Falmouth primary academy

Calculation Policy 2020

Pupils at Falmouth Primary Academy are given opportunities to use varied fluency, reasoning and problem solving skills in their daily Maths lessons as well as through cross-curricular opportunities. They are supported to make links with their prior learning and to apply their knowledge through investigations across a range of real life contexts.

This policy has been largely adapted from the White Rose Maths Hub Calculation Policy with further material added. It is a working document and will be revised and amended as necessary.

Concrete, pictorial, abstract (CPA) concepts should not be confused as differentiation for lower, middle, higher attaining children. CPA is an approach to be used with the whole class and teachers should promote each area as equally valid. Manipulatives in particular must not be presented as a resource to support the less confident or lower attaining pupils.

Addition

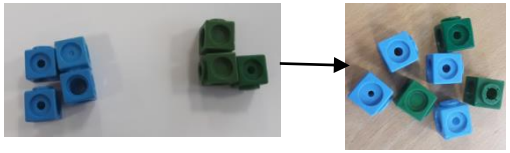
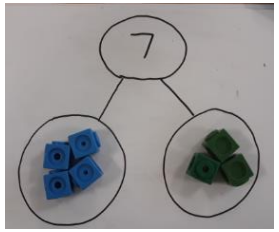
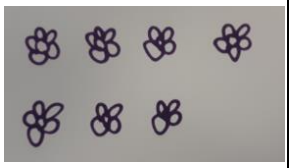
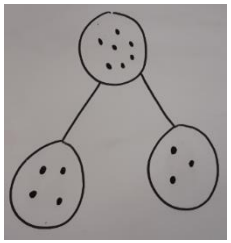
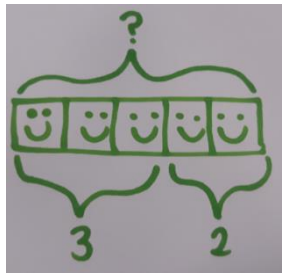
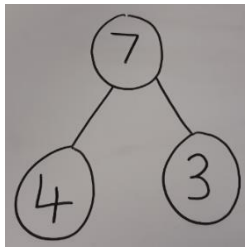
Year 1

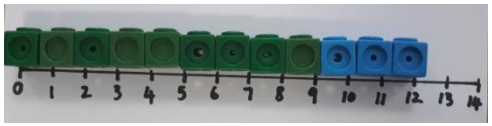
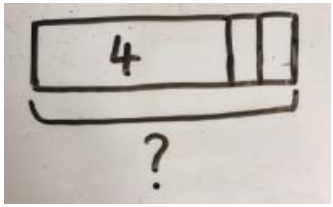
Statutory Requirements:

- Read, write and interpret mathematical statements involving addition (+) and equals (=) signs – this means THE SAME AS – relate this to balanced number sentences and scales
- Represent and use number bonds and related subtraction facts within 20
- Add one-digit and two-digit numbers to 20, including zero
- Solve one-step problems that involve addition, using concrete objects and pictorial representations, and missing number problems such as 9 = □ + 7

Vocabulary:

Plus, add, more, total, sum, altogether, make, partition, parts and wholes, how many more is . . .?, tens, ones, teen number, 'is equal to', 'is the same as', number bonds, number line, hundred squares, inverse, double, near double.

Objective and Strategy	Concrete	Pictorial	Abstract
Combining two parts to make a whole Using the part whole model	Use cubes and other resources e.g. teddy bears, cars etc to add 2 numbers together as a group or in a bar. e.g. 4+ 3 = 7   Use a part-whole model to show the 4 and 3 as parts and the 7 as the whole. 	Use pictures to add two number numbers as a group. e.g. 4+ 3 = 7  Draw dots on a part whole model.  Use pictures to add two numbers together in a bar. 	Use part whole model to show 4 is part, 3 is part and the whole is 7. 4 + 3 = 7 

Starting at bigger number and counting on	Start with the larger number and then count on the smaller number 1 by 1 to find the answer. 9 + 3 =  Count on using a number line and cubes. 	11 + 4 = Start with the largest number and count on in 1s.  Use a number line to start at the biggest number and count on in 1s.  Draw a bar model which encourages children to count on, rather than count all. 	11 + 4 = Place the larger number in your head and count on the smaller number in 1s to find the answer.

Addition

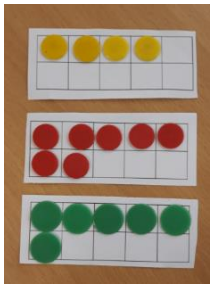
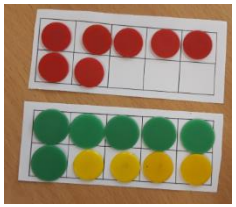
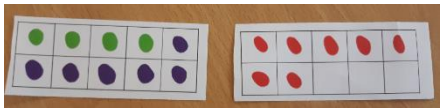
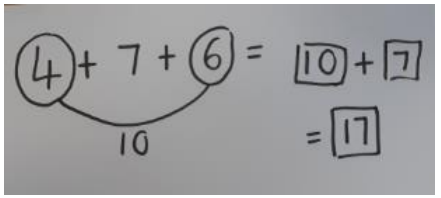
Year 2

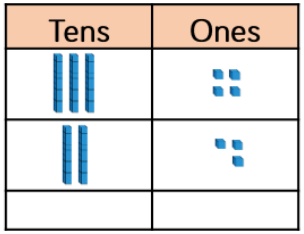
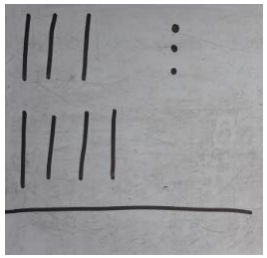
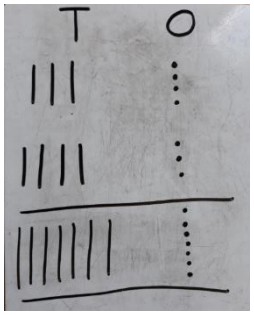
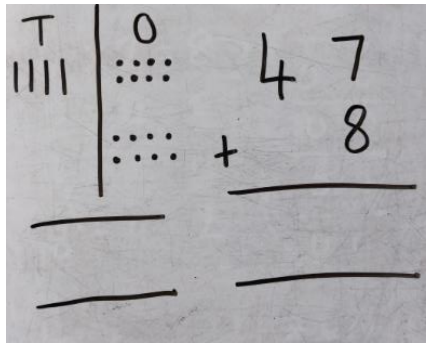
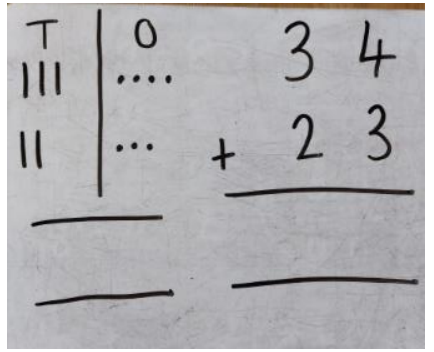
Statutory Requirements:

- Solve problems with addition using concrete objects and pictorial representations, including those involving numbers, quantities and measures, apply their increasing knowledge of mental and written methods.
- Recall and use addition facts to 20 fluently, and derive and use related facts up to 100
- Add numbers using concrete objects, pictorial representations and mentally, including:
  a two-digit number and ones.
  a two-digit number and tens,
  two two-digit numbers
  three one-digit numbers
- Show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot
- Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems

Vocabulary:

Plus, add, more, total, sum, altogether, make, partition, recombine, parts and wholes, how many more is . . .?, digit, hundreds, tens, ones, 'is equal to', 'is the same as', number bonds, number line, inverse, double, near multiples, commutative law.

Objective and Strategy	Concrete	Pictorial	Abstract
Adding 3 single digits	Use 2 tens frames to show how three 1-digit numbers can be added together. Children to use the partitioning skills they learnt in year 1 to help them identify their number bonds. 4+7+6= Frame 1: put 4 counters and 6 counters together. Frame 2: 7 counters   Can also be shown using Numicon. 	Draw dots on tens frames using different colours. 4+7+6= 	Combine the two numbers together that make 10 and then add the remainder. 

Use base 10 to combine 2 numbers	Using base 10, children create the amounts using their tens and ones knowledge. Children to put the amounts into columns and rows so they can easily see the tens and ones that they are adding. e.g. 34 + 60 =  or 34 + 23 = 	Once children are secure in using the base 10 they can then draw the tens and ones. E.g. 33 + 40 =  or 34 + 23 = 	The children are then able to move onto using abstract form alongside the pictorial representation. This stage only happens when they are completely secure with using the tens and ones.  

Addition

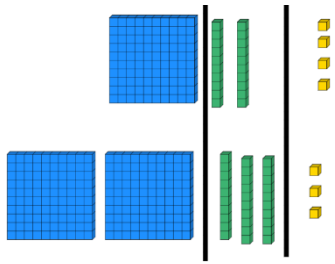
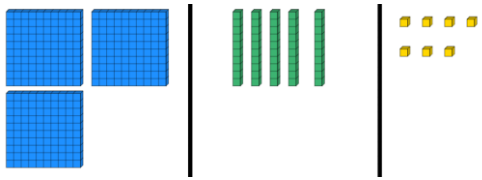
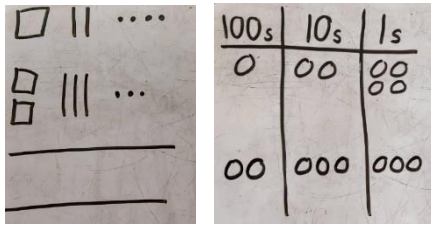
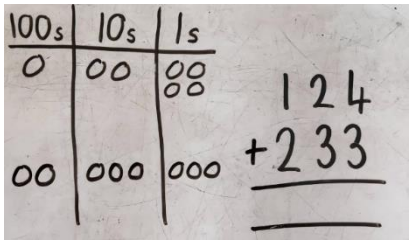
Year 3

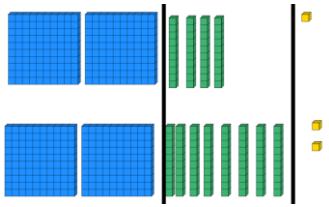
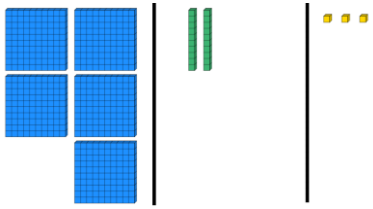
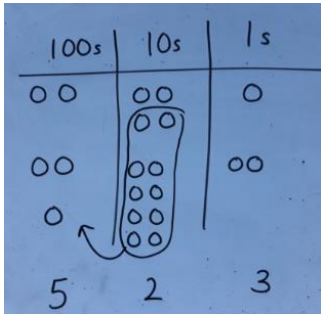
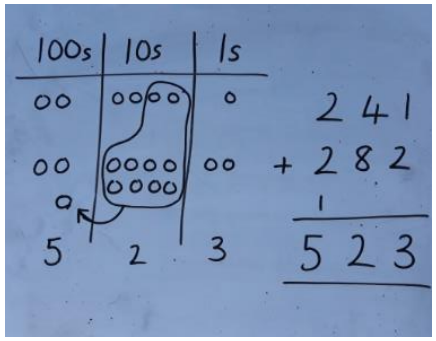
Statutory Requirements:

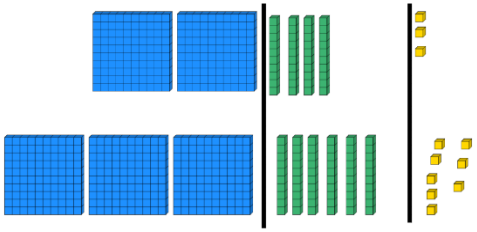
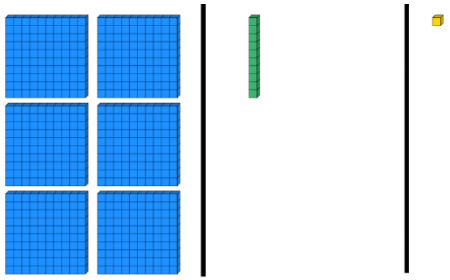
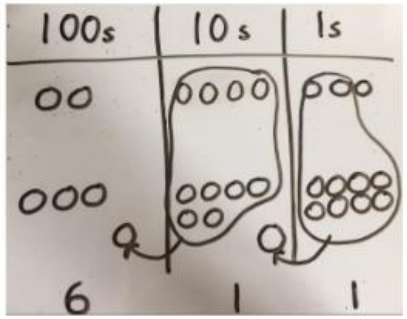
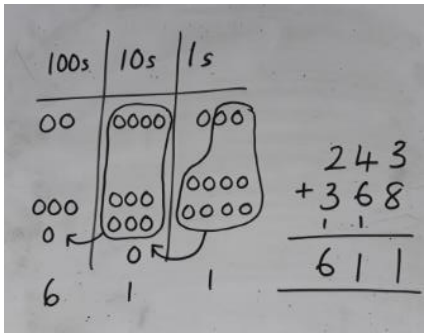
- Add numbers mentally, including:
  a three-digit number and ones,
  a three-digit number and tens
  a three-digit number and hundreds
- Add numbers with up to three digits, using formal written methods of column addition
- Estimate the answer to a calculation and use inverse operations to check answers
- Solve problems, including missing number problems, using number facts, place value, and more complex addition.

