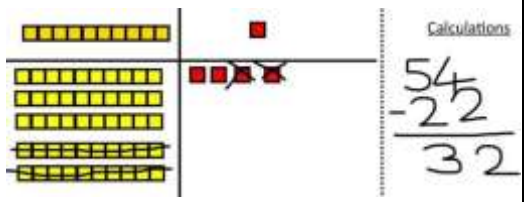
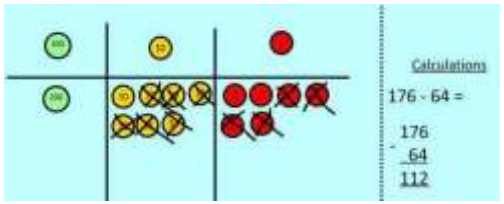
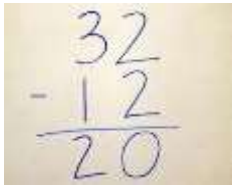
CALCULATION GUIDANCE: Addition

	Objective	Concrete	Pictorial	Abstract
Year 3/4	Column method with regrouping	Make both numbers on a place value grid.  Add up the units and exchange 10 ones for 1 ten.  As children move on to decimals, money and decimal place value counters can be used to support learning. **NB** By Year 4 children will progress on to adding four digit numbers.	100s 10s 1s  100s 10s 1s  Children can draw a pictoral representation of the columns and place value counters to further support their learning and understanding. **NB** Addition of money needs to have £ and p added separately.	100 + 40 + 6 500 + 20 + 7 600 + 70 + 3 = 673 As the children progress, they will move from the expanded to the compacted method. 146 + 527 673 1 As the children move on, introduce decimals with the same number of decimal places and different. Money can be used here.
Year 5/6	Column method with regrouping	Consolidate understanding using numbers with more than 4 digits and extend by adding numbers with up to 3 decimal places.		

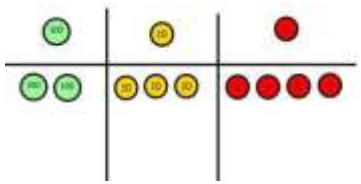
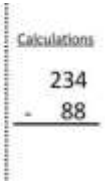
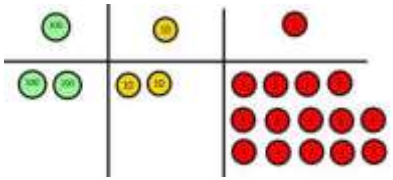
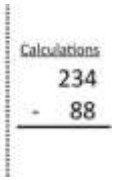
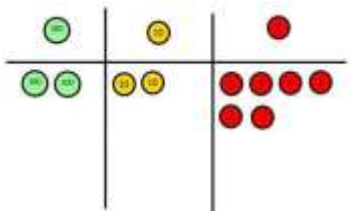
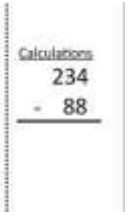
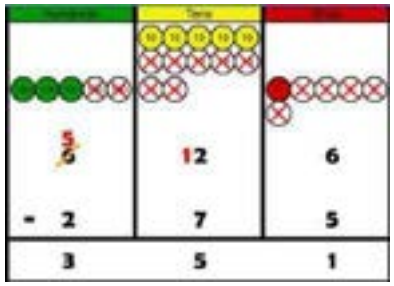
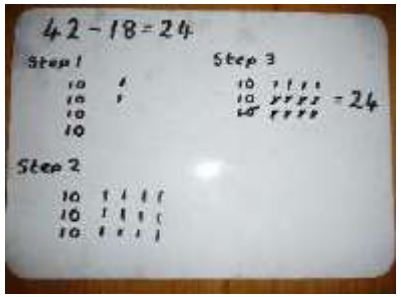
CALCULATION GUIDANCE: Subtraction

	Objective	Concrete	Pictorial	Abstract
Year 1	Taking away ones	Use physical objects, counters, cubes etc. to show how objects can be taken away. 4 – 2 = 2 	Cross out drawn objects to show what has been taken away. 4 – 2 = 2 	4 – 2 = 2
	Counting back	Make the larger number in your subtraction. Move the beads along your bead string as you count backwards in ones.  13 – 4 = 9	Count back on a number line or number track  Start at the bigger number and count back the smaller number, showing the jumps on the number line.	Put 13 in your head, count back 4. What number are you at? Use your fingers to help.
	Find the difference	Compare amounts and objects to find the difference.  Use cubes to build towers or make bars to find the difference. Use basic bar models with items to find the difference.	 Count on to find the difference.  Draw bars to find the difference between 2 numbers.	Hannah has 8 goldfish. Helen has 3 goldfish. Find the difference between the number of goldfish the girls have.

