Walter Halls Primary School

MATHEMATICS

KS1 & 2 Calculation Policy and Vocabulary Progression

Calculation policy.

The progression of skills within the 2014 KS1 National Curriculum is focused on children moving from concrete (using manipulatives), to pictorial (drawing representations in books), to abstract (using written methods to solve problems).

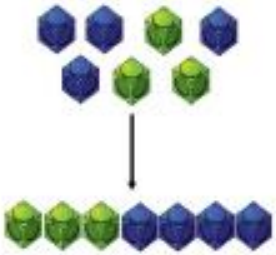
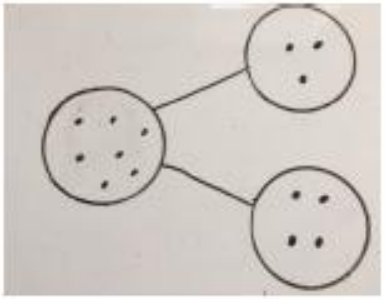
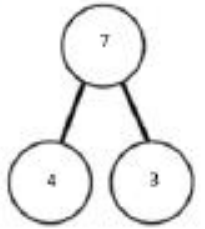
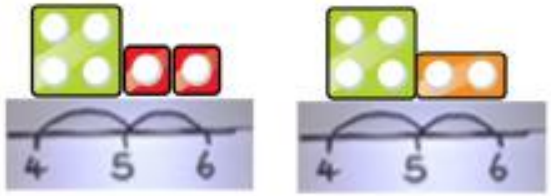
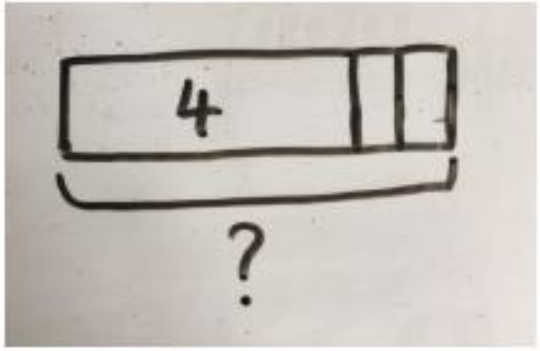
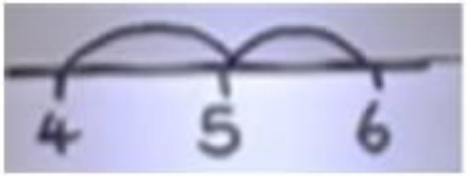
As a wide range of concrete and pictorial representations could be used, a KS1 calculation policy cannot be exhaustive and as a result is a suggested progression from concrete to abstract. EYFS and Lower KS2 have been included for reference.

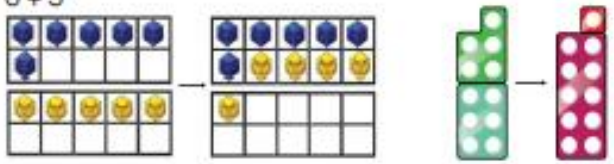
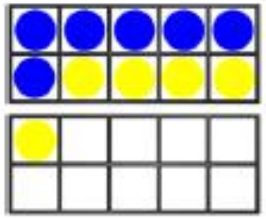
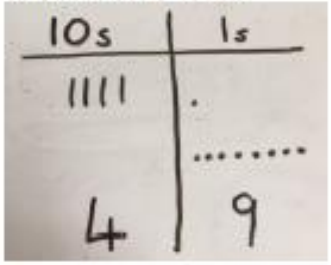
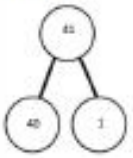
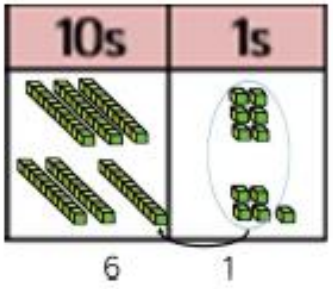
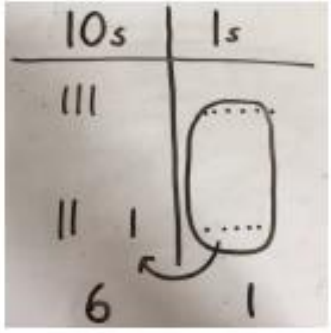
The KS1 policy has been derived from the White Rose example. This allows teachers to make the best use of the planning resources, activities and assessments produced by White Rose.

	EYFS / Year 1	Year 2	Year 3
Addition	Combining two parts to make a whole: part whole model. Starting at the bigger number and counting on- using cubes. Regrouping to make 10 using ten frame.	Adding three single digits. Use of base 10 to combine two numbers.	Column method- regrouping. Using place value counters (up to 3 digits).
Subtraction	Taking away ones Counting back Find the difference Part whole model Make 10 using the ten frame	Counting back Find the difference Part whole model Make 10 Use of base 10	Column method with regrouping. (up to 3 digits using place value counters)
Multiplication	Recognising and making equal groups. Doubling Counting in multiples use cubes, Numicon and other objects in the classroom	Arrays- showing commutative multiplication	Arrays 2d × 1d using base 10
Division	Sharing objects into groups Division as grouping e.g. I have 12 sweets and put them in groups of 3, how many groups? Use cubes and draw round 3 cubes at a time.	Division as grouping Division within arrays- linking to multiplication Repeated subtraction	Division with a remainder-using lollipop sticks, times tables facts and repeated subtraction. 2d divided by 1d using base 10 or place value counters

Addition

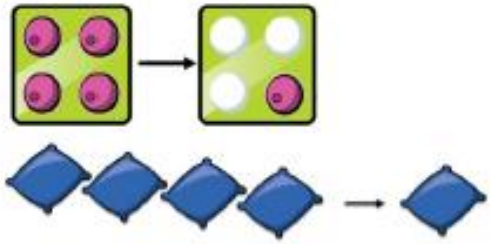
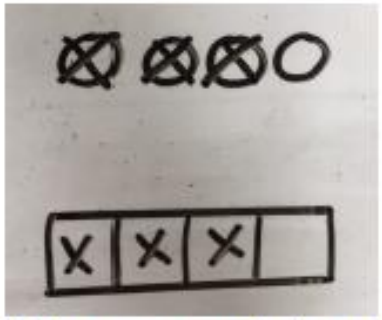
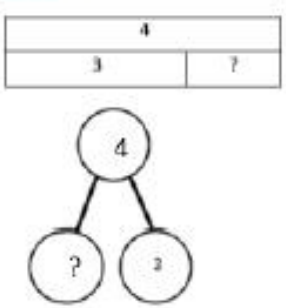
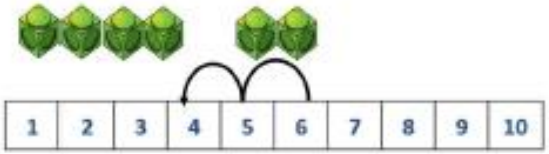
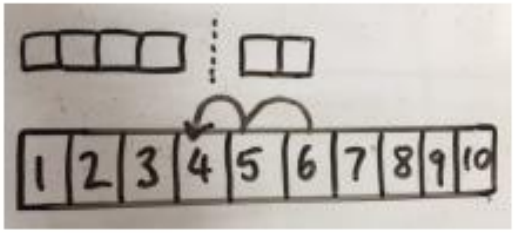
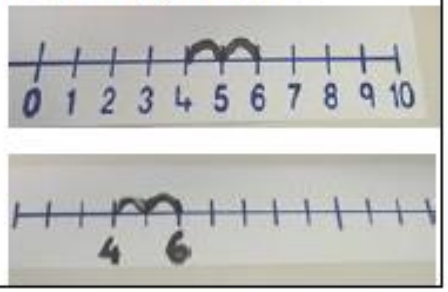
Key Language: sum, total, parts and wholes, plus, add, altogether, more, 'is equal to' & 'is the same as'.