Vocabulary:

Plus, add, more, total, sum, altogether, make, partition, recombine, how many more is . . .?, hundreds , 'is equal to', 'is the same as', digit, inverse, column addition, vertical, 'regroup', expanded, compact, commutative law.

Objective and Strategy	Concrete	Pictorial	Abstract
Column method up to 3-digit numbers (no regrouping)	Make both numbers up using the base 10 or place value counters. 124 + 233 =  Add up each column, starting with the 1s.  3 5 7	Children to draw the base 10 or place value counters in the columns. 	Using the drawn representation alongside, children to complete the column method for addition. 
Column method up to 3-digit numbers (1 exchange)	Make both numbers up using the base 10 or pv counters.	Children to represent the two numbers by drawing counters on a place value chart. They add up each column,	Using the drawn representation alongside, children to complete the column method for addition.

	241 + 282 =  Add up each column, starting with the 1s, making exchanges as required.  5 2 3	starting with the 1s, circling the counters when they make an exchange. 	

Column method up to 3-digit numbers (2 exchanges)	Make both numbers up using the base 10 or place value counters. 243 + 368 =  Start with the ones column. Add up the ones. Exchange 10 ones for 1 ten. Carry on adding up the columns, ensuring that an amount greater than 10 counters is exchanged for the next place value amount.  6 1 1	Children to represent the counters in a place value chart, circling when they make an exchange. 	Using the drawn representation alongside, children to complete the column method for addition. 

Addition

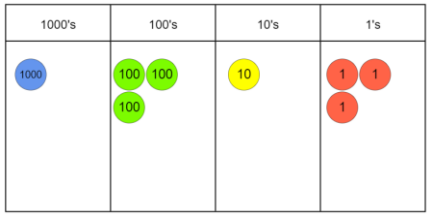
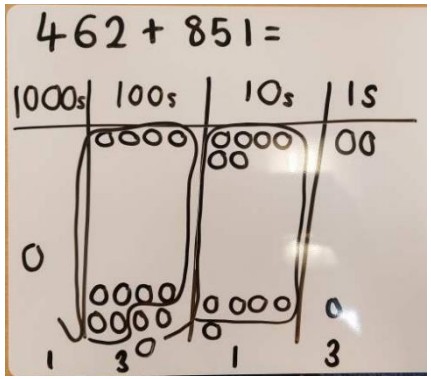
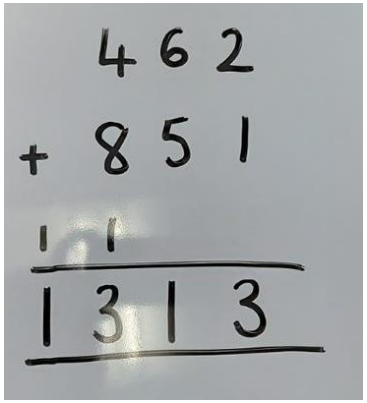
Year 4

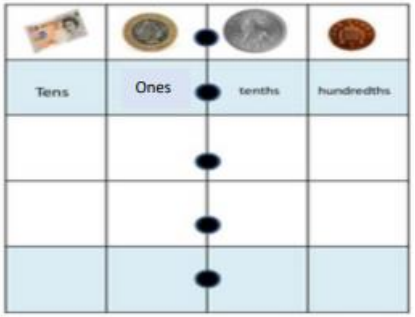
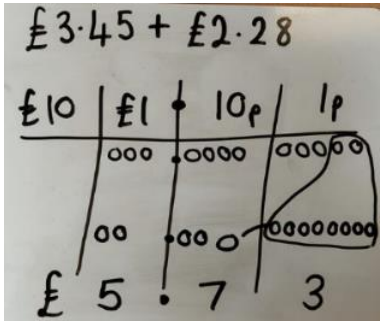
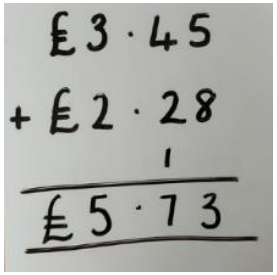
Statutory Requirements:

- Add with up to 4 digits using the formal written methods of column addition where appropriate
- Estimate and use inverse operations to check answers to a calculation
- Solve addition two-step problems in contexts, deciding which operations and methods to use and why

Vocabulary:

Plus, add, more, total, sum, altogether, make, partition, recombine, how many more is . . .?, thousands, hundreds, tens, ones, 'is equal to', 'is the same as', inverse, column addition, vertical, 'regroup', expanded, compact, number line, increase, digits, tenths, hundredths, decimal (places), count through zero, commutative law.

Objective and Strategy	Concrete	Pictorial	Abstract
Column method up to 4 digits with 2 exchanges	Children to make up both numbers using base 10 or place value counters. Children to identify which column(s) will need an exchange.  Add up the columns, exchanging 10 counters from one column for the next place value counter until every column has been added.  1 3 1 3	Children to represent the counters in a place value chart, circling when they make an exchange.  	Using the drawn representation alongside, children to complete the column method for addition. 

Using the column method to add decimal numbers in the context of money	Children use coins on the place value chart to add two amounts. E.g. £3.45 + £2.28 Limit the amount of carrying initially so that the process is clear. 	Children to show the place value counters in the chart pictorially, ensuring that they have the decimal point in the correct place. 	Children to show the pictorial method alongside the column method until secure. 

Addition

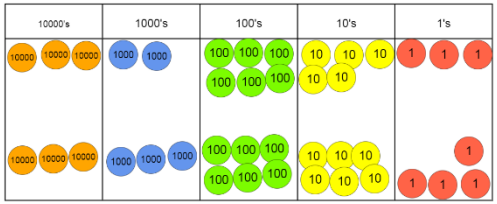
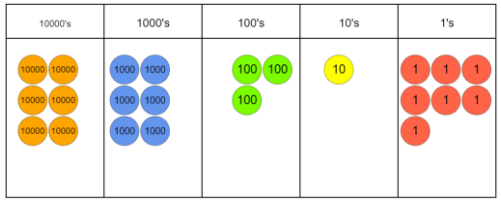
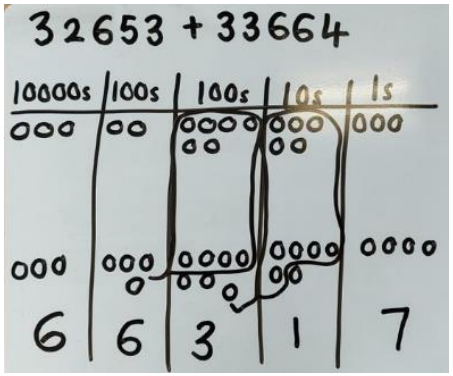
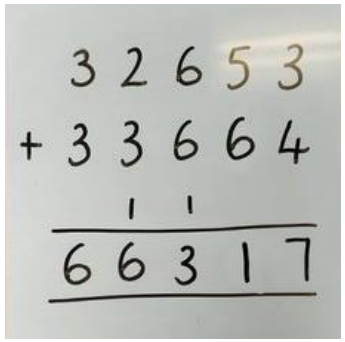
Year 5

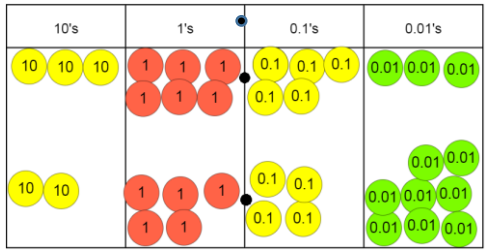
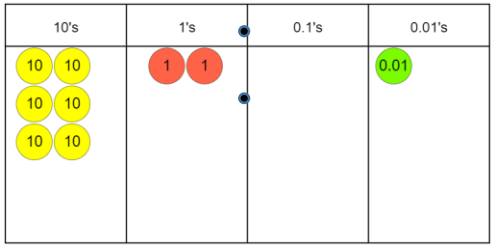
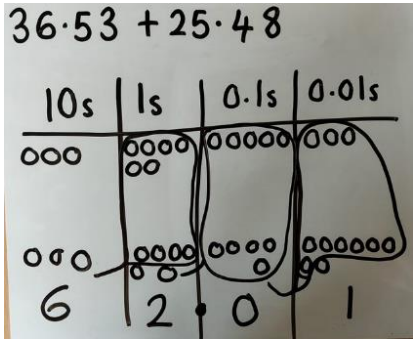
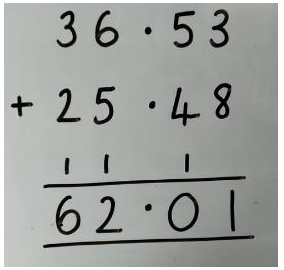
Statutory Requirements:

- Add whole numbers with more than 4 digits, including using column addition where appropriate
- Add numbers mentally with increasingly large numbers
- Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy
- Solve addition multi-step problems in contexts, deciding which operations and methods to use and why

Vocabulary:

Plus, add, more, total, sum, altogether, make, partition, recombine, how many more is . . .?, ten thousands, thousands, hundreds, tens, ones, 'is equal to', 'is the same as', inverse, column addition, vertical, 'regroup', expanded, compact, number line, increase, digits, tenths, hundredths, decimal (places), count through zero, efficient written method commutative law.

Objective and Strategy	Concrete	Pictorial	Abstract
Column method for adding more that 4-digits with exchanges	Children to make up both numbers using base 10 or place value counters. Children to identify which column(s) will need an exchange.  Add up the columns, exchanging 10 counters from one column for the next place value counter until every column has been added.  6 6 3 1 7	Children to represent the counters in a place value chart, circling when they make an exchange.  	Using the drawn representation alongside, children to complete the column method for addition. 

Adding 2 decimal numbers (with up to 2 decimal places) with regrouping	Children to use place value counters on the place value chart.  Add up the columns, exchanging 10 counters from one column for the next place value counter until every column has been added.  6 2 • 0 1	Children to show the place value counters in the chart pictorially, ensuring that they have the decimal point in the correct place.  	Children to show the pictorial method alongside the column method until secure. 