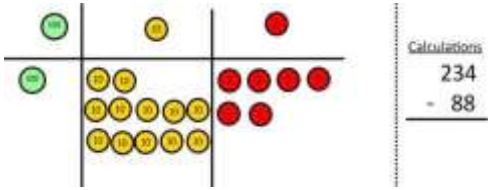
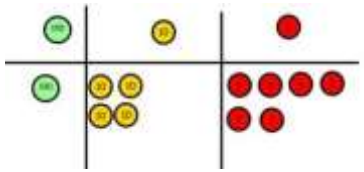
CALCULATION GUIDANCE: Subtraction

	Objective	Concrete	Pictorial	Abstract
Year 2	Column method without regrouping	75 – 42 = 33  Use Base 10 to make the bigger number then take the smaller number away. Show how you partition numbers to subtract. Again make the larger number first. 	 Draw the Base 10 or place value counters alongside the written calculation to help to show working. 	47 – 24 = 23 40 + 7 – 20 + 4 20 + 3 This will lead to a clear written column subtraction. 

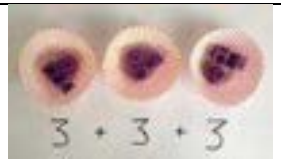
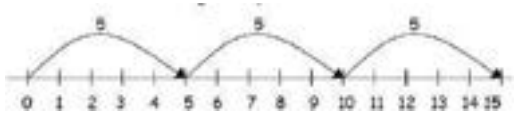
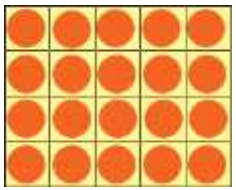
CALCULATION GUIDANCE: Subtraction

	Objective	Concrete	Pictorial	Abstract
Year 3 onwards	Column method with regrouping	Use Base 10 to start with before moving on to place value counters. Start with one exchange before moving onto subtractions with 2 exchanges. Make the larger number with the place value counters   Start with the ones, can I take away 8 from 4 easily? I need to exchange 1 of my tens for 10 ones.   Now I can subtract my ones.   	 Draw the counters onto a place value grid and show what you have taken away by crossing the counters out as well as clearly showing the exchanges you make. When confident, children can find their own way to record the exchange/regrouping. Just writing the numbers as shown here shows that the child understands the method and knows when to exchange/regroup.  	 Children can start their formal written method by partitioning the number into clear place value columns.  Moving forward the children use a more compact method. This will lead to an understanding of subtracting any number including decimals. 5 12 1 2 6 3 . 0 - 2 6 . 5 2 3 6 . 5

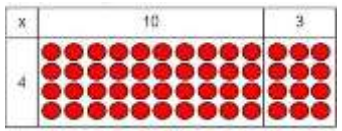
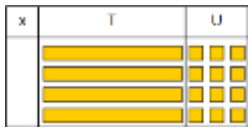
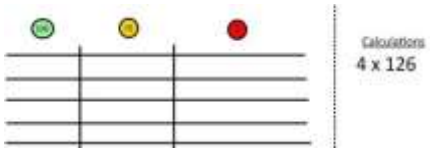
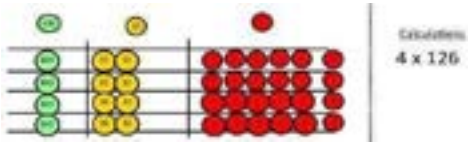
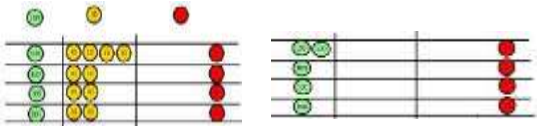
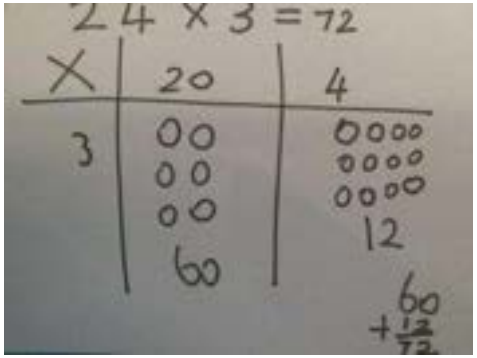
CALCULATION GUIDANCE: Subtraction