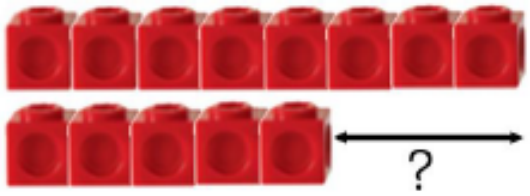
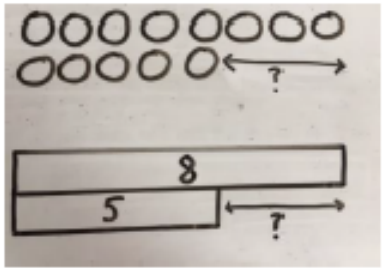
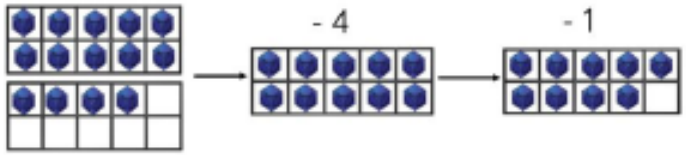
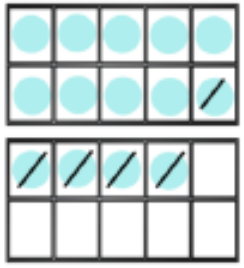
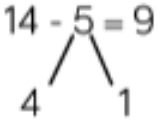
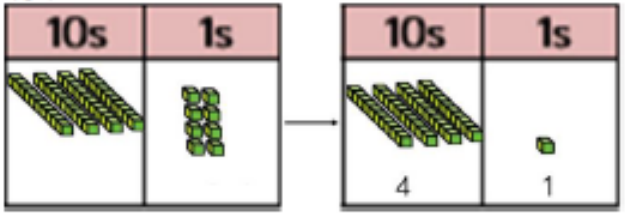
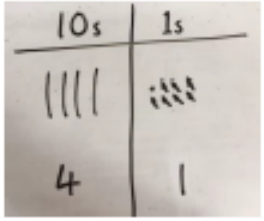
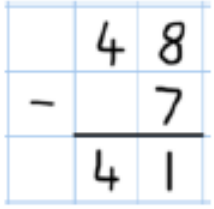
Concrete	Pictorial	Abstract
Combining two parts to make a whole (use other resources too e.g. eggs, shells, teddy bears, cars). 	Children to represent the cubes using dots or crosses. They could put each part on a part whole model too. 	4 + 3 = 7 Four is a part, 3 is a part and the whole is seven. 
Counting on using number lines using cubes or Numicon.  	A bar model which encourages the children to count on, rather than count all. 	The abstract number line: What is 2 more than 4? What is the sum of 2 and 4? What is the total of 4 and 2? 4 + 2 

Concrete	Pictorial	Abstract
Regrouping to make 10; using ten frames and counters/cubes or using Numicon. 6 + 5 	Children to draw the ten frame and counters/cubes. 	Children to develop an understanding of equality e.g. 6 + □ = 11 6 + 5 = 5 + □ 6 + 5 = □ + 4
TO + O using base 10. Continue to develop understanding of partitioning and place value. 41 + 8 	Children to represent the base 10 e.g. lines for tens and dot/crosses for ones. 	41 + 8  1 + 8 = 9 40 + 9 = 49 4 1 + 8 4 9
TO + TO using base 10. Continue to develop understanding of partitioning and place value. 36 + 25 	Chidlren to represent the base 10 in a place value chart. 	Looking for ways to make 10. 36 + 25 = 1 5 30 + 20 = 50 5 + 5 = 10 50 + 10 + 1 = 61 36 Formal method: +25 61 1

Subtraction

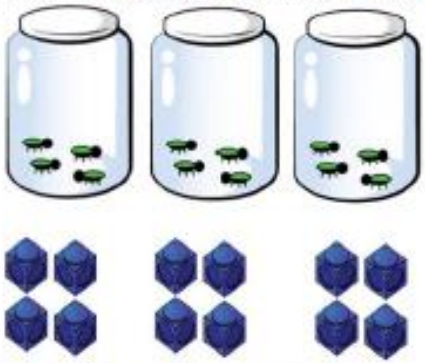
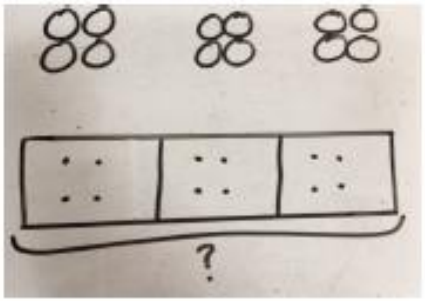
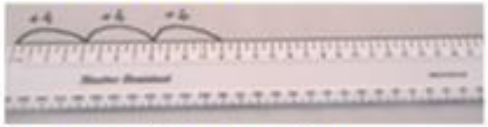
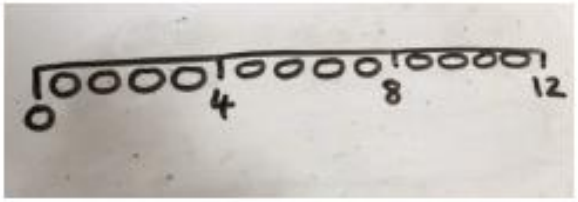
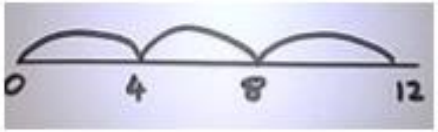
Key language: take away, less than, the difference, subtract, minus, fewer, decrease.

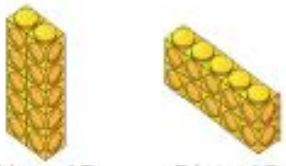
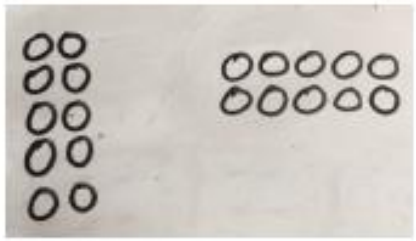
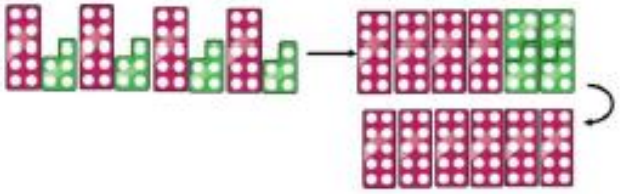
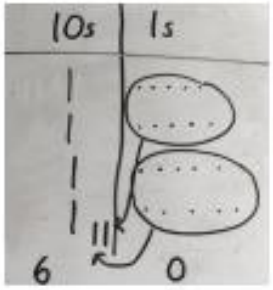
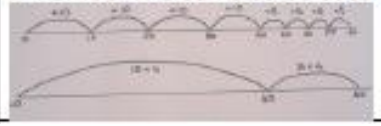
Concrete	Pictorial	Abstract
Physically taking away and removing objects from a whole (ten frames, Numicon, cubes and other items such as beanbags could be used). 4 – 3 = 1 	Children to draw the concrete resources they are using and cross out the correct amount. The bar model can also be used. 	4- 3 = 
Counting back (using number lines or number tracks) children start with 6 and count back 2. 6 – 2 = 4 	Children to represent what they see pictorially e.g. 	Children to represent the calculation on a number line or number track and show their jumps. Encourage children to use an empty number line 

Concrete	Pictorial	Abstract
Finding the difference (using cubes, Numicon or Cuisenaire rods, other objects can also be used). Calculate the difference between 8 and 5. 	Children to draw the cubes/other concrete objects which they have used or use the bar model to illustrate what they need to calculate. 	Find the difference between 8 and 5. 8 – 5, the difference is ☐ Children to explore why 9 - 6 = 8 – 5 = 7 – 4 have the same difference.
Making 10 using ten frames. 14 – 5 	Children to present the ten frame pictorially and discuss what they did to make 10. 	Children to show how they can make 10 by partitioning the subtrahend.  14 – 4 = 10 10 – 1 = 9
Column method using base 10. 48-7 	Children to represent the base 10 pictorially. 	Column method or children could count back 7. 

Multiplication

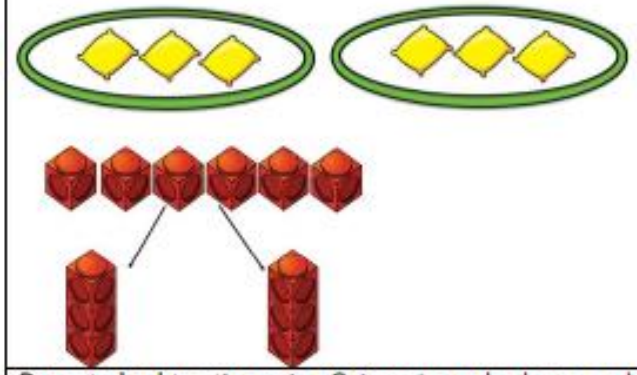
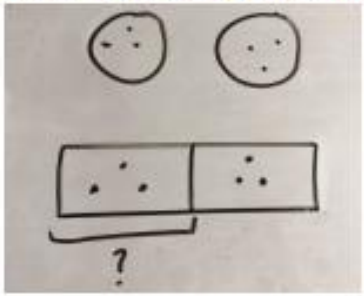
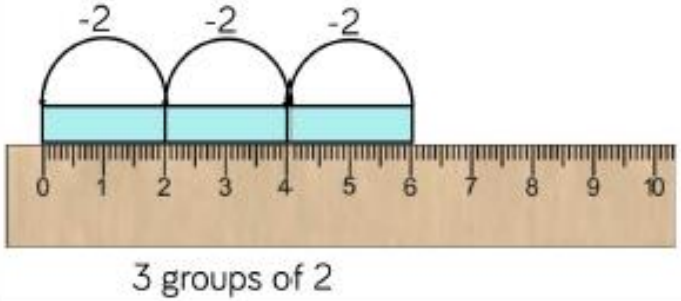
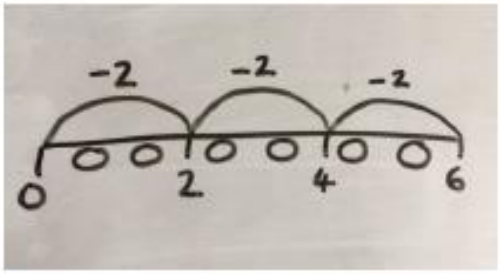
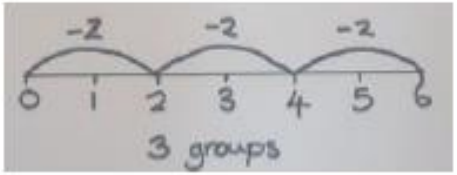
Key language: double, times, multiplied by, the product of, groups of, lots of, equal groups.