Addition

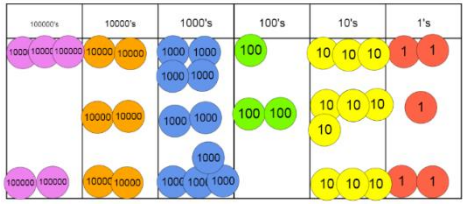
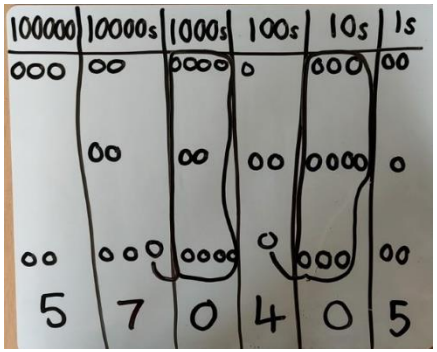
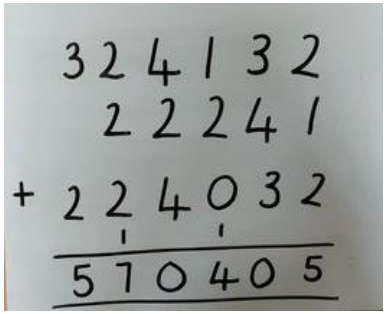
Year 6

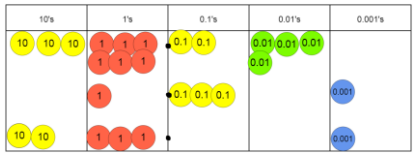
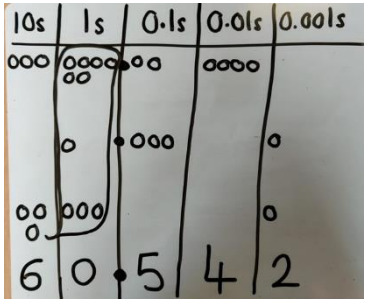
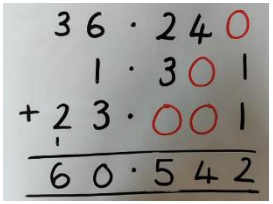
Statutory Requirements:

- Perform mental calculations, including with mixed operations and large numbers
- Use knowledge of the order of operations to carry out calculations involving the 4 operations
- I can solve addition and subtraction multi-step problems in context, deciding which operations and methods to use and why
- I can use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy

Vocabulary:

Plus, add, more, total, sum, altogether, make, partition, recombine, how many more is . . .?, hundred thousands, ten thousands, thousands, hundreds, tens, ones, 'is equal to', 'is the same as', inverse, column addition, vertical, 'regroup', expanded, compact, number line, increase, digits, tenths, hundredths, decimal (places), count through zero, efficient written method, order of operations, commutative law.

Objective and Strategy	Concrete	Pictorial	Abstract
Adding several numbers with more than 4 digits (including regrouping)	Children to make up all numbers using place value counters. Children to identify which column(s) need an exchange. Add up the columns, exchanging 10 counters from one column for the next place value counter until every column has been added. 	Children to represent the counters in a place value chart, circling when they make an exchange. 	Using the drawn representation alongside, children to complete the column method for addition. Ensure the digits are correctly aligned when adding numbers with different amounts of digits. 

Adding several numbers with different numbers of decimal places (including money and measures)	Children to make all numbers using place value counters. Children to identify with column(s) needs an exchange. Add up the columns, exchanging 10 counters from one column for the next place value counter until every column has been added.  	Children to represent the counters in a place value chart, circling when they make an exchange.  	Using the drawn representation alongside, children to complete the column method for addition. Ensure all the digits are correctly aligned. Draw attention to the role of 0 as a place holder. 

Subtraction

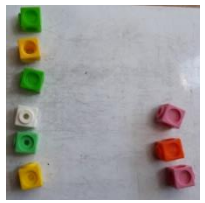
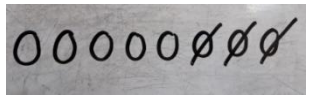
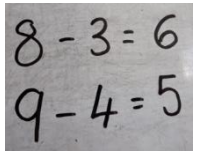
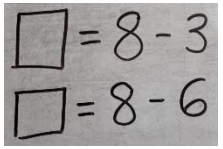
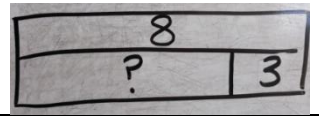
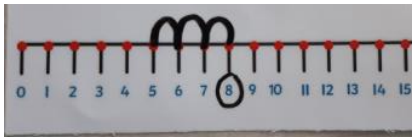
Year 1

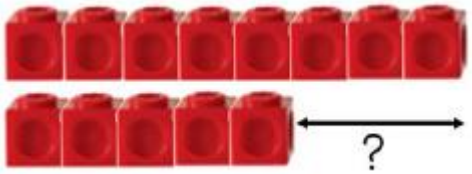
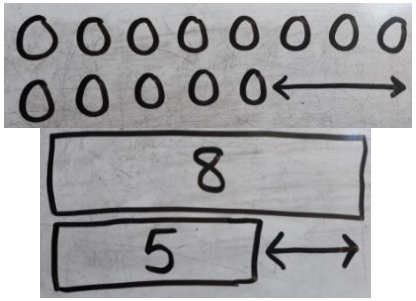
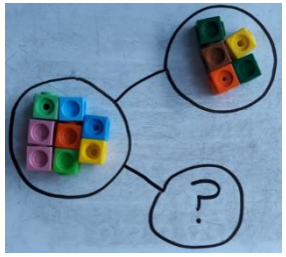
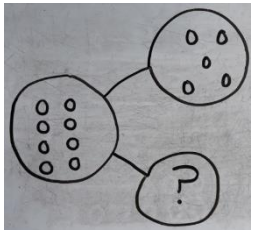
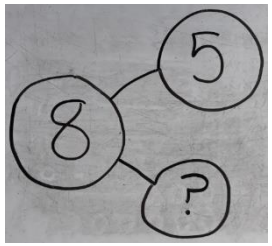
Statutory Requirements:

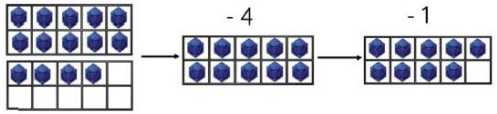
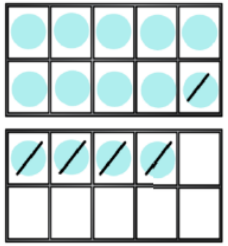
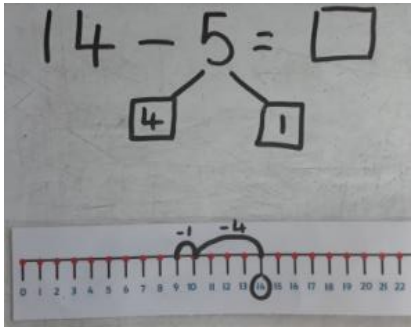
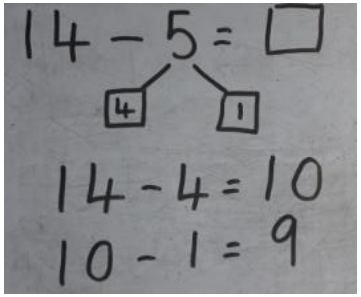
- Read, write and interpret mathematical statements involving subtraction (-) and equals (=) signs
- Represent and use number bonds and related subtraction facts within 20
- Subtract one-digit and two-digit numbers to 20, including zero
- Solve one-step problems that involve subtraction, using concrete objects and pictorial representations, and missing number problems.

Vocabulary:

Take away, less than, subtract, minus, fewer, decrease, the difference between, number bonds, 'is equal to', 'is the same as', how many have gone? number line, how many more to make..?, how many more is...than..?, how much more is..? How many fewer is...than..?, how much less is..? inverse.

Objective and Strategy	Concrete	Pictorial	Abstract
Taking away ones	Use physical objects: counters, cubes etc. to show how objects can be taken away. 8 – 3 = 	Cross out drawn objects to show what has been taken away. 8 – 3 = 	  
Counting back	Make the number you are taking away from on the bead string e.g. 8. Take away a bead 1 at a time as you count back.  	Circle the number you are taking away from on the number line. Count back the number you are taking away by showing the jumps on the number line.  	8 – 3 = Put 8 in your head and count back 3. What number do you land on?

Finding the difference	Comparing amounts of objects to find the difference. Line the objects up against each other so the difference is more obvious. Find the difference using cubes, counters, Cuisenaire, Numicon or any other similar objects. E.g. What is the difference between 8 and 5? 	Children to draw cubes or other concrete objects which they previously used for the bar model. E.g. What is the difference between 8 and 5? 	What is the difference between 8 and 5? 8 – 5 The difference is ..
Part whole model	The part whole model links with addition and will help explain the inverse between addition and subtraction. If 8 is the whole and 5 is the part. What is the other part? 8 – 5 = 	Show the part whole model using pictorial representations. This could be shown using dots, images etc. 	Once secure children can use numbers to make up the part whole model. 

Making 10 using the tens frame	14 – 5 Make 14 on the tens frame. Partition the 5 into 4 and 1. Take away 4 then take away 1. 	14 – 5 Children can then show this pictorially. Make 14. Partition 5 into 4 and 1. Take away 4 then take away 1.  This can also be shown on a number line. 	14 – 5 Children to show how they can make 10 by continuing to partition the subtrahend. 

Subtraction

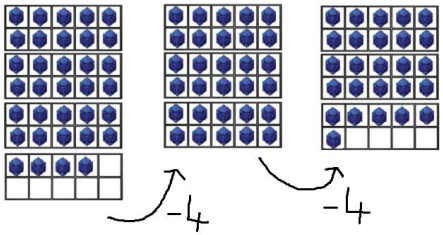
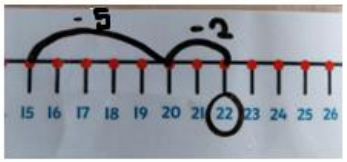
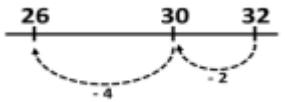
Year 2

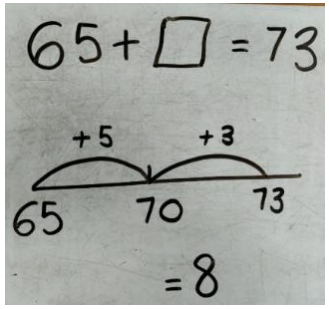
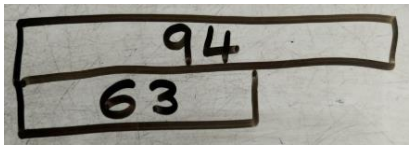
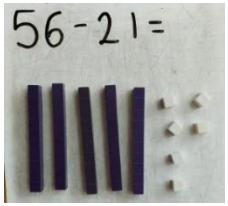
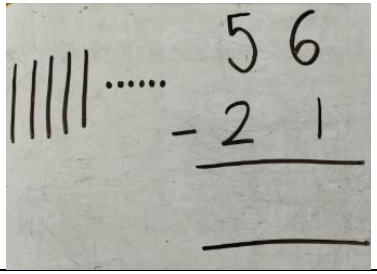
Statutory Requirements:

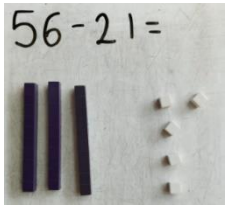
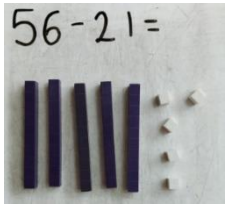
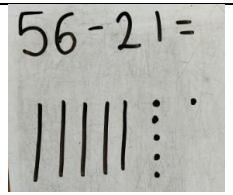
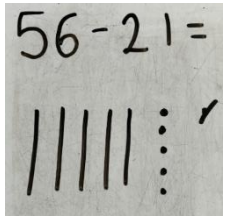
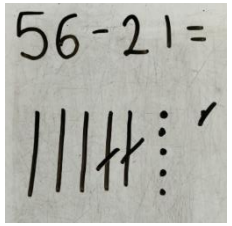
- Solve problems with subtraction: using concrete objects and pictorial representations, including those involving numbers, quantities and measures and apply their increasing knowledge of mental and written methods
- Recall and use subtraction facts to 20 fluently, and derive and use related facts up to 100
- Subtract numbers using concrete objects, pictorial representations, and mentally, including:
  - a two-digit number and ones,
  - a two-digit number and tens,
  - two two-digit numbers and
  - subtract three one-digit numbers
- Show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot
- Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems

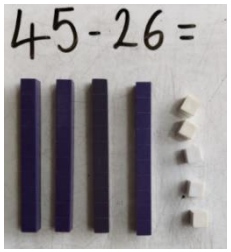
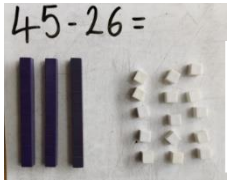
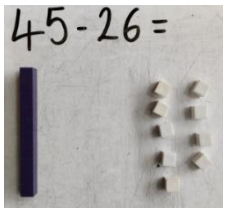
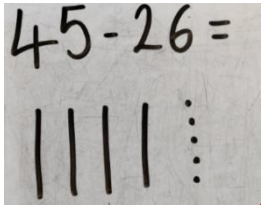
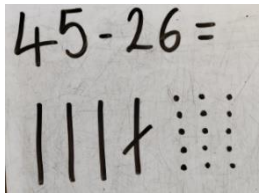
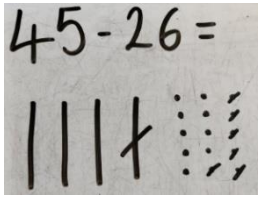
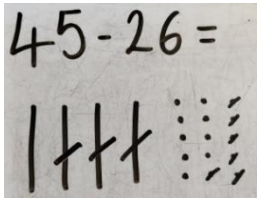
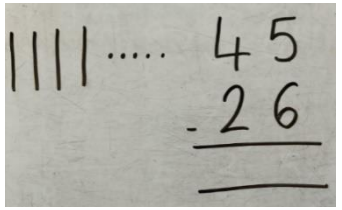
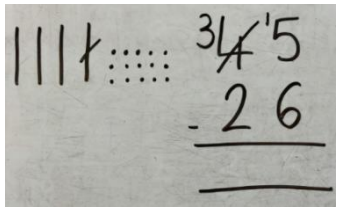
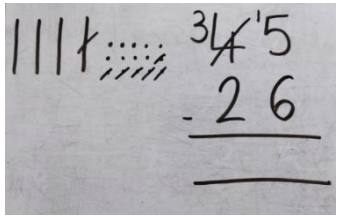
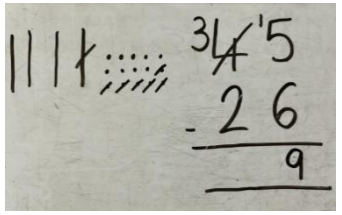
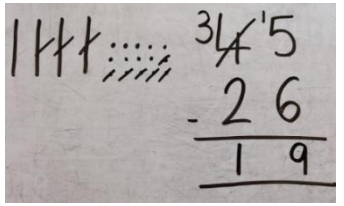
Vocabulary:

Take away, less than, subtract, minus, fewer, decrease, the difference between, number bonds, is equal to, 'is the same as', how many are left?, how many have gone? how many more to make...? how many more is... than...? how much more is...? how many fewer is...than..?, how much less is..? inverse, partition, recombine, hundred.

Objective and Strategy	Concrete	Pictorial	Abstract
Counting back (When subtracting a 1 digit number)	Subtract a single digit from a 2-digit number by bridging multiples of 10. 34 – 8 = Show 34 using counters on tens frames. Partition the 8 into 4 and 4. Take away the 4 and then take away the 4.  	32 – 6 = Circle 32 on a 100-square. Partition the 6 into 2 and 4. Take away the 2, take away the 4.  22 – 7 = Circle 22 on a number line. Partition the 7 into 2 and 5. Take away the 2, then take away the 5.  	32 – 6 = Partition the 6 into 2 and 4. Take away the 2, take away the 4. Drawn onto a blank number line. 

Find the difference (Between two 2-digit numbers)	Revisit finding the difference from year 1.	Find the difference between 65 and 73. Turn this into a missing addition number sentence. Start at 65 and jump on to reach 73. Make sure you jump to landmark numbers. 	Draw a bar model to show the amount you need to find. Count in multiples of 10s and then in 1s. 
Partitioning to subtract **without** regrouping.	Use base 10 to show how to partition the larger number when subtracting.  Show the 5 tens and 6 ones.	This time the children will draw the tens and ones and then cross them off as they are taken away.	Children to move onto the column method alongside the pictorial representation **only when** they have a secure understanding. 

	 Take away the 1 one from 21.  Take away the 2 tens from 21. Add together what is left, counting in 10s and then 1s.	 Show the 5 tens and 6 ones.  Cross out the 1 one from 21.  Cross out the 2 tens from 21. Add together what is left, counting in 10s and then 1s.	
Partitioning to subtract using re-grouping.	Use base 10 to show how to partition the larger number when subtracting. E.g. 45 – 26 = As you can't subtract 6 from 5 you will need to exchange one 10 for 10 ones.	This time the children will draw the tens and ones. Children need to show the exchanged 10 by crossing it out and adding 10 ones.	Children to move onto column method alongside the pictorial representation **only when** they have an absolute secure understanding.

	 Show the 4 tens and 5 ones.  Exchange 1 ten for 10 ones.  Take away the 6 ones.  Take away the 2 tens. Add together what is left, counting in 10s and then 1s.	 Show the 4 tens and 5 ones.  Exchange 1 ten for 10 ones.  Take away the 6 ones.  Take away the 2 tens. Add together what is left, counting in 10s and then 1s.	    

Subtraction

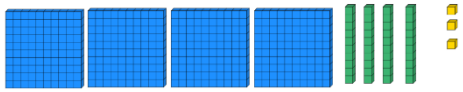
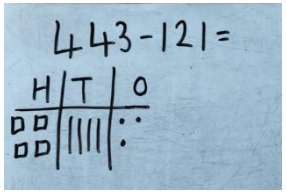
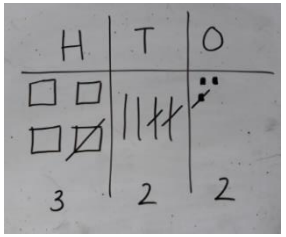
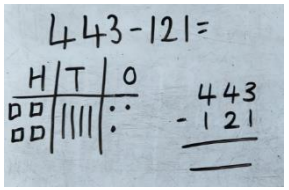
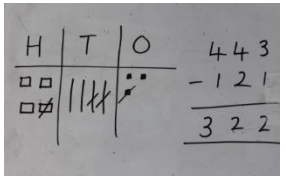
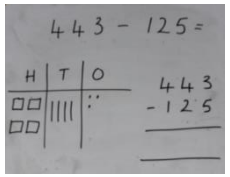
Year 3

Statutory Requirements:

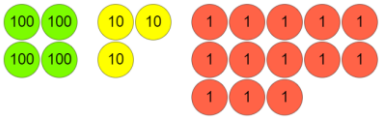
- Subtract numbers mentally, including:
  - a three-digit number and ones,
  - a three-digit number and tens,
  - a three-digit number and hundreds,
  - a three-digit number and thousands
- Subtract numbers with up to three digits, using formal written methods of column subtraction where appropriate
- Estimate the answer to a calculation and use inverse operations to check answers
- Solve problems, including missing number problems, using number facts, place value, and more complex subtraction

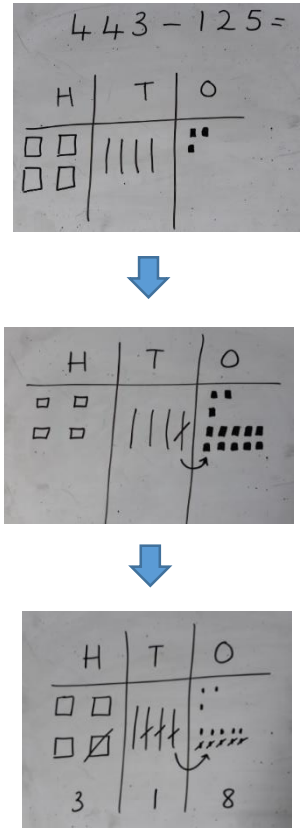
Vocabulary:

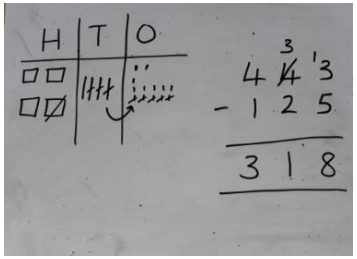
Take away, less than, subtract, minus, fewer, decrease, the difference between, number bonds, is equal to, 'is the same as' , how many more is... than ..?, how much more is..? how many fewer is...than..?, how much less is..? inverse, partition, recombine, hundred, column method.

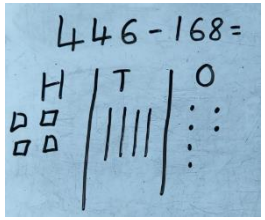
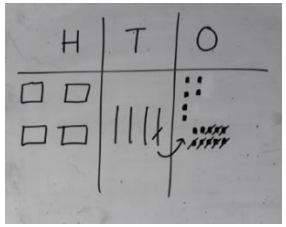
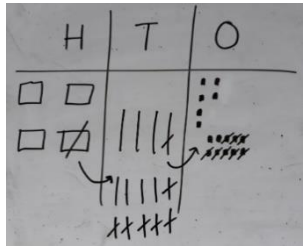
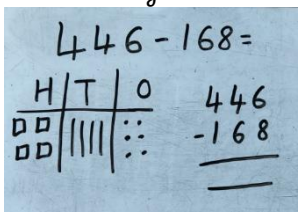
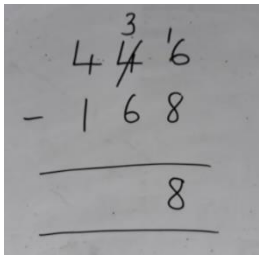
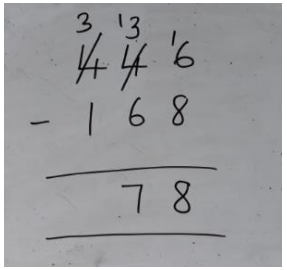
Objective and Strategy	Concrete	Pictorial	Abstract
Column method up to 3 digit numbers (no regrouping)	Make the largest number using the base 10 or pv counters and subtract the smaller number, starting from the 1s column. 443 – 121 = 	Children to draw the largest number using base 10 or pv counters in the columns. Subtract the smaller number, starting with the 1s, crossing off as you go.   	Using the drawn representation alongside, children to complete the column method for subtraction.  
Column method up to 3 digit numbers (1 exchange)	Make the largest number using the base 10 or pv counters. 443 – 125 = Identify the column which you will need to make an exchange for.	Children to represent the counters in a place value chart. Children need to identify where they need to make an exchange and show this clearly on the chart.	Using the drawn representation alongside, children to complete the column method for subtraction. 

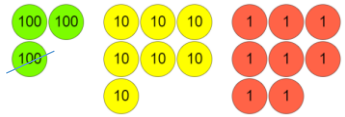
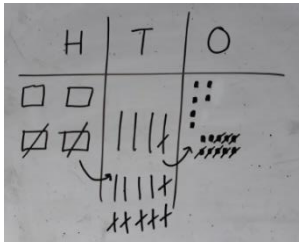
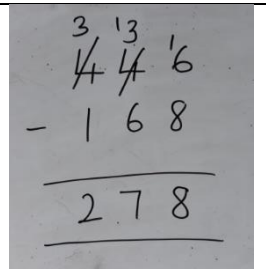
As you can't take five 1s away from 3 1s you will need to exchange a 10s counter for ten 1s. You can then subtract the smaller number, starting with the 1s column.







Column method up to 3 digit numbers (2 exchanges)	Make the largest number using the dienes or pv counters. 446 – 168 = Identify the columns which you will need to make an exchange for.  Exchange a 10s counter for ten 1s and then subtract eight from the 1s column.  Exchange a 100s counter for ten 10s and then subtract six tens from the 10s column.  	Children to represent the counters in a place value chart. Children need to be able to identify if and where they need to make an exchange.    	Using the drawn representation alongside, children to complete the column method for subtraction.   

	Finally, subtract one hundred from the 10s column.  You are left with the answer of 278.	 	