	Objective	Concrete	Pictorial	Abstract
Year 3 up	Column method with regrouping	Now look at the tens, can I take away 8 tens easily? I need to exchange 1 hundred for 10 tens.  Calculations 234 - 88 Now I can take away 8 tens and complete my subtraction.  Calculations ~~234~~ - 88 146 Show children how the concrete method links to the written method alongside your working. Cross out the numbers when exchanging and show where we write our new amount.		

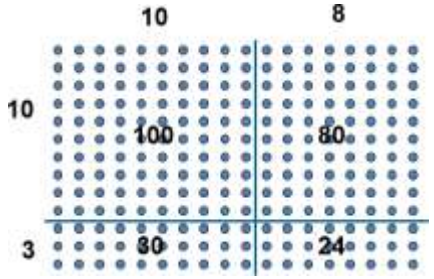
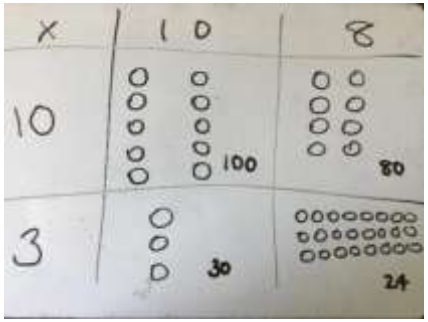
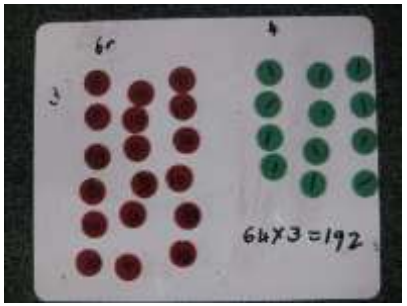
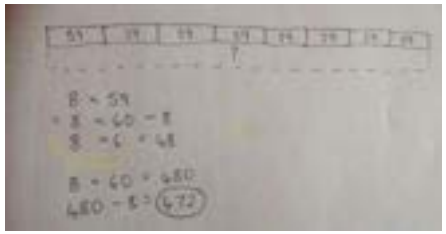
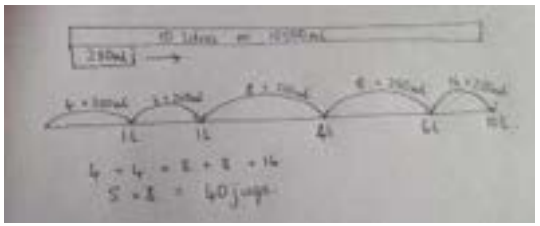
CALCULATION GUIDANCE: Multiplication

	Objective	Concrete	Pictorial	Abstract
Year 1/2	Repeated addition	   Use different objects to add equal groups.	There are 3 plates. Each plate has 2 star biscuits on. How many biscuits are there?  2 + 2 + 2 = 6  5 + 5 + 5 = 15	Write addition sentences to describe objects and pictures.  2 + 2 + 2 = 6
	Arrays- showing commutative multiplication	Create arrays using counters/cubes to show multiplication sentences.  	Draw arrays in different rotations to find **commutative** multiplication sentences.  4 × 2 = 8 2 × 4 = 8  2 × 4 = 8 4 × 2 = 8 Link arrays to area of rectangles. 	Use an array to write multiplication sentences and reinforce repeated addition.  5 + 5 + 5 = 15 3 + 3 + 3 + 3 + 3 = 15 5 x 3 = 15 3 x 5 = 15