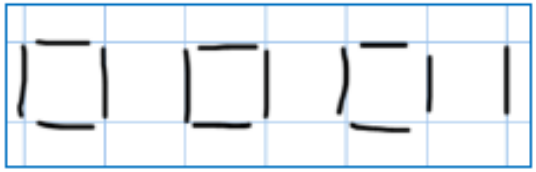
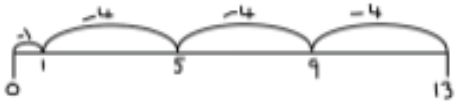
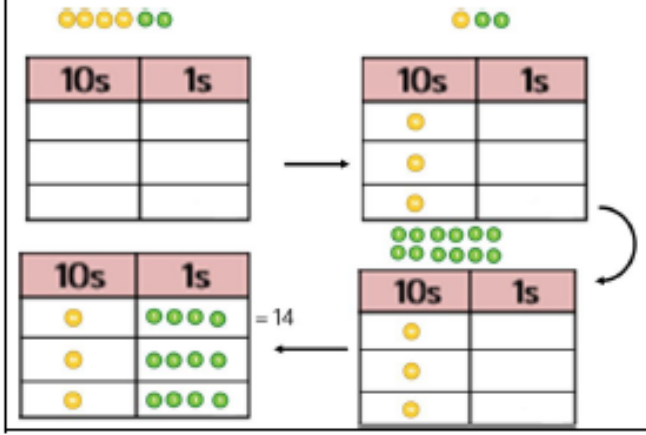
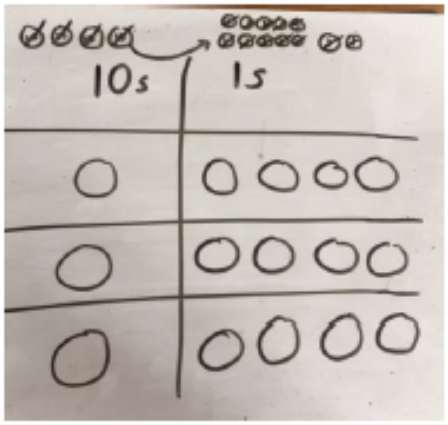
Concrete	Pictorial	Abstract
Repeated grouping/repeated addition 3 × 4 4 + 4 + 4 There are 3 equal groups, with 4 in each group. 	Children to represent the practical resources in a picture and use a bar model. 	3 × 4 = 12 4 + 4 + 4 = 12
Number lines to show repeated groups- 3 × 4   Cuisenaire rods can be used too.	Represent this pictorially alongside a number line e.g.: 	Abstract number line showing three jumps of four. 3 × 4 = 12 

Concrete	Pictorial	Abstract
Use arrays to illustrate commutativity counters and other objects can also be used. $2 \times 5 = 5 \times 2$  2 lots of 5 5 lots of 2	Children to represent the arrays pictorially. 	Children to be able to use an array to write a range of calculations e.g. $10 = 2 \times 5$ $5 \times 2 = 10$ $2 + 2 + 2 + 2 + 2 = 10$ $10 = 5 + 5$
Partition to multiply using Numicon, base 10 or Cuisenaire rods. 4×15 	Children to represent the concrete manipulatives pictorially. 	Children to be encouraged to show the steps they have taken. 4 x 15 10 5 10 x 4 = 40 5 x 4 = 20 40 + 20 = 60 A number line can also be used 

Division

Key language: share, group, divide, divided by, half.

Concrete	Pictorial	Abstract
Sharing using a range of objects. 6 ÷ 2 	Represent the sharing pictorially. 	6 ÷ 2 = 3  Children should also be encouraged to use their 2 times tables facts.
Repeated subtraction using Cuisenaire rods above a ruler. 6 ÷ 2  3 groups of 2	Children to represent repeated subtraction pictorially. 	Abstract number line to represent the equal groups that have been subtracted. 

Concrete	Pictorial	Abstract
2d ÷ 1d with remainders using lollipop sticks. Cuisenaire rods, above a ruler can also be used. 13 ÷ 4 Use of lollipop sticks to form wholes- squares are made because we are dividing by 4.  There are 3 whole squares, with 1 left over.	Children to represent the lollipop sticks pictorially.  There are 3 whole squares, with 1 left over.	13 ÷ 4 = 3 remainder 1 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 = 14 	Children to represent the place value counters pictorially. 	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

Maths vocabulary for year 1							
Number and place value	Addition and subtraction	Multiplication and division	Measure	Geometry (position and direction)	Geometry (properties of shape)	Fractions	General/problem solving
Number Zero, one, two, three to twenty, and beyond None Count (on/up/to/from/ down) Before, after More, less, many, few, fewer, least, fewest, smallest, greater, lesser Equal to, the same as Odd, even	Number bonds, number line Add, more, plus, make, sum, total, altogether Inverse Double, near double Half, halve Equals, is the same as (including equals sign) Difference between How many more to make..?, how	Odd, even Count in twos, threes, fives Count in tens (forwards from/backwards from) How many times? Lots of, groups of Once, twice, three times, five times Multiple of, times, multiply, multiply by Repeated addition	Full, half full, empty Holds Container Weigh, weighs, balances Heavy, heavier, heaviest, light, lighter, lightest Scales Time Days of the week: Monday, Tuesday, etc. Seasons: spring, summer, autumn, winter Day, week, month, year, weekend Birthday, holiday Morning, afternoon, evening,	Position Over, under, underneath, above, below, top, bottom, side on, in, outside, inside around, in front, behind Front, back Before, after Beside, next to, Opposite Apart Between, middle, edge, centre Corner	Group, sort Cube, cuboid, pyramid, sphere, cone, cylinder, circle, triangle, square Shape Flat, curved, straight, round Hollow, solid Corner (point, pointed) Face, side, edge Make, build, draw	Whole Equal parts, four equal parts One half, two halves A quarter, two quarters	Listen, join in Say, think, imagine, remember Start from, start with, start at Look at, point to Put, place, fit Arrange, rearrange Change, change over Split, separate Carry on, continue, repeat, what comes next? Find, choose, collect, use, make, build

Pair Units, ones, tens Ten more/less Digit Numeral Figure(s) Compare (In) order/a different order Size Value Between, halfway between Above, below	many more is…than..?, how much more is..? Subtract, take away, minus How many fewer is…than..?, how much less is..?	Array, row, column Double, halve Share, share equally Group in pairs, threes, etc. Equal groups of Divide, divided by, left, left over	night, midnight Bedtime, dinnertime, playtime Today, yesterday, tomorrow Before, after Next, last Now, soon, early, late Quick, quicker, quickest, quickly , fast, faster, fastest, slow, slower, slowest, slowly Old, older, oldest, new, newer, newest Takes longer, takes less time Hour, o'clock, half past Clock, watch, hands How long ago?, how long will it be to…?, how long will it take to…?, how often? Always, never, often, sometimes, usually Once, twice First, second, third, etc. Estimate, close to, about the	Direction Journey Left, right, up, down, forwards, backwards, sideways Across Close, far, near Along, through To, from, towards, away from Movement Slide, roll, turn, whole turn, half turn Stretch, bend			Tell me, describe, pick out, talk about, explain, show me Read, write, record, trace, copy, complete, finish, end Fill in, shade, colour, tick, cross, draw, draw a line between, join (up), ring, arrow Cost Count, work out, answer, check same number(s)/different number(s)/missing number(s) Number facts, number line, number track, number square, number cards Abacus, counters, cubes, blocks, rods, die, dice, dominoes, pegs, peg board Same way, different

			same as, just over, just under Too many, too few, not enough, enough Length, width, height, depth Long, longer, longest, short, shorter shortest, tall, taller, tallest, high, higher, highest Low, wide, narrow, deep, shallow, thick, thin Far, near, close Metre, ruler, metre stick Money, coin, penny, pence, pound, price, cost, buy, sell, spend, spent, pay, change, dear(er), costs more, costs less, cheaper, costs the same as How much?, how many? Total				way, best way, another way In order, in a different order Not all, every, each

New maths vocabulary for year 2						
Number and place value	Measure	Geometry (position and direction)	Geometry (properties of shape)	Fractions	Data/statistics	General/problem solving
Numbers to one hundred Hundreds Partition, recombine Hundred more/less	Quarter past/to m/km, g/kg, ml/l Temperature (degrees)	Rotation Clockwise, anticlockwise Straight line Ninety degree turn, right angle	Size Bigger, larger, smaller Symmetrical, line of symmetry Fold Match Mirror line, reflection Pattern, repeating pattern	Three quarters, one third, a third Equivalence, equivalent	Count, tally, sort Vote Graph, block graph, pictogram, Represent Group, set, list, table Label, title Most popular, most common, least popular, least common	Predict Describe the pattern, describe the rule Find, find all, find different Investigate