Subtraction

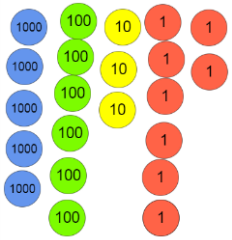
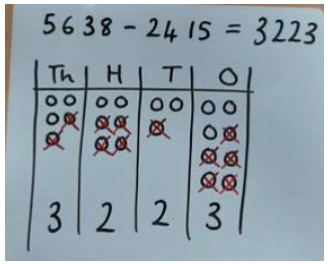
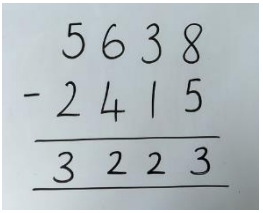
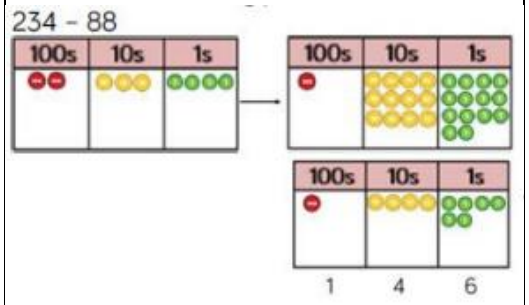
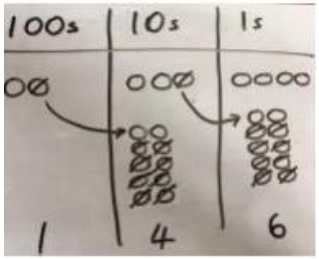
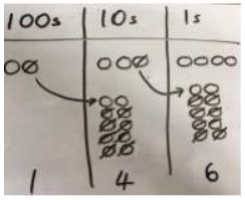
Year 4

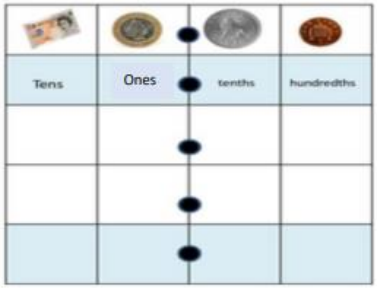
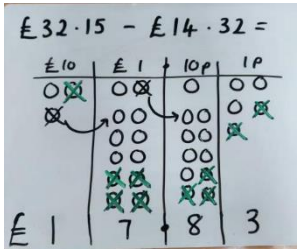
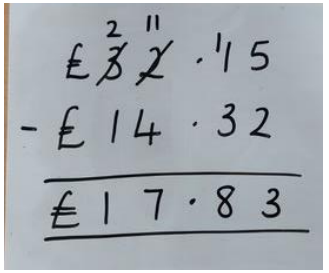
Statutory Requirements:

- Subtract with up to 4 digits using the formal written methods of column subtraction where appropriate
- Estimate and use inverse operations to check answers to a calculation
- Solve subtraction two-step problems in contexts, deciding which operations and methods to use and why

Vocabulary:

Take away, less than, subtract, minus, fewer, decrease, the difference between, inverse, partition, recombine, hundred, is equal to, the same as, how many have gone? how many more to make..?, how many/much more is... than ..?, how many fewer/much less is... than..?, number bonds, column method, thousand more/less, expanded, compact, estimate, efficient.

Objective and Strategy	Concrete	Pictorial	Abstract
Column method without regrouping (up to 4 digits).	Make the largest number using the dienes or place value counters, then take the smaller number away. 5638 – 2415 = 	Children to draw the dienes or place value counters into the columns, then take the smaller number by crossing out the counters. 	Using the drawn representation alongside, children to complete the column method for subtraction. 
Column method with regrouping (up to 4 digits).	Use place value counters to show regrouping using column method. 	Represent the place value counters pictorially; remembering to show what has been exchanged. 	Formal column method. Children must understand what has happened when they have crossed out digits. To be shown alongside the pictorial representation until  $\begin{array}{r} {}^{2}2{}^{1}\cancel{3}4 \\ -\ 88 \\ \hline 6 \end{array}$ children are secure.

Subtraction of decimal numbers in the context of money.	Using coins, children create the larger amount on the place value chart. Take away the smaller amount, exchanging where necessary. 	Represent the coins using counters in a place value chart. Remember to show the decimal point and to clearly show what has been exchanged. Cross out the counters as you take away. 	Formal column method. Children must understand what has happened when they have crossed out digits. To be shown alongside the pictorial representation until secure. 

Subtraction

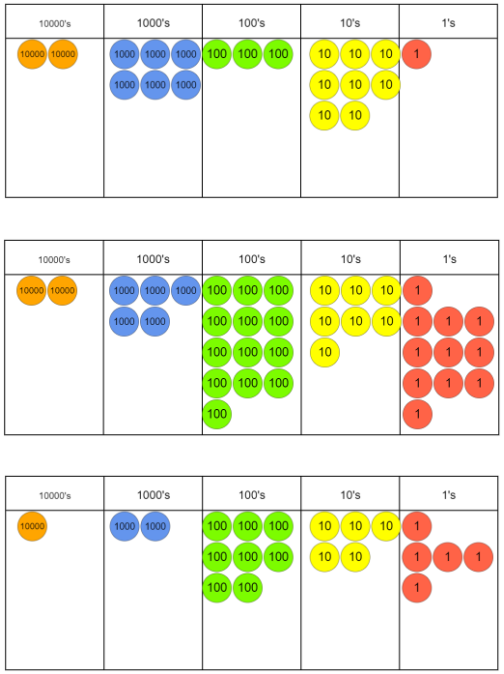
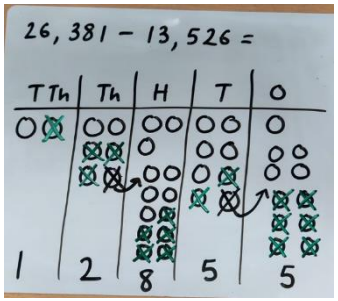
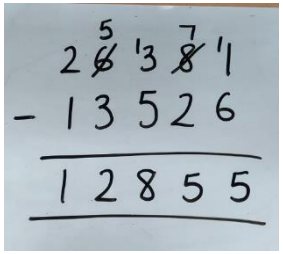
Year 5

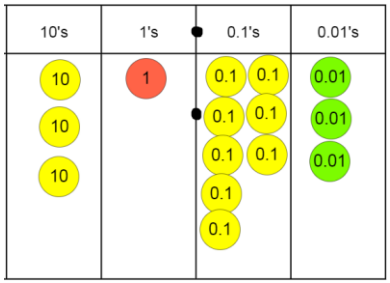
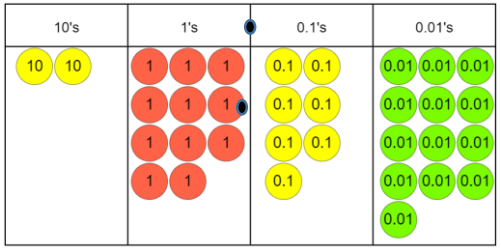
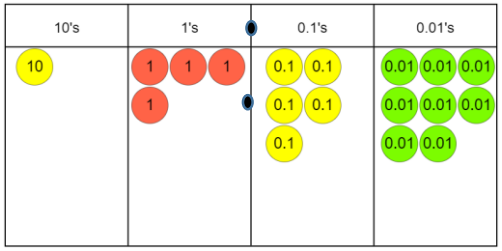
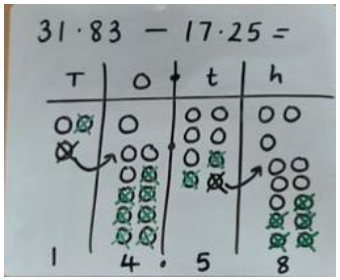
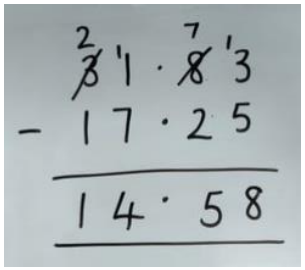
Statutory Requirements:

- Subtract whole numbers with more than 4 digits, including the use of column subtraction
- Subtract numbers mentally with increasingly large numbers
- Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy
- Solve subtraction multi-step problems in contexts, deciding which operations and methods to use and why.

Vocabulary:

Take away, less than, subtract, minus, fewer, decrease, the difference between, number bonds, is equal to, 'is the same as', leave, how many have gone? how many more to make..?, how many more is... than ..?, how much more is..? how many fewer is...than..?, how much less is..? inverse, partition, recombine, hundred, column method, thousand more/less, expanded, compact.

Objective and Strategy	Concrete	Pictorial	Abstract
Subtract pairs of numbers up to 5 digits.	Using place value counters to show regrouping using column method. E.g. 26,381 – 13, 526 =  1 2 8 5 5	Represent the place value counters pictorially, remembering to show what has been exchanged.  	Formal column method. Children must understand what has happened when they have crossed out digits. To be shown alongside the pictorial representation until children are secure. 

Subtract pairs of decimal numbers with the same number of decimal places.	Using place value counters, children create the larger amount on the place value chart. Take away the smaller amount, exchanging where necessary.    1 4 5 8	Represent the place value counters by drawing counters in a place value chart. Remember to show the decimal point and to clearly show what has been exchanged. Cross out the counters as you take away.  	Formal column method. Children must understand what has happened when they have crossed out digits. To be shown alongside the pictorial representation until children are secure. 

Subtraction

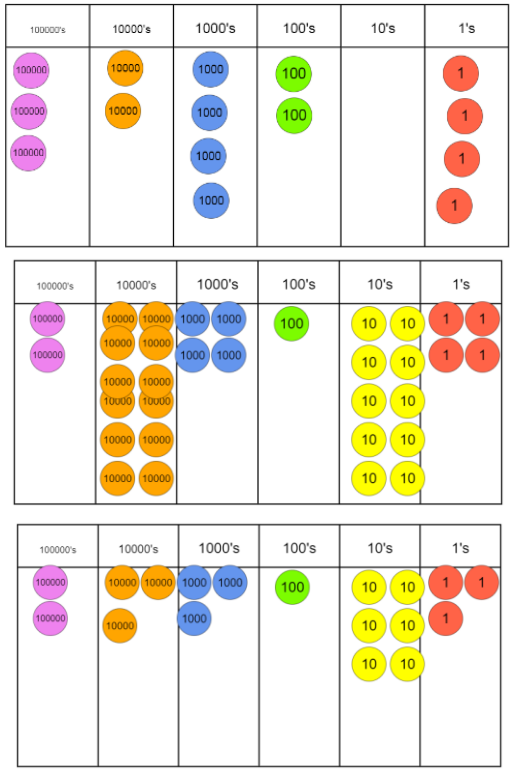
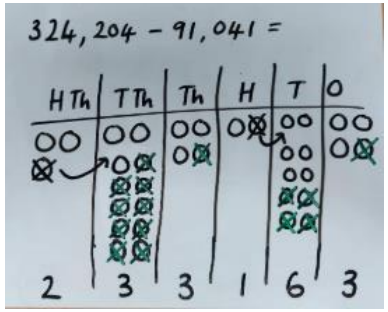
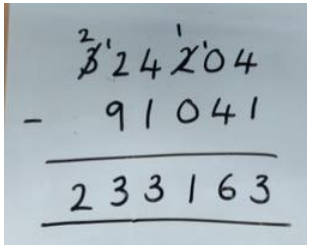
Year 6

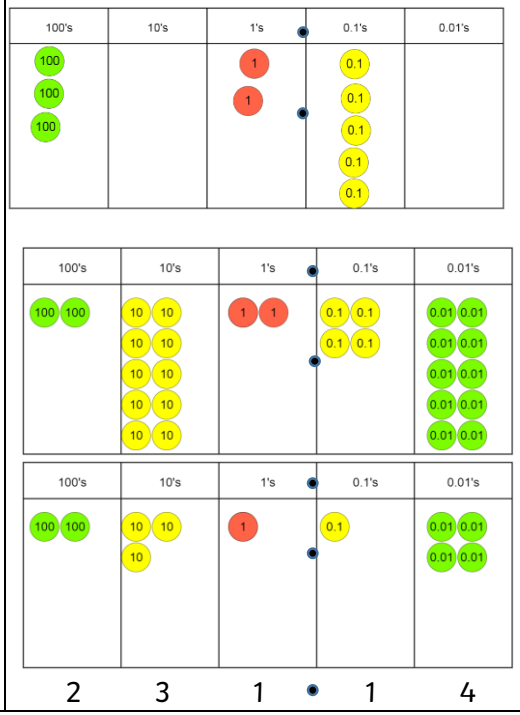
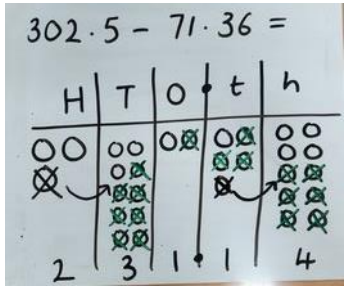
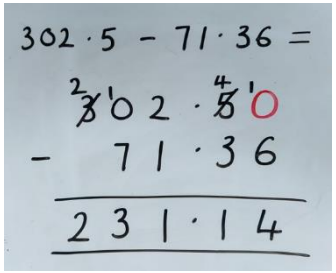
Statutory Requirements:

- Perform mental calculations, including with mixed operations and large numbers
- Use my knowledge of the order of operations to carry out calculations involving the 4 operations
- Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why
- Use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy

Vocabulary:

Take away, less than, subtract, minus, fewer, decrease, the difference between, number bonds, is equal to, leave, inverse, partition, recombine, ten/hundred thousand, thousand, hundred, column method, thousand more/less, expanded, compact, order of operations.

