

Cheadle Primary School

"We aim to be outstanding in all we do"

Agreed and Adopted February 2016



Agreed Methods for the Teaching of Calculations



Our Calculation Policy