Calculation Policy

Addition and Subtraction

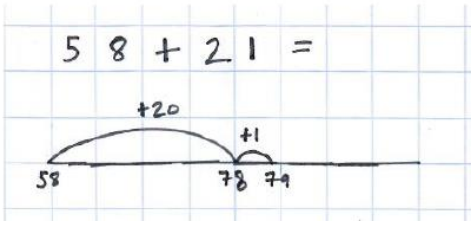
The 2014 National Curriculum outlines the progression of addition and subtraction in Key Stage 2 as introducing the column method in Year 3 with 3 digit numbers and moving towards dealing with increasing larger numbers and decimals as children progress through the Key Stage. This is outlined below:

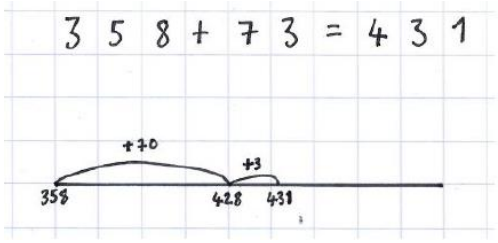
	Year 3	**Year 4**	**Year 5**	**Year 6**
Formal methods expected	Add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction	Add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate	Add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)	No new content introduced for addition and subtraction. Instead, the focus is on: 'solving addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why'
Addition and Subtraction involving decimals	Add and subtract amounts of money to give change, using both £ and p in practical contexts	Solve simple measure and money problems involving fractions and decimals to two decimal places	They practise adding and subtracting decimals, including a mix of whole numbers and decimals and decimals with different numbers of decimal places	
Expectations for mental fluency in Addition and Subtraction	Add and subtract numbers mentally, including: a three-digit number and ones, a three-digit number and tens and a three-digit number and hundreds	Pupils continue to practise both mental methods and columnar addition and subtraction with increasingly large numbers to aid fluency	Add and subtract numbers mentally with increasingly large numbers	They undertake mental calculations with increasingly large numbers and more complex calculations

The following pages will show the progression in the Key Stage towards the formal written methods. Pupils will soon move away from methods such as partitioning early on in Year 3 as the column method becomes more efficient. However, the table above also shows the expectation for mental fluency in addition and subtraction and it is important to remember that partitioning, rather than column methods, best represents the techniques we use for mental calculation.

Addition

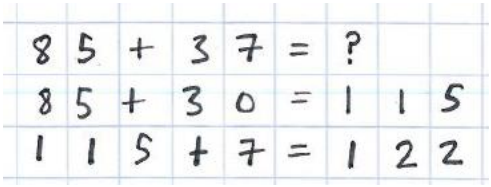
Step 1: Partitioning with a number line (Year 3)





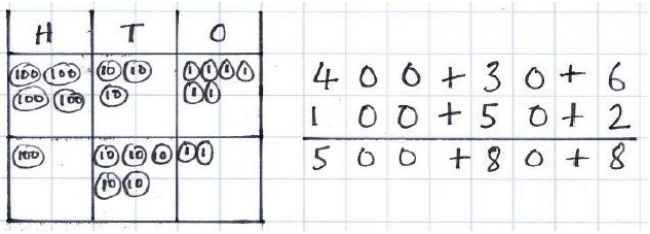
Pupils will already be familiar with this method from Year 2. The number being added is partitioned and then added to the other number in jumps. This starts with jumps of hundreds, then tens, then ones. This may also be taught with dienes cubes or place value counters.

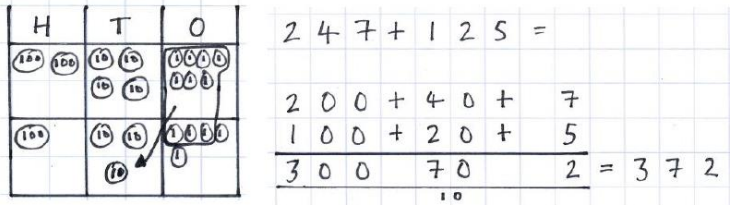
Step 2: Partitioning without a number line (Year 3)



Pupils replicate the process above in Step 1 are able to do so without the need of a diagram. Just as before, hundreds are added first, then tens, followed by the ones.

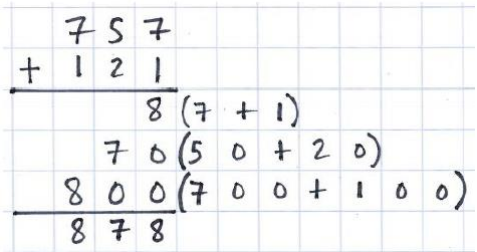
Step 3: Partitioning with expanded column method (Year 3)





This will be pupils' first exposure to adding vertically and should therefore be introduced with dienes cubes or place value counters to demonstrate the process. As seen above, the written method should accompany it at all times (the example on the right shows how to deal with crossing tens barriers).

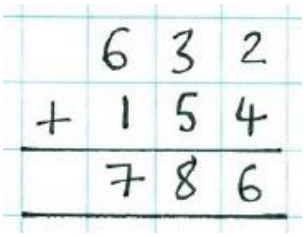
Step 4: Expanded column method (Year 3)



This method should be used to illustrate the formal column method. It may or may not be necessary for pupils to spend time becoming fluent with it.

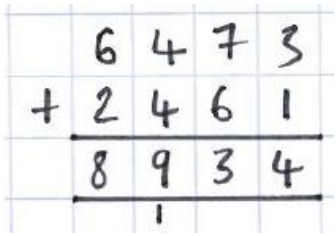
NB: SEE THE TABLE ON PAGE 1 FOR THE NUMBER OF DIGITS REQUIRED FOR EACH YEAR GROUP

Step 5: Formal column method without carrying (Year 3 onwards)



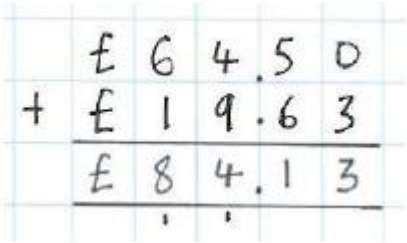
It may support pupils' understanding to have the columns labelled with H, T and O when this method is first introduced. Teachers must encourage pupils to see the above as '2 ones as 4 ones equals 6 ones, 3 tens add 5 tens equals 8 tens and 6 hundreds add 1 hundred equals 7 hundreds'.

Step 6: Formal column method with carrying (Year 3 onwards)

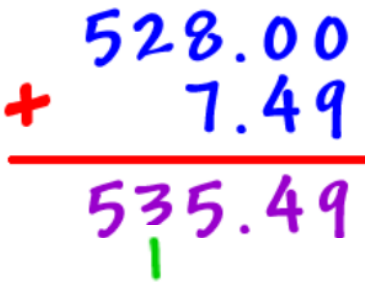


The carried number is to be written below the equal sign.

Step 7: Formal column method with decimals (Year 4 onwards)

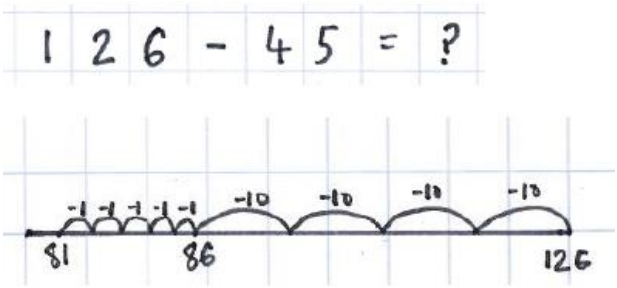


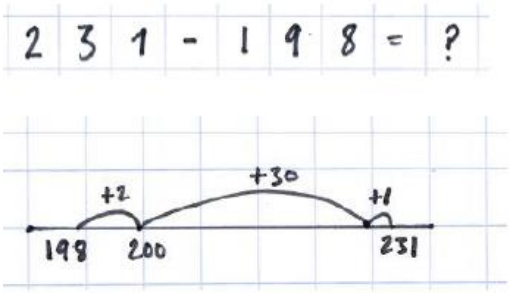
When dealing with decimals, pupils must be able to manipulate the two numbers so that they have the same number of decimal places. In the example below, the calculation was 528 + 7.49. Therefore 528 becomes 528.00 so that the two numbers have the same number of decimal places.