Objective and Strategy	Concrete	Pictorial	Abstract
Subtraction with up to 6 digit numbers (including numbers with different amounts of digits).	Use place value counters to show regrouping using column method.  	Represent the place value counters pictorially, remembering to show what has been exchanged before smaller number is subtracted.  	Formal column method. Ensure that digits are correctly aligned. Children must understand what has happened when they have crossed out digits. To be shown alongside the pictorial representation until children are secure. 

Subtraction of pairs of numbers with different numbers of decimal places.	Using place value counter, children create the larger amount on the place value chart. Take away the smaller amount, exchanging where necessary. 	Represent the place value counters by drawing counters in a place value chart. Remember to show the decimal point and to clearly show what has been exchanged. Cross out the counters as you take away. 	Formal column method. Ensure that digits are correctly aligned and you have included a decimal point. Empty decimal places can be filled with a 0. Children must understand what has happened when they have crossed out digits. To be shown alongside the pictorial representation until secure. 

Multiplication

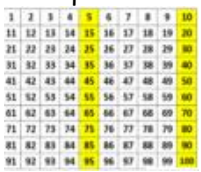
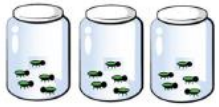
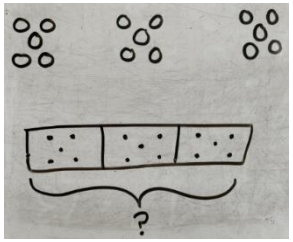
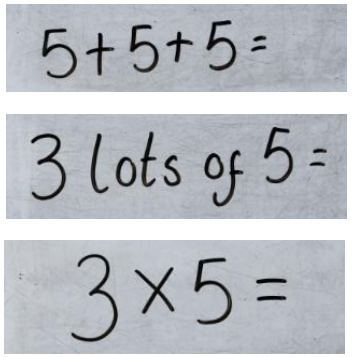
Year 1

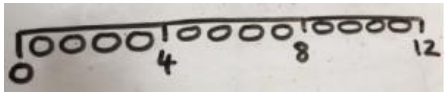
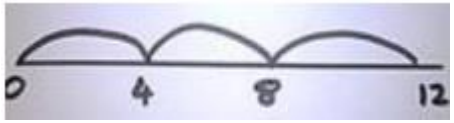
Statutory Requirements:

- Solve one-step problems involving multiplication, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher

Vocabulary:

Odd, even, double, halves, the same, lots of, groups of, times (once, twice etc.), add again and again, repeated grouping, repeated adding, (how many) equal groups, total, is equal to, 'is the same as', counting in 2s, 3s, 5s, 10s , (forwards from/backwards from), how many times? multiples of, times, multiply, multiply by, repeated addition.

Objective and Strategy	Concrete	Pictorial	Abstract
Counting in multiples (2,5 and 10)	Counting in groups of 2s, 5s and 10s. Children to use a variety of concrete resources to support this.    	Use a number line or different images to support in the counting of multiples.   	Children to write a sequence of multiples of numbers. They should be able to identify the missing number in the sequence. 15, 20, 25, ?, 35, 40 90, 80, 70 ... What am I counting in? How do you know?
Repeated addition	Children need to understand that repeated addition is adding the same amount each time. All groups are equal. Show in a variety of different ways. E.g. Can you show 3 lots of 5 bugs?  There are 3 equal groups with 5 in each group. 	Children to represent what they achieved practically into an image and then use a bar model to show it. 	Children to write the repeated addition number sentences. 

Number lines to show repeated addition.	Using Numicon to show 3 lots of 4. 	This can then be represented pictorially onto a number line. 	Use a blank number line to show the repeated addition. 

Multiplication

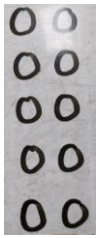
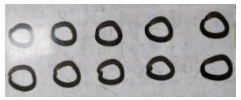
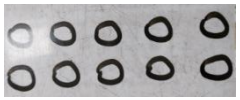
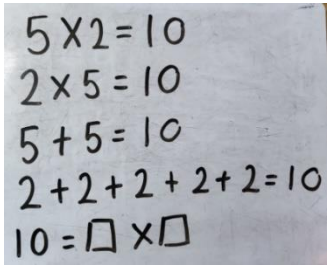
Year 2

Statutory Requirements:

- Recall and use multiplication facts for the 2, 3 and 5 and 10 multiplication tables, including recognising odd and even numbers
- Calculate mathematical statements for multiplication within the 2, 5, 10 tables and write them using the multiplication (×) and equals (=) signs
- Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot
- Solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts

Vocabulary:

Odd, even, double, halves, the same, lots of, groups of, times (once, twice etc.), add again and again, repeated grouping, repeated adding, (how many) equal groups, total, is equal to, 'is the same as', counting in 2s, 3s, 5s, 10s , (forwards from/backwards from), how many times? multiple of, multiply, multiply by, repeated addition, commutative law.

Objective and Strategy	Concrete	Pictorial	Abstract
Arrays – Showing cumulative multiplication	Counters, cubes and other objects that can represent 1 can be used.  2 lots of 5 5 lots of 2 	Children to represent the arrays pictorially in different rotations.   Arrays can be drawn as stars, smiley faces, dots etc. As long as each represents 1.	Use an array to write multiplication and repeated addition number sentences.  

Multiplication

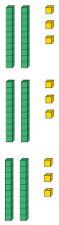
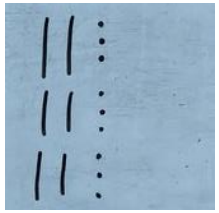
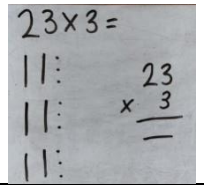
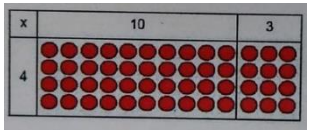
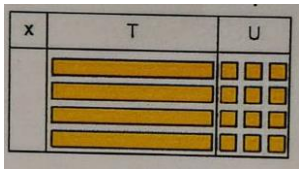
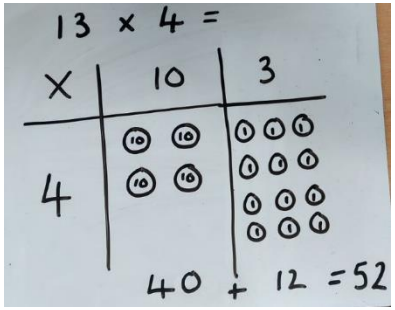
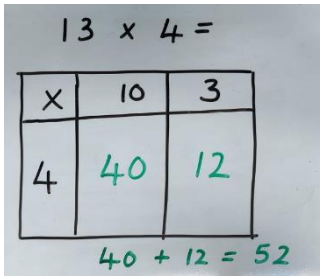
Year 3

Statutory Requirements:

- Recall and use multiplication facts for the 3, 4 and 8 multiplication tables
- Write and calculate mathematical statements for multiplication using the multiplication tables that they know, including for 2-digit numbers times 1-digit numbers, using mental and progressing to written methods
- Solve problems involving missing number problems involving multiplication including positive number scaling problems and correspondence problems where n objects are connected to m objects.
- Time tables - Pupils recall x2, x5, x10, x3, x4, x6, x8 and x9. For x4 and x8 use doubling to help recall.

Vocabulary:

Odd, even, double, halves, the same, lots of, groups of, times (once, twice etc.), repeated adding, (how many) equal groups, total, is equal to, times tables, counting in 10s, 100s, how many times? multiple of, multiply, multiply by, repeated addition, scale up, distributive law, commutative law.

Objective and Strategy	Concrete	Pictorial	Abstract
2d x 1d using base 10 or place value counters.	Create the 2 digit number using the base 10 or place value counters. Then whatever you are multiplying by you need create that many 'lots of'. 	Draw the 2 digit number using the base 10 or place value counters. Then whatever you are multiplying by you need create that many 'lots of'. E.g. 23 x 3 = 	Draw the 2 digit number using the base 10 or place value counters. Then whatever you are multiplying by you need create that many 'lots of'. Complete this alongside the column method. 
Multiplying a 2d x 1d number using the grid method.	Show the link with arrays to first introduce the grid method (refer back to year 2).  Move onto base 10 to move towards a more compact method.  You can also show this as place value counters.	Draw place value counters or base 10 in a grid. 	Create a multiplication grid using numbers rather an images. Clearly show the addition alongside the grid. 

Multiplication

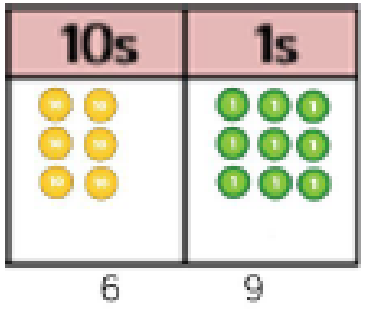
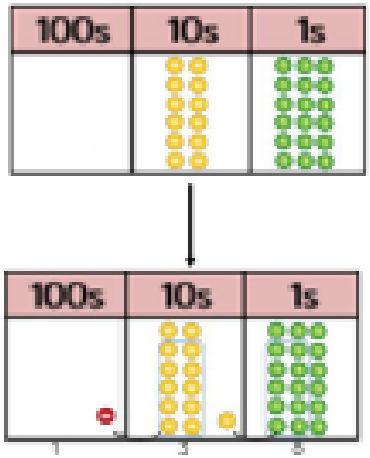
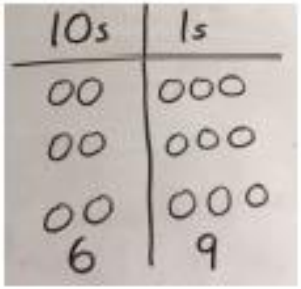
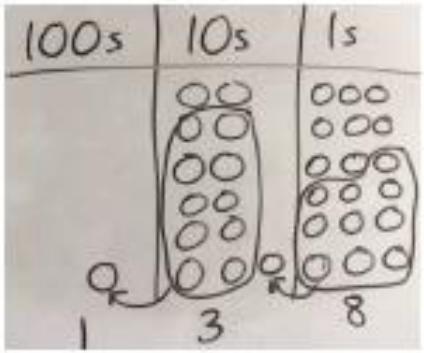
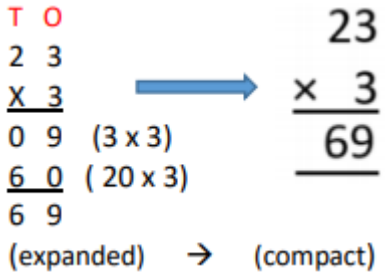
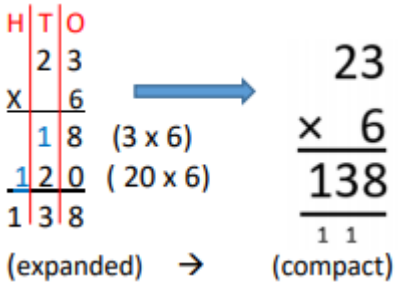
Year 4

Statutory Requirements:

- Use place value, known and derived facts to multiply mentally, including x0 x1 and multiplying together three numbers
- Recognise and use factor pairs and commutativity in mental calculations
- Multiply two-digit and three-digit numbers by a one-digit number using formal written layout
- Solve problems involving multiplying, including the distributive law to multiply two-digit numbers by one-digit including positive number scaling problems and correspondence problems where n objects are connected to m objects
- Times tables - Pupils recall all times tables up to 12 x 12.

Vocabulary:

Odd, even, double, halves, the same, lots of, groups of, times (once, twice etc.), total, counting in 10s, 100s, 1000s, how many times? multiple of, multiply, multiply by, scale up, distributive law, regrouping, times tables, product of, commutative law.