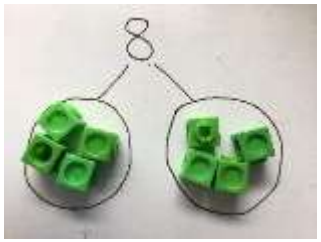
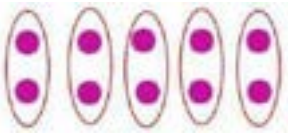
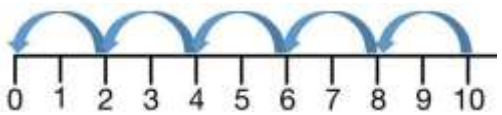
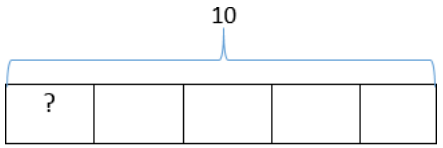
CALCULATION GUIDANCE: Multiplication

	Objective	Concrete	Pictorial	Abstract
Year 3/4	Grid method	Show the link with arrays to first introduce the grid method.  4 rows of 10 4 rows of 3 Move on to using Base 10 to move towards a more compact method.  4 rows of 13 Move on to place value counters to show how we are finding groups of a number.We are multiplying by 4 so we need 4 rows.  Fill each row with 126.  Add up each column, starting with the ones making any exchanges needed.  4 × 126 = 504	Children can represent the work they have done with place value counters in a way that they understand. They can draw the counters, using colours to show different amounts or just use circles in the different columns to show their thinking as shown below. 	Start with multiplying by one digit numbers and showing the clear addition alongside the grid. × 30 5 7 210 35 210 + 35 = 245 Moving forward, multiply by a 2 digit number showing the different rows within the grid method. 10 8 10 100 80 3 30 24 X 1000 300 40 2 10 10000 3000 400 20 8 8000 2400 320 16

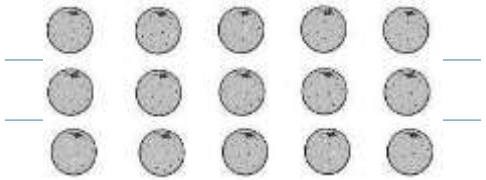
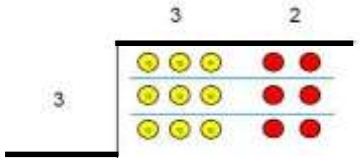
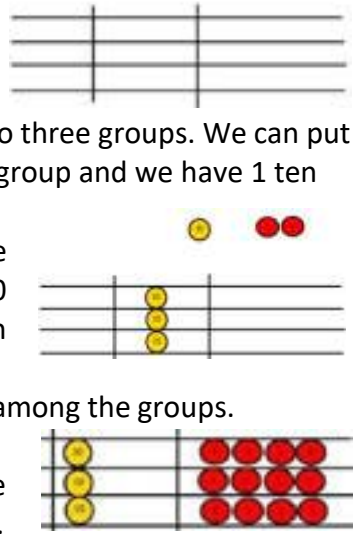
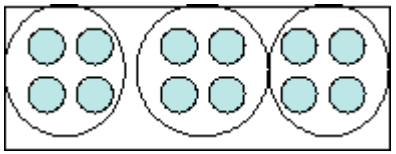
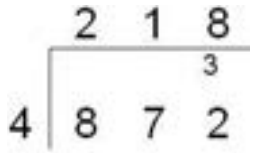
CALCULATION GUIDANCE: Multiplication

	Objective	Concrete	Pictorial	Abstract
	Expanded method	Show the link with arrays to first introduce the expanded method. 		Start with long multiplication, reminding the children about lining up their numbers clearly in columns. 18 x 13 24 (3 x 8) 30 (3 x 10)) 80 (10 x 8) 100 (10 x 10) 234
Year 5/6	Compact method	Children can continue to be supported by place value counters at the stage of multiplication.  It is important at this stage that they always multiply the ones first and note down their answer followed by the tens which they note below.	Bar modelling and number lines can support learners when solving problems with multiplication alongside the formal written methods.  	Start with long multiplication, reminding the children about lining up their numbers clearly in columns. If it helps, children can write out what they are solving next to their answer. 74 x 63 12 210 240 - 420 462 This moves to the more compact method. 1342 x 18 13420 10736 24156