Subtraction

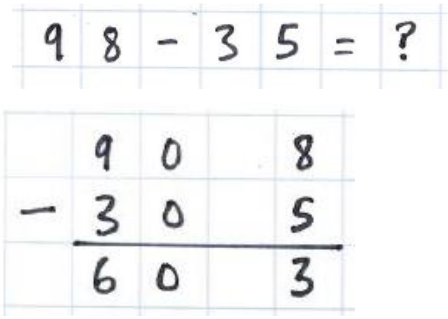
Step 1: Number line (Year 3)





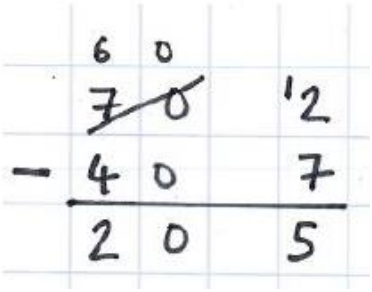
Building on their knowledge from Year 2, pupils progress to using a number line with 3 digit numbers. They will partition the amount being subtracted to 'count back' in jumps of hundreds, tens and ones as shown in the example above left. Alternatively, if the two numbers in the calculation are close together, it may be more efficient to 'count on' to work out the difference between the two numbers, as shown in the example above right.

Step 2: Expanded column method without regrouping (Year 3)



The two numbers in the calculation are partitioned into their tens and units (or hundreds, tens and units) and placed vertically. Unlike column addition, it is essential they are placed in the right order with the original total at the top and the amount being subtracted placed beneath (avoid phrases such as "The bigger number always goes at the top" as later in the Key Stage, children will find out that it is possible to subtract a bigger number from a smaller number).

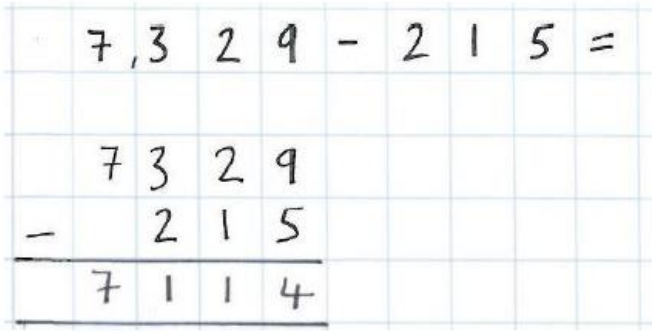
Step 3: Expanded column method with regrouping (Year 3)



Here, pupils are first introduced to the idea that we can regroup the number 72 into 60 and 12 for it to be possible to then subtract 40 and 7.

NB: SEE THE TABLE ON PAGE 1 FOR THE NUMBER OF DIGITS REQUIRED FOR EACH YEAR GROUP

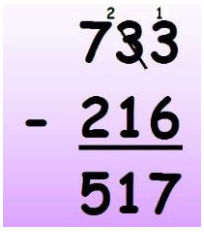
Step 4: Formal column method without regrouping (Year 3 onwards)

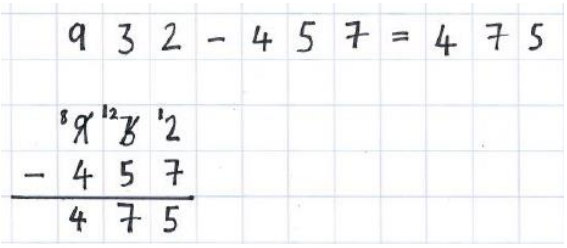


(Year 4 example)

Pupils should already be familiar with this layout from their recent learning on column addition. Again, it may be necessary initially for pupils to label each column. As with column addition, teachers must encourage children to see the above example as '9 ones subtract 5 ones equals 4 ones, 2 tens subtract 1 ten equals 1 ten, 3 hundreds subtract 2 hundreds equals 1 hundred and 7 thousands subtract no thousands equals 7 thousands.

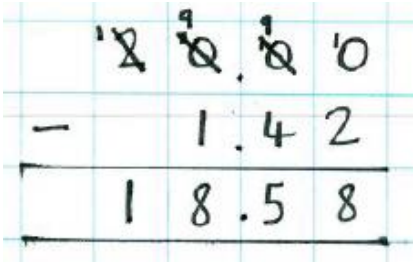
Step 5: Formal column method with regrouping (Year 3 onwards)





Pupils are now required to regroup the number on the top in order to carry out the subtraction. Initially, pupils will have to do this once as shown in the example above left where the number 733 is regrouped as 720 and 13. Following this, children progress to being able to regroup on multiple occasions for one calculation, as demonstrated in the example above right.

Step 6: Formal column method with decimals (Year 4 onwards)



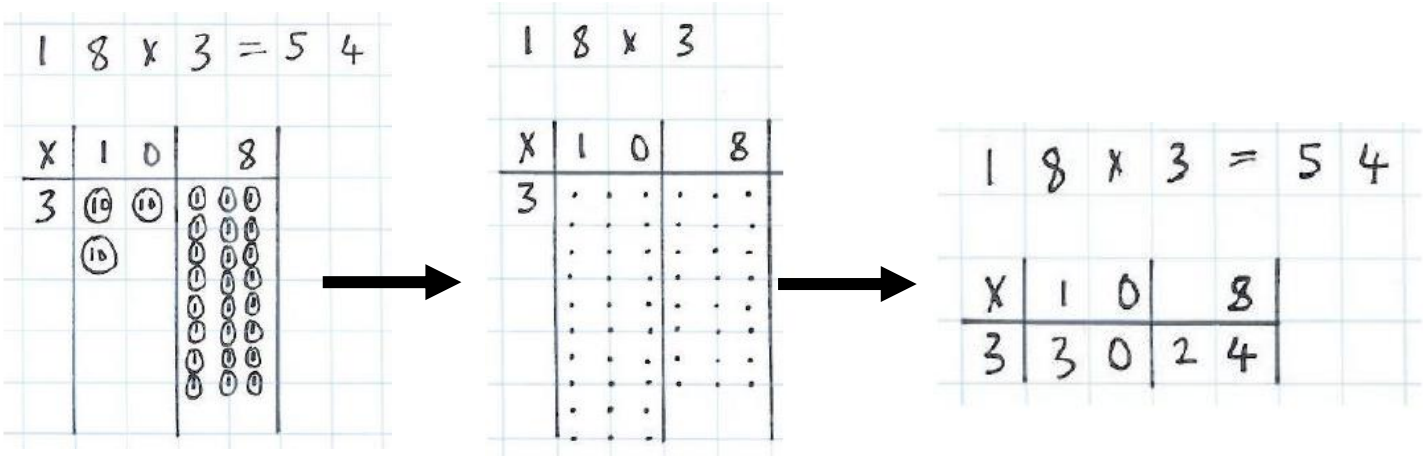
As with column addition with decimals, the first stage of column methods with decimals is ensuring both numbers have the same number of decimal places. The above example shows the calculation 20 – 1.42 and how 20 becomes 20.00 so that both numbers have 2 decimal places.

Multiplication

Pupils beginning Key Stage 2 will already be familiar with the concept of multiplication. They will have used various techniques (such as arrays or counting in the multiple) to solve multiplication statements involving the 2, 3, 5 and 10 times tables. As outlined in the table below, the Key Stage 2 curriculum introduces the formal method of multiplication in Year 3 moving towards long multiplication in Upper Key Stage 2.

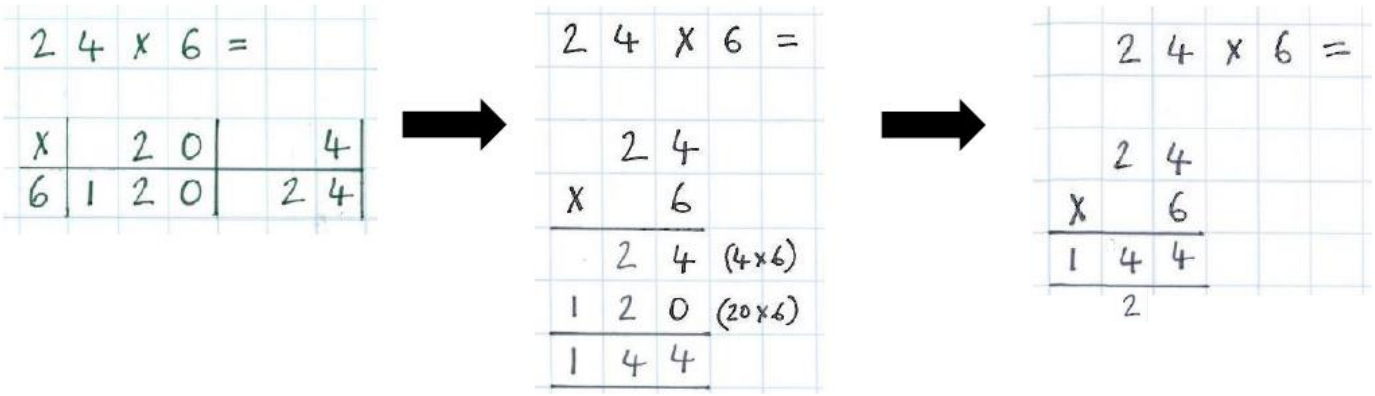
	Year 3	**Year 4**	**Year 5**	**Year 6**
Formal methods expected	Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods	Multiply two-digit and three-digit numbers by a one-digit number using formal written layout	Multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers	multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication
Multiplication and Division facts pupils are required to recall	2, 3, 5 and 10 (from Key Stage 1) as well as 4 and 8 times tables new for Year 3. Pupils must also be able to count in multiples of 50 and 100.	All multiplication and division facts up to the 12 times table. This includes 6, 7, 9, 11 and 12 times tables which are new to Year 4. Pupils must also be able to count in multiples of 25 and 1000.	Children should already be fluent in all times tables up to the 12 times table. In Year 5, they should be able to count in powers of 10 (10, 100, 1000, 10,000, 100,000 and 1,000,000) starting on any number less than 1,000,000.	

Step 1: The grid method using equipment, arrays and then just the numbers themselves (Year 3)



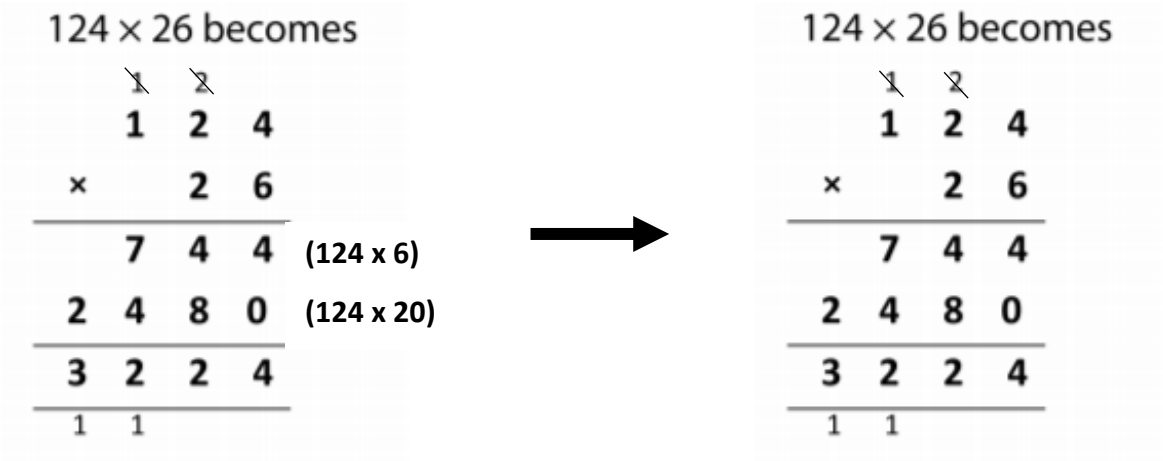
Here, the number that is being multiplied (18 in this case) is partitioned into tens and ones. This breaks up the calculation into a pair of multiplication sentences (3 x 10 and 3 x 8) which the child can work out and then add together. This should be introduced with equipment (such as place value counters or dienes cubes) then reinforced with pictorial representations (such as arrays) before relying solely on the numbers.

Step 2: Grid method to Short Multiplication (Year 3 onwards)



This step is so that pupils are able to understand how the method of short multiplication works. The grid method is transferred into an expanded vertical column and then this develops into the formal written method or short multiplication (2 digit multiplied by 1 digit in Year 3 followed by 3 digit multiplied by 1 digit in Year 4).

Step 3: Long multiplication (Year 5 and 6)



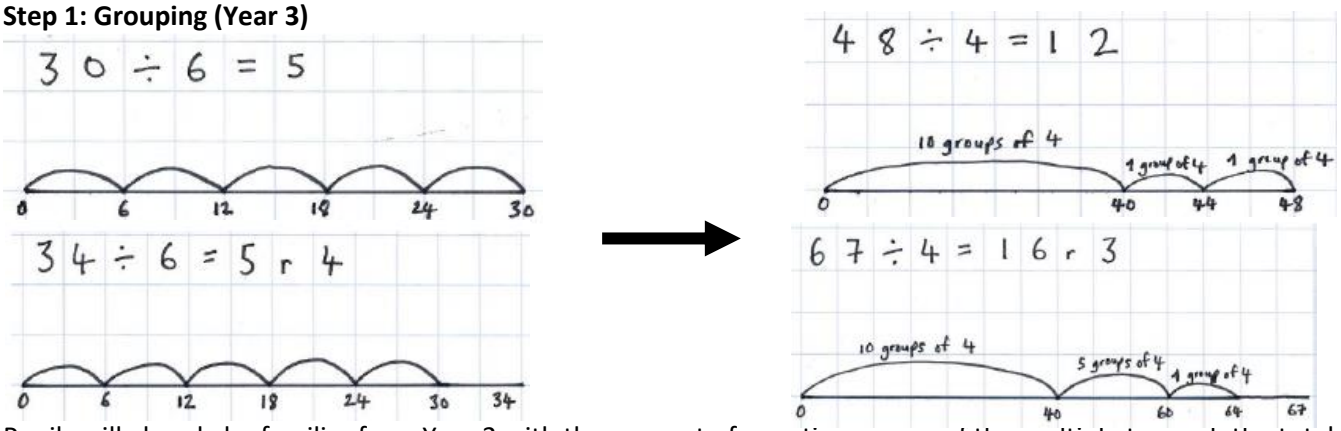
Long multiplication is introduced first with brackets describing each calculation to reinforce the procedure of doing 124 multiplied by 6 ones followed by 124 multiplied by 2 tens (20). This can be removed once this is internalised. Also, note how the carried values are crossed out once they have been used to avoid confusion when there are multiple values being carried.

Division

Pupils beginning Key Stage 2 will already be familiar with the concept of division. They will have used various techniques (such as counting in the multiple) to solve division statements involving the 2, 3, 5 and 10 times tables. As outlined in the table below, the Key Stage 2 curriculum introduces the formal method of division in Year 3 and Year 4 (although this only becomes statutory in Year 5) moving towards long multiplication in Upper Key Stage 2.

	Year 3	**Year 4**	**Year 5**	**Year 6**
Formal methods expected	Short division with TU divided by U giving exact answers (non-statutory) Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know.	Short division with HTU divided by U giving exact answers (non-statutory)	Divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context, either as fractions, decimals, rounding to the nearest integer or leaving it as a remainder.	Divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division (or short division where appropriate), and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context.
Multiplication and Division facts pupils are required to recall	2, 3, 5 and 10 (from Key Stage 1) as well as 4 and 8 times tables new for Year 3. Use division facts (for example, using 3 × 2 = 6, 6 ÷ 3 = 2 and 2 = 6 ÷ 3) to derive related facts (for example, 30 × 2 = 60, 60 ÷ 3 = 20 and 20 = 60 ÷ 3).	All multiplication and division facts up to the 12 times table. This includes 6, 7, 9, 11 and 12 times tables which are new to Year 4. Pupils practise mental methods and extend this to three-digit numbers to derive facts, (for example 600 ÷ 3 = 200 can be derived from 2 x 3 = 6).	Continued use of multiplication and division facts up to the 12 times table.	Continued use of multiplication and division facts up to the 12 times table.

Step 1: Grouping (Year 3)

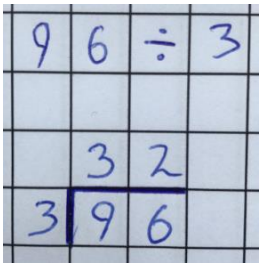


Pupils will already be familiar from Year 2 with the concept of counting groups of the multiple to reach the total for division problems. The number line formalises this and shows how to handle remainders (see the two examples above with remainders). This progresses towards a more efficient method (as shown on the right hand examples) where larger groupings are made.

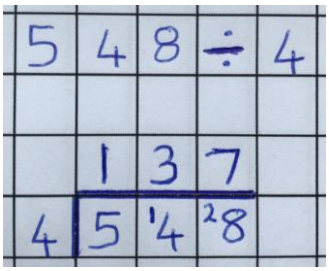
Step 2: Short division (Year 3 and Year 4 non-statutory, Year 5 onwards statutory)

(Year 3 and Year 4)

In this introduction to Short Division, there is no carrying and there are no remainders. Emphasis is made on asking the question: 'how many groups of 3 are in 90?' rather than the procedural '3s into 9 go 3'. Answers are whole numbers.

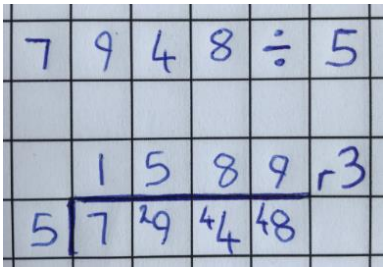


Here, remainders are carried over to the following column. Again, emphasis is made on the place value at each stage: "We can make 1 hundred groups of 4 in 500, with 1 hundred remaining which carries over to the tens column" etc. Again, answers are whole numbers.



(Year 5 and Year 6)

In Year 5, pupils are expected to divide a 4 digit number by a one digit number. They are also expected to deal with remainders appropriately, deciding whether it should be left as a remainder, turned into a fraction or a decimal or rounded to the nearest whole number.

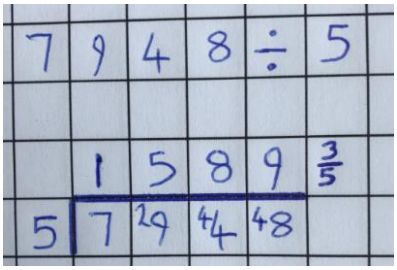


<u>Left as a remainder</u>

In this example, the remainder is simply left as a remainder using 'r' to indicate this.

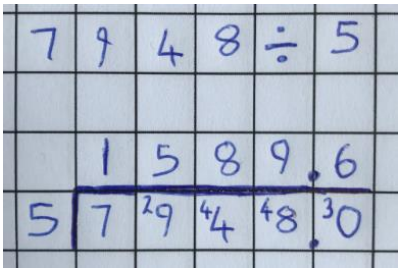
<u>Displayed as a fraction</u>

In this example, we take the 3 that is left over as a remainder and divide it by 5 making the fraction $^{3}/_{5}$.



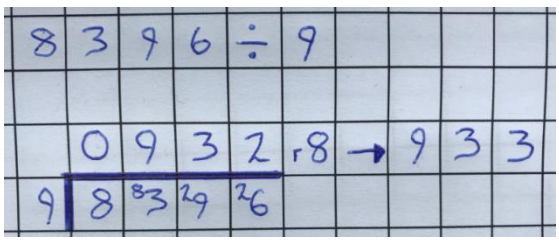
<u>Displayed as a decimal</u>

In this example, the number being divided (7948) is given a decimal value of 0 (7948.0) so that the remaining 3 can be carried over. Notice the decimal point written above and below the bus stop in the same position.



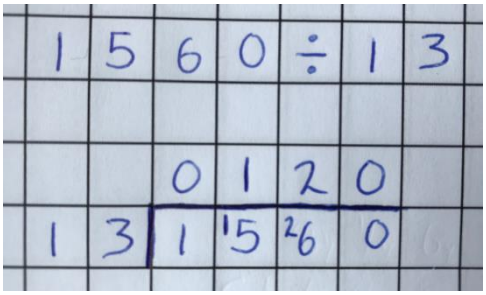
<u>Rounded to the nearest integer (whole number)</u>

In some cases (such as 'How many pencil cases would you need to fit 8,396 pencil crayons if each one could hold a maximum of 9 pencil crayons?'), the remainder is rounded up to the nearest whole number. In other cases (such as 'How many complete pencil cases would you be able to make?') the answer is rounded down to the previous integer.

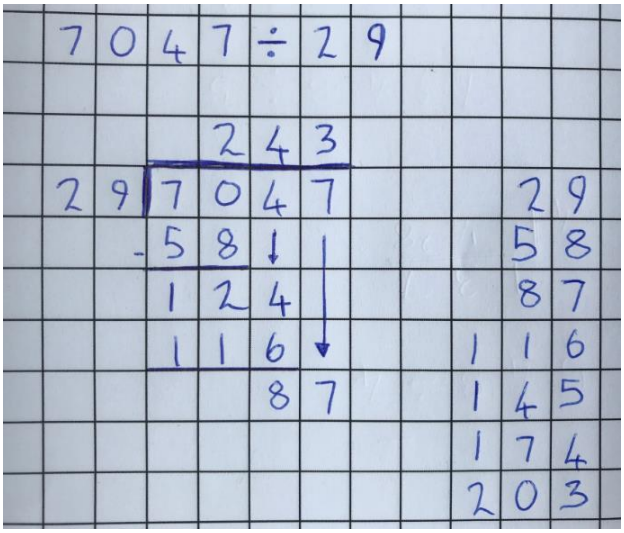


Step 3: Long Division (Year 6)

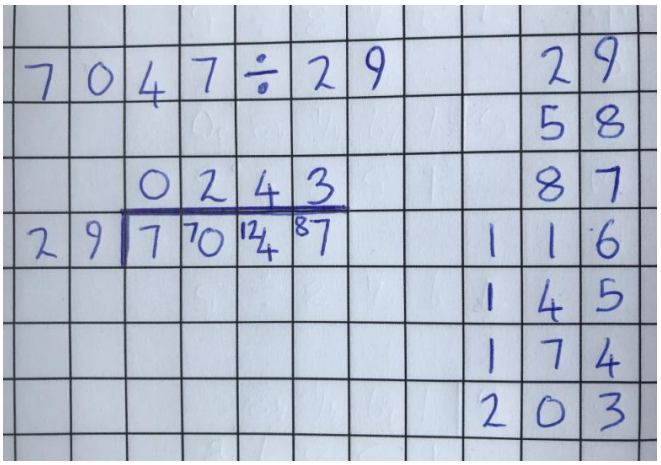
When faced with a four digit number divided by a two digit number, there are some instances when the calculation may be require a simple short division as shown in this example.



The National Curriculum gives examples of different ways to tackle long division problems. The example on the right shows what we feel is the simplest method for Long Division. As you can see, the calculation is set out like a Short Division calculation. The multiples of the divisor are then written out (in this case, the first seven multiples are recorded although more may have been needed in other circumstances). The pupil finds the multiple of the divisor which is nearest to 70 – here it is 58 – and writes it down underneath with 2 written in the hundreds column indicating that 2 hundred 29s could be made from 7,000. A column subtraction is then made (70 – 58) with the remainder written underneath (12). The following digit (here it is 4 tens) is brought down and the process is repeated.



Once children have mastered this, and if their mental fluency is of a sufficient standard, they may wish to carry out this method but with a simplification. As shown in the example on the right, the pupil has written down the multiples of the divisor and then carried out the rest of the calculation as a Short Division, carrying each remainder to the next column. When mastered, this is the simplest way of carrying out the calculation although jottings may be needed to calculate what quantity must be carried over to the next column.



Fractions

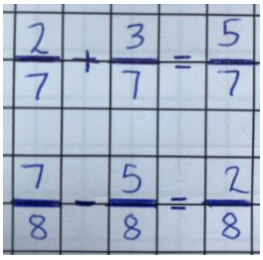
By the end of Key Stage 1, pupils should be familiar with the concept of fractions – dealing with halves, thirds and quarters – and will even be used to calculating fractions of amount, both for unit fractions (such as ¼ of 12) and for non-unit fractions (¾ of 20). Key Stage 2 builds on this foundation. By the end of the Key Stage, pupils should be able to add, subtract, multiply and divide fractions in their different forms (unit and non-unit as well as improper fractions and mixed numbers). The table below shows this progression for each year.

	Year 3	**Year 4**	**Year 5**	**Year 6**
Calculation work with fractions	Add and subtract fractions with the same denominator within a whole. Calculate fractions of amount with unit and non-unit fractions with small denominators.	Add and subtract fractions with the same denominator beyond a whole. Calculate fractions of amount with increasingly harder fractions including non-unit fractions where the answer is a whole number.	Add and subtract fractions with the same denominator and denominators that are multiples of the same number. Use mixed numbers and improper fractions to write mathematical statements beyond 1. Multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams	Add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions. Multiply simple pairs of proper fractions, writing the answer in its simplest form. Divide proper fractions by whole numbers

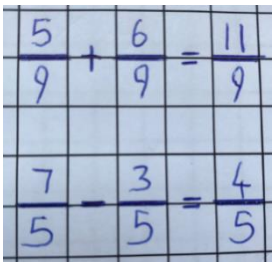
Addition and Subtraction of Fractions

Step 1: Addition and Subtraction of Fractions with the same denominator (Year 3 and Year 4)

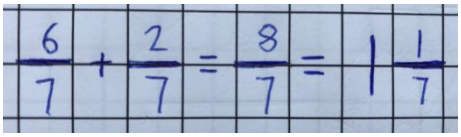
At this stage, children need to be familiar with the concept that the numerators are added or subtracted but the denominators remain the same.



Year 3 example: Add and subtract fractions with the same denominator within a whole.



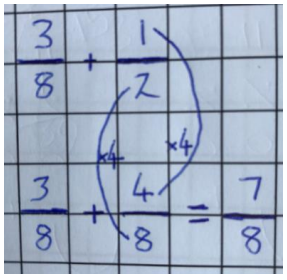
Year 4 example: Add and subtract fractions with the same denominator beyond a whole.

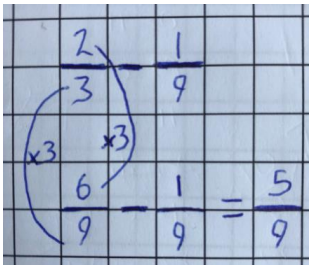


Year 5 example: Add and subtract fractions with the same denominator beyond a whole but converting improper fraction to a mixed number.

Step 2: Addition and Subtraction of Fractions with denominators that are multiples of the same number (Year 5)

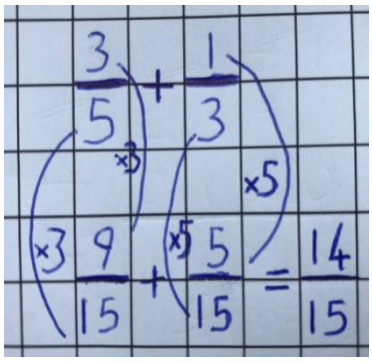
This is when children are first introduced to the idea that they can manipulate two unlike fractions so that they can be added or subtracted (or ordered and compared). At this stage, one fraction is written in its equivalent form so that the denominators are the same. Pupils must get used to rewriting the calculation underneath.

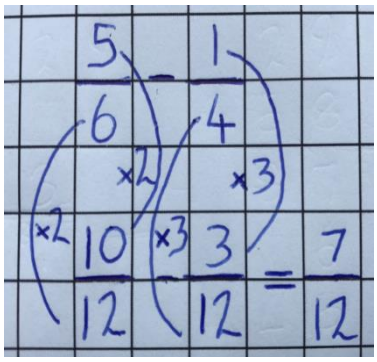




Step 3: Addition and Subtraction of Fractions with different denominators using equivalent fractions (Year 6)

In Year 6, children must be able to manipulate both fractions so that their denominators are the same in order for them to be added or subtracted (or ordered or compared). In some circumstances, the lowest common denominator is found by multiplying the two denominators together (as shown in the addition example here) however there may be times when there is an alternative common multiple as shown in the subtraction example. In any case, the number sentence is rewritten underneath as illustrated in the examples.

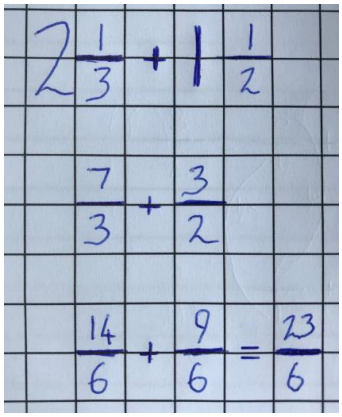




Step 4: Addition and Subtraction of Mixed Numbers with different denominators (Year 6)

Also in Year 6, children must be able to calculate with mixed numbers. As shown in this example, the mixed numbers are converted to improper fractions and then the calculation can be carried out as shown in Step 3 by finding a common denominator (6 in this case). The improper fraction can always be converted back to a mixed number at the end.

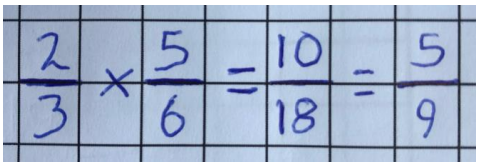
NB. In this example, it may have been more efficient to add the two integers (2 + 1 = 3) and then add the two fractions (1/3 + 1/2 = 5/6) and finally put them together to make 3 5/6 but problems occur if this were a subtraction as 2 – 1 = 1 but then 1/3 – 1/2 would create a negative number.



Multiplication of Fractions (Year 6)

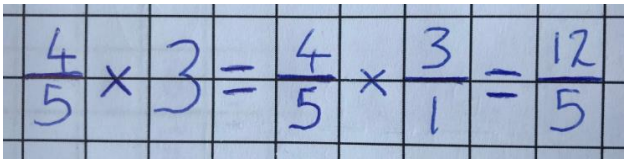
Proper fractions multiplied by a proper fraction

Very simply, the numerators are multiplied together and the denominators are divided together. Sometimes the answer may need to be simplified as shown in this example.

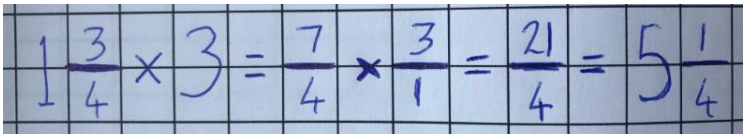


Fractions multiplied by a whole number

When dealing with whole numbers in calculations involving fractions, we convert the whole number into an improper fraction by putting it as the numerator over 1 as a denominator. After this has been done, the calculation becomes identical to the proper fraction multiplied by a proper fraction example above.

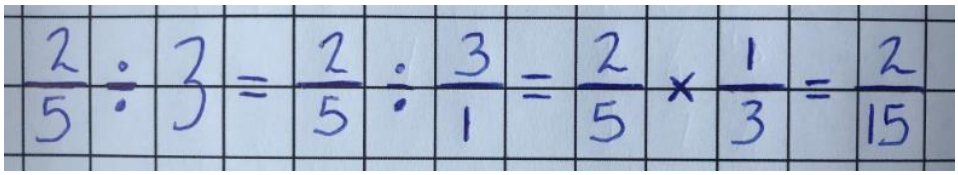


The only further complexity arises when it is a mixed number multiplied by a whole number. In this scenario, the mixed number is converted to an improper fraction as shown in the example on the right.



Division of Fractions

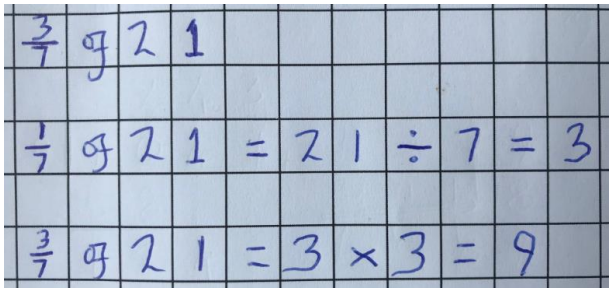
Division of proper fractions by whole numbers (Year 6)



As with multiplication, when dealing with whole numbers in a fraction calculation, the first step is to convert the whole number into an improper fraction by putting it as the numerator over 1 as a denominator. Once this has been done, pupils follow the 'KFC' procedure: **k**eep the first fraction the same, **f**lip the second fraction and **c**hange the symbol from a multiplication to a divide. Once this has been done, the calculation becomes a simple proper fraction multiplied by a proper fraction.

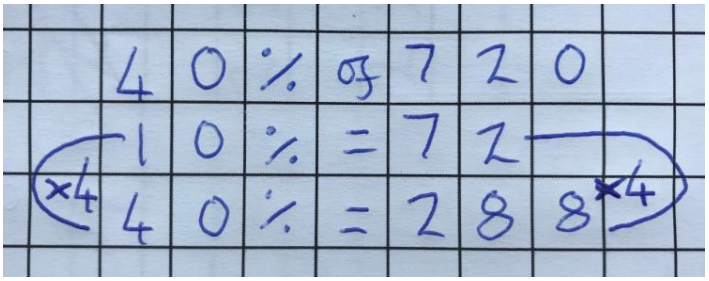
Calculating Fractions of Amount (Year 3 onwards)

As outlined in the table progression table for fractions above, children have to be able to find fractions of amount throughout Key Stage 2. The example below shows how these calculations are to be set out. This format will be identical from Year 3 to Year 6; the only thing that may differ is the complexity of the numbers involved.



Calculating Percentages of Amount (Year 6)

As calculating with percentages makes up a relatively small part of the National Curriculum compared with fractions, the layout for working out percentages of amount is included in the fractions section on this document. As you can see from the example, it follows a similar layout to calculating fractions of amount.



New maths vocabulary for year 3							
Number and place value	Addition and subtraction	Multiplication and division	Measure	Geometry (position and direction)	Geometry (properties of shape)	Fractions	Data/statistics
Numbers to one thousand	Column addition and subtraction	Product Multiples of four, eight, fifty and one hundred Scale up	Leap year Twelve-hour/twenty-four-hour clock Roman numerals I to XIII	Greater/less than ninety degrees Orientation (same orientation, different orientation)	Horizontal, vertical, perpendicular and parallel lines	Numerator, denominator Unit fraction, non-unit fraction Compare and order Tenths	Chart, bar chart, frequency table, Carroll diagram, Venn diagram Axis, axes Diagram

New maths vocabulary for year 4						
Number and place value	Multiplication and division	Measure	Geometry (position and direction)	Geometry (properties of shape)	Fractions and decimals	Data/statistics
Tenths, hundredths Decimal (places) Round (to nearest) Thousand more/less than Negative integers Count through zero Roman numerals (I to C)	Multiplication facts (up to 12x12) Division facts Inverse Derive	Convert	Coordinates Translation Quadrant x-axis, y-axis Perimeter and area	Quadrilaterals Triangles Right angle, acute and obtuse angles	Equivalent decimals and fractions	Continuous data Line graph

New maths vocabulary for year 5						
Number and place value	Addition and subtraction	Multiplication and division	Measure	Geometry (position and direction)	Geometry (properties of shape)	Fractions, decimals and percentages
Powers of 10	Efficient written method	Factor pairs Composite numbers, prime number, prime factors, square number, cubed number Formal written method	Volume Imperial units, metric units	Reflex angle Dimensions	Regular and irregular Polygons	Proper fractions, improper fractions, mixed numbers Percentage Half, quarter, fifth, two fifths, four fifths Ratio, proportion

New maths vocabulary for year 6							
Number and place value	Addition and subtraction	Multiplication and division	Geometry (position and direction)	Geometry (properties of shape)	Fractions, decimals and percentages	Algebra	Data/statistics
Numbers to ten million	Order of operations	Order of operations Common factors, common multiples	Four quadrants (for coordinates)	Vertically opposite (angles) Circumference, radius, diameter	Degree of accuracy Simplify	Linear number sequence Substitute Variables Symbol Known values	Mean Pie chart Construct