Objective and Strategy	Concrete	Pictorial	Abstract
Column multiplication using place value counters (2 digit x 1 digit). This same method can also be used for 3 digit x 1 digit.	23 x 3 Children to make 3 lots of 23.  23 x 6  	Children to represent multiplication using place value counters pictorially.  23 x 6  	 In the early stages of multiplying 1-digit numbers by 2-digit numbers, the expanded method should be used. Move on to compact method once children are secure. 

Multiplication

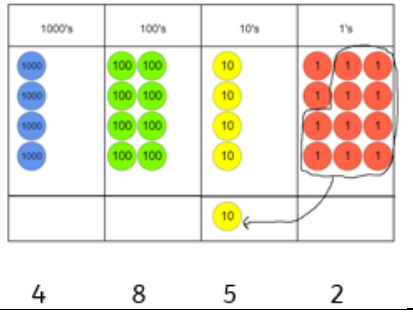
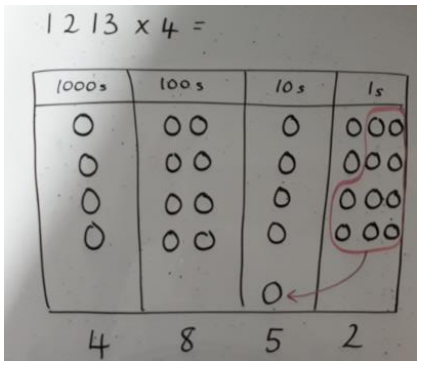
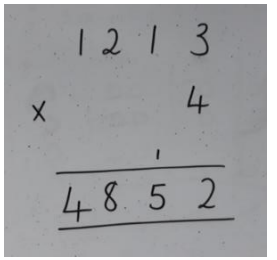
Year 5

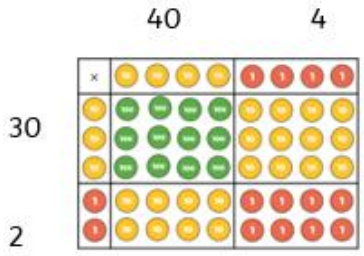
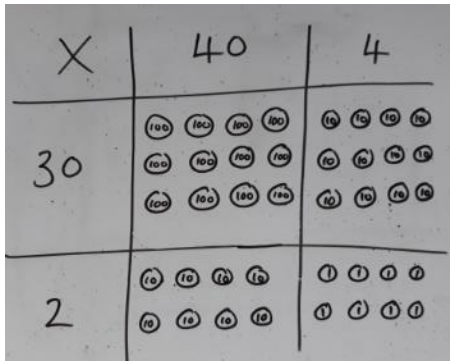
Statutory Requirements:

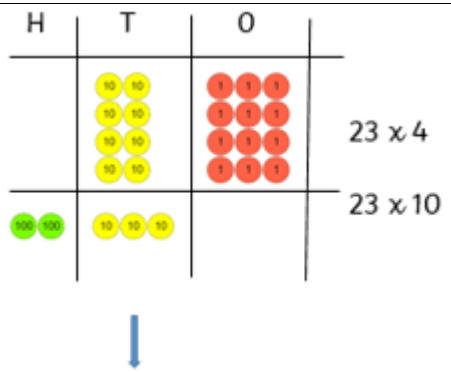
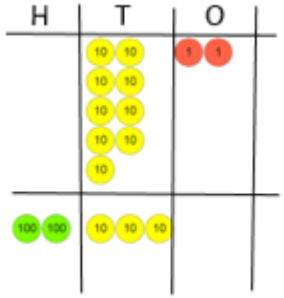
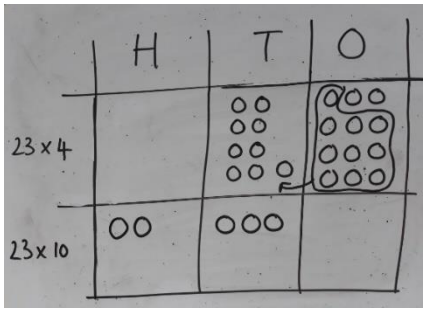
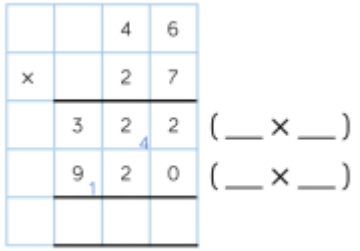
- Identify multiples and factors: all factor pairs of a number, common factors of two numbers
- Establish whether a number up to 100 is prime and recall prime numbers up to 19
- Recognise and use square numbers and cube numbers and their notation
- Multiply numbers up to four digits by a one- or two-digit number using a formal written method
- Multiply whole numbers and those involving decimals by 10, 100 and 1000
- Solve problems using multiplication and division using my knowledge of factors and multiples, squares and cubes

Vocabulary:

Odd, even, double, halves, the same, lots of, groups of, times (once, twice etc.), (common) multiple of, times, multiply, multiply by, scale up, decimal point, decimal place, factors, square number, cube number, prime number, prime factors, commutative law.

Objective and Strategy	Concrete	Pictorial	Abstract
Multiply numbers up to 4 digits by a 1-digit number using a formal written method.	Use place value counters to show how we are finding groups of a number. In this example, we are multiplying by 4 so we need 4 rows. Fill each row with 1213. Add up each column, starting with the ones, making any exchanges needed. 1213 x 4 =  	Children draw counters using circles, clearly showing any exchanges.  	Show compact method alongside pictorial representation until children are confident with this method. 

Multiply 2-digit numbers by 2-digit numbers using the grid method.	Partition both 2-digit numbers Use base 10 or place value counters to represent the multiplications in the grid. 44 x 32 =  Add the answers to each part of the grid together to get the final answer.	Draw and label a simple grid. Draw pv counters to represent each multiplication. Add up the answers.  	Draw and label a simple grid. Partition each number and write in the grid. Multiply the respective numbers. Use column addition to add the answers. × 40 4 30 1,200 120 = 1320 2 80 8 = 88 1 1408
Using long multiplication to multiply up to 4 digits by 2 digits.	23 x 14 = Partition 14 into 10 and 4 and multiply each part by 23. Record the answers in a pv grid using counters.	23 x 14 = Partition 14 into 10 and 4 and multiply each part be 23. Draw counters on a pv grid to show answers. Children then add up each column, starting with the ones and doing any exchanges needed.	23 x 14 = 2 3 × 1 4 9 2 (23 × 4) 1 2 3 0 (23 × 10) Begin by multiplying a number up to 4 digits by a 2-digit number less than 20. Model multiplying the 1s and then the 10s by the 4 from 14. Record in the

	 Children then add up each column, starting with the ones and doing any exchanges needed. 		correct columns, emphasising the value of the numbers being multiplied and the numbers carried. It is useful for children to write out what they are solving next to each answer. Explain that when multiplying by 10 the number will be 10 times bigger so digits will move one place to the left and a zero place holder is required. Complete calculation by adding up the two rows. Once confident with this, children can move on to multiplying up to 4 digits by any 2-digit number.  Draw attention to the use of a zero place holder in the 1s column when multiplying by the tens number.

Multiplication

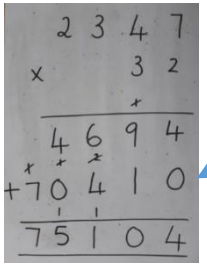
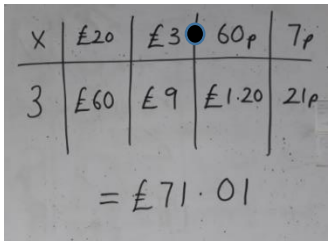
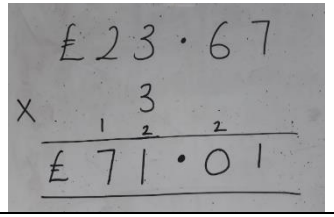
Year 6

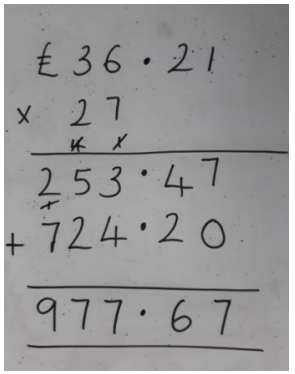
Statutory Requirements:

- Multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication.
- Perform mental calculations, including with mixed operations and large numbers
- Identify common factors, common multiples and prime numbers.
- Use knowledge of the order of operations to carry out calculations involving the 4 operations
- Multiply one-digit numbers with up to 2 decimal places by whole numbers
- Solve problems involving multiplication and division which require answers to be rounded to specified degrees of accuracy

Vocabulary:

Odd, even, double, halves, the same, lots of, groups of, times (once, twice etc.), (common) multiple of, times, multiply, multiply by, scale up, decimal point, decimal place, factors, square number, cube number, prime number, prime factors, commutative law.

Objective and Strategy	Concrete	Pictorial	Abstract
Multiply 4-digits by 2-digits using long multiplication.	It may be useful to revise multiplying by a single digit first and then multiplying 2- and 3-digit numbers by a 2-digit number before moving on to larger calculations. When children start to multiply 4-digit numbers by 2-digit numbers they should be confident with the abstract. However, concrete resources and pictorial representations can be used to reason and explain the method as per Year 5.		 Reinforce 0 as a place holder when multiplying by the tens digit. Encourage children to cross out carried over digits so that they are not mistakenly added in when adding the two rows.
Multiply decimal numbers by a single digit using a formal method.	Concrete resources and pictorial representations can be used if required.		Initially show the grid method alongside the short multiplication and talk through how to record each part of the calculation on each method. £23.67 x 3 =  

Multiply decimal numbers by a 2-digit number (between 10 and 35) using long multiplication.	Following the same order for calculating as when multiplying a 4-digit number by a 2-digit number, use the context of money to ensure a firm understanding of the value of the concept and value of the digits. Children should use rounding to approximate the answer before performing the calculation.	£36.21 x 27 =  As before, ensure that children understand the use of 0 as a place holder and encourage them to cross out carried over digits to prevent confusion.

Division

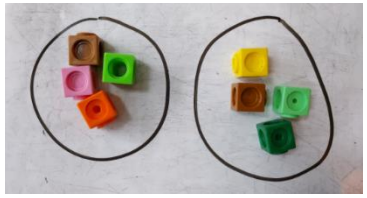
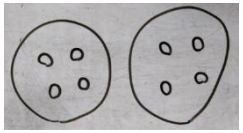
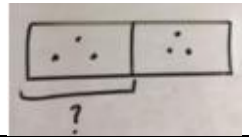
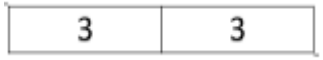
Year 1

Statutory Requirements:

- Solve one-step problems involving division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.

Vocabulary:

Odd, even, double, halves, quarter, three quarters, the same, lots of, groups of, share equally, bar, altogether, divide, split, array divided by, left, left over.

Objective and Strategy	Concrete	Pictorial	Abstract
Division as equal sharing	Physically share objects into groups using hoops, boxes, circles etc. 	Children to draw pictures to help them equally share an amount into equal groups.  	 6 ÷ 2 = 3
Division as grouping	Physically group items. There are 5 groups of 2 socks. How many sock are there? 	How many groups of hands are there? How many hands in each group? How many hands altogether?  Solve division problems by drawing groups of. Circle the flowers into groups of 3. How many groups did you make? 	25 ÷ 5 = How many goes into each group?

Division

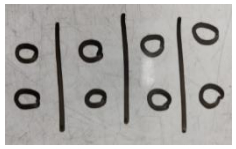
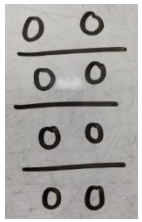
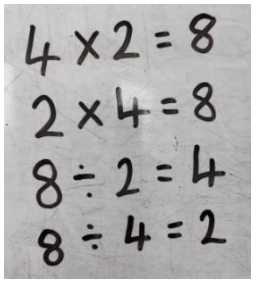
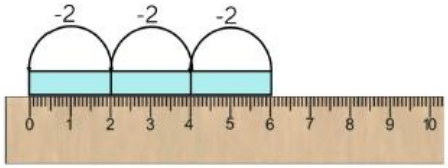
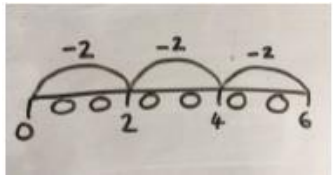
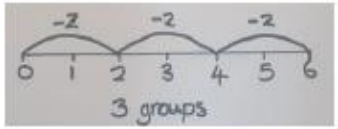
Year 2

Statutory Requirements:

- Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables fluently, including recognising odd and even numbers.
- Calculate mathematical statements for multiplication and division within the 2, 5 and 10 multiplication tables and write them using the multiplication (x), division (÷) and equals (=) signs
- Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot

Vocabulary:

Odd, even, double, halves, the same, lots of, groups of, share equally, bar, altogether, divide, split, array divided by, left over.

Objective and Strategy	Concrete	Pictorial	Abstract
Division as grouping	See year 1.		
Division within arrays – linking to multiplication	Link division to multiplication using an array. Look at the link between the number sentences that can be created. 	Draw an array, use vertical or horizontal lines to show the different groups created. Notice the link between the number sentences created.  	Find the inverse of multiplication and division number sentences by creating linking number sentences. 
Repeated subtraction	Using Cuisenaire rods above a ruler. 6 ÷ 2  3 groups of 2.	Represent repeated addition on a number line, only recording the numbers you land on. 	Abstract number line to represent the equal groups that have been subtracted.  This can also be extended by completely on a blank number line and only adding in the numbers you land on.

Division

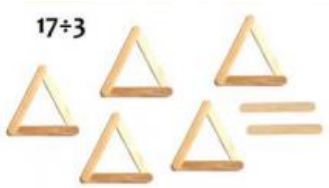
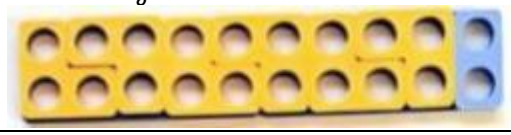
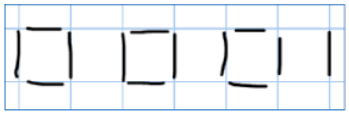
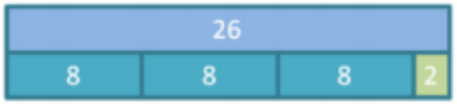
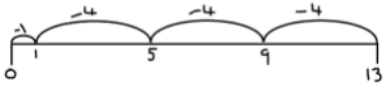
Year 3

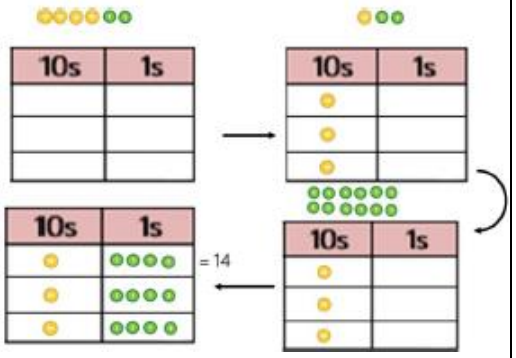
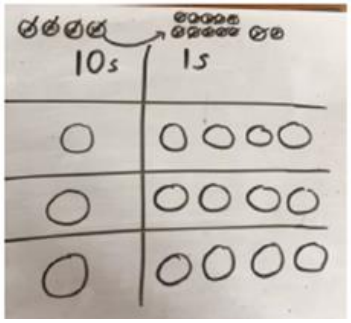
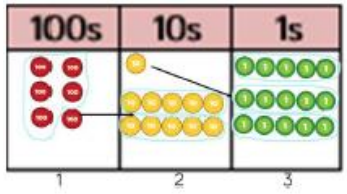
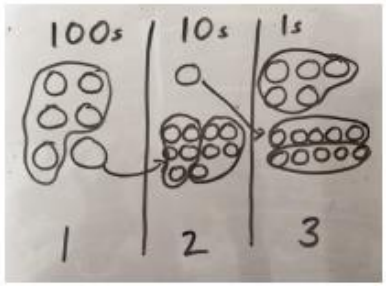
Statutory Requirements:

- Recall and use multiplication and division facts for the 3, 4 and 8 x tables ÷
- Write and calculate mathematical statements for division using the multiplication tables they know, including 2-digit divided by 1-digit using mental and progressing to formal written methods
- Solve problems involving division, including missing number problems

Vocabulary:

The same, lots of, groups of, share equally, bar, altogether, divide, split, array divided by, left, left over division, chunks, multiples.

Objective and Strategy	Concrete	Pictorial	Abstract
Division with a remainder	Using practical resources such as lollipop sticks and Numicon, children to shown division. e.g. How many 4s are in 13? Use of lollipop sticks to form wholes- squares because we are dividing by 4.  There are 3 whole squares, with 1 left over.  How many 3's are in 20? 	Children draw the representation. How many 4s in 13?   	13 ÷ 4 = ? Children should be encouraged to use their times table facts; they could also represent repeated addition on a number line. '3 groups of 4, with 1 left over' 

Sharing using place value counters.	42 ÷ 3 = To be completed practically using the place value counters. 	Children to then represent the place value counters pictorially. 42 ÷ 3 = 	Children to be able to make sense of the place value counters and write calculations to show the process. 42 ÷ 3 42 = 30 + 12 30 ÷ 3 = 10 12 ÷ 3 = 4 10 + 4 = 14
Short division (up to 3 digits by 1 digit – concrete and pictorial)	Children to use place value counters to group. 615 ÷ 5 =  1. Make 615 with place value counters. 2. How many groups of 5 hundreds can you make with 6 hundred counters? 3. Exchange 1 hundred for 10 tens. 4. How many groups of 5 tens can you make with 11 ten counters? 5. Exchange 1 ten for 10 ones. 6. How many groups of 5 ones can you make with 15 ones?	Children to represent the place value counters pictorially. 615 ÷ 5 = 	

Division

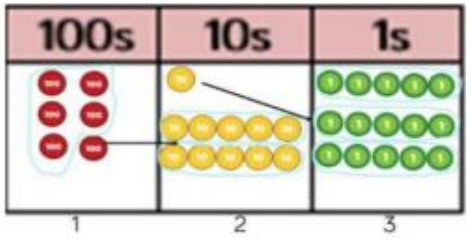
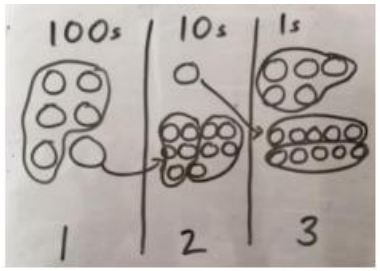
Year 4

Statutory Requirements:

- Recall multiplication and division facts up to 12 x 12
- Use place value, known and derived facts to divide mentally, including dividing by 1 ÷
- Solve problems involving dividing a three-digit number by one-digit and number using a formal layout

Vocabulary:

Odd, even, double, halves, quarter, three quarters, the same, lots of, groups of, share equally, bar, altogether, divide, split, array, left over, division, divided by, chunks, multiples, fraction partitioning, recombining, divisor, dividend, quotient, short-division, algorithm, prime number, long-division, factor pairs, square.

Objective and Strategy	Concrete	Pictorial	Abstract
Short division including short division with remainders (up to 3 digits by 1 digit).	Using place value counters to group. 615 ÷ 5 = How many groups of 5 hundreds can you make with 5 hundred counters? Exchange 1 hundred for 10 tens etc. 	Represent the place value counters pictorially, showing exchanges 	$\begin{array}{r} 123 \\ 5\overline{)\,6^{1}1^{1}5} \end{array}$

Division

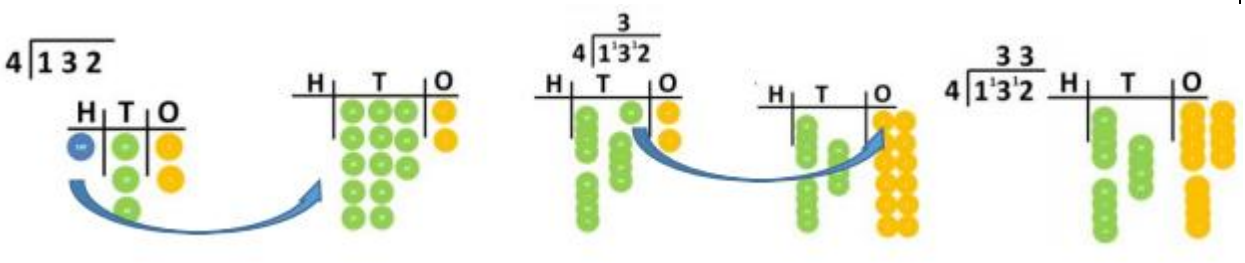
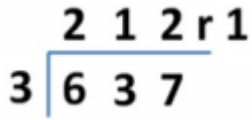
Year 5

Statutory Requirements:

- Identify multiples and factors, including finding all factor pairs of a number, common factors of two numbers, know and use the vocabulary of prime numbers and establish whether a number up to 100 is prime
- Multiply and divide numbers mentally drawing on known facts ÷ Divide numbers up to 4 digits by a one-digit number using a written method and interpret remainders appropriately for the context
- Divide whole numbers and those involving decimals by 10, 100 and 1000.

Vocabulary:

Odd, even, double, halves, quarter, three quarters, the same, lots of, groups of, share equally, bar, altogether, divide, split, array, left over, division, divided by, chunks, multiples, fraction partitioning, recombining, divisor, dividend, quotient, short-division, algorithm, prime number, factor pairs, square, place value holder, integer.

Objective and Strategy	Concrete	Pictorial	Abstract
Short division up to 4 digits by 1 digit – including remainders.	Exchange when/if needed and group the place value counters into groups of 4 until all are used up or a remainder is left. Show these groupings in the algorithm with the number of groups and the remainder. 		When secure use formal written method. 

Division

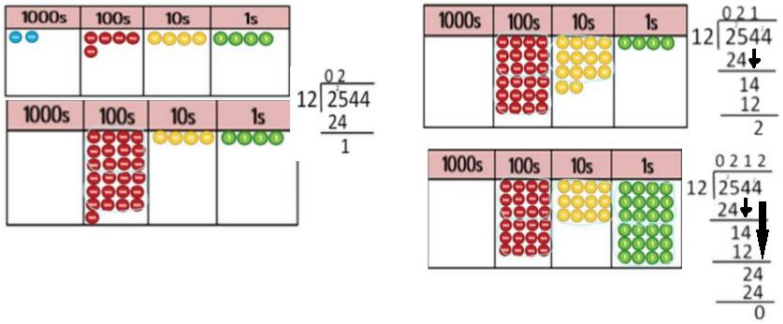
Year 6

Statutory Requirements:

- Divide numbers up to 4 digits by a two-digit number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding as appropriate for the context.
- Divide numbers up to 4 digits by a two-digit number using the formal written method of short division as appropriate. ÷ Use common factors to simplify fractions, common multiples to express fractions in same denominator
- Compare, order and +/- fractions including fractions>1 and fractions with different denominator ÷ x simple pairs of proper fractions (answer in simplest form)
- ÷ proper fractions by whole number.
- ÷ x/÷ numbers by 10, 100, 1000
- Solve problems involving relative sizes of two quantities (missing values using integer x/÷ facts)
- Solve problems involving the calculation of % and the use of % for comparison
- Solve problems involving similar shapes where the scale factor is known or can be found ÷ Solve problems involving unequal sharing and grouping using knowledge of fractions and multiples

Vocabulary:

Odd, even, double, halves, quarter, three quarters, the same, lots of, groups of, share equally, bar, altogether, divide, split, array, left over, division, divided by, chunks, multiples, fraction partitioning, recombining, divisor, dividend, quotient, short-division, long division, algorithm, prime number, factor pairs, square, place value holder, integer.

Objective and Strategy	Concrete	Pictorial	Abstract
Short division	See year 5.		
Short division with a fraction or decimal remainder.	Use place value counters if necessary.		$3\overline{)637}$ → $3\overline{)637}$ (212r1 → 212 1/3) Record the remainder 1 whole being divided by 3 as 1/3. $5\overline{)1332}$ → $5\overline{)1332.0}$ (026 → 026·4)
Long division Divide numbers up to 4 digits by a 2- digit number using formal written method.	Use place value counters alongside algorithm. 		Long division using multiples.