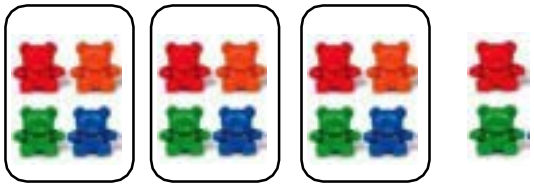
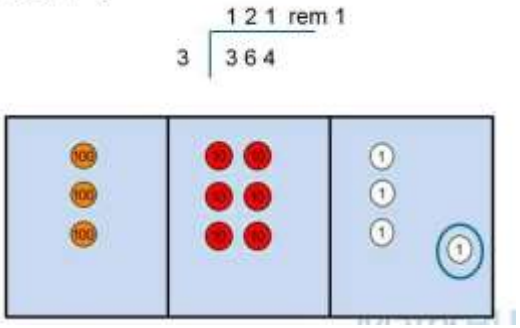
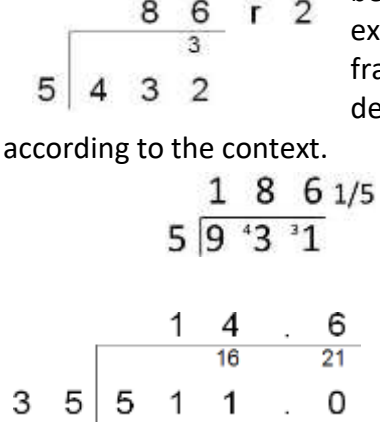
CALCULATION GUIDANCE: Division

	Objective	Concrete	Pictorial	Abstract
Year 1/2	Sharing	I have 8 cubes, can you share them equally between two people?	Children use pictures or shapes to share quantities.  8 ÷ 2 = 4	Share 8 buns between two people. 8 ÷ 2 = 4 
	Grouping	Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.  	Use a number line to show jumps in groups. The number of jumps equals the number of groups.  Think of the bar as a whole. Split it into the number of groups you are dividing by and work out how many would be within each group.  10 ÷ 5 = ? 5 x ? = 10	10 ÷ 5 = 2 Divide 10 into 5 groups. How many are in each group?

CALCULATION GUIDANCE: Division

	Objective	Concrete	Pictorial	Abstract
Year 3/4	Division with arrays	Link division to multiplication by creating an array and thinking about the number sentences that can be created. Eg 15 ÷ 3 = 5 5 x 3 = 15 15 ÷ 5 = 3 3 x 5 = 15 	 Draw an array and use lines to split the array into groups to make multiplication and division sentences.	Find the inverse of multiplication and division sentences by creating four linking number sentences. 5 x 3 = 15 3 x 5 = 15 15 ÷ 5 = 3 15 ÷ 3 = 5
	Short division	Use place value counters to divide using the short division method alongside. 96 ÷ 3  42 ÷ 3 Start with the biggest place value. We are sharing 40 into three groups. We can put 1 ten in each group and we have 1 ten left over. We exchange this ten for 10 ones and then share the ones equally among the groups. We look at how many are in each group. 	Students can continue to use drawn diagrams with dots or circles to help them divide numbers into equal groups.  Encourage them to move towards counting in multiples to divide more efficiently.	Begin with divisions that divide equally with no remainder. 

CALCULATION GUIDANCE: Division

	Objective	Concrete	Pictorial	Abstract
Year 5/6	Division with remainders	14 ÷ 3 = Divide objects between groups and see how much is left over 	Jump forward in equal jumps on a number line then see how many more you need to jump to find a remainder.  Draw dots and group them to divide an amount and clearly show a remainder. 	Complete written divisions and show the remainder using r. 
	Short division with remainders	364 ÷ 3 = 		Move onto divisions with a remainder. Once children understand remainders, begin to express as a fraction or decimal according to the context. 

	Objective	Concrete	Pictorial	Abstract
Year 6	Long division			Children will use long division to divide numbers with up to 4 digits by 2 digit numbers. 015 32 ⟌ 487 -0 48 -32 167 -160 7 17 r 19 31 ⟌ 546 31↓ 236 217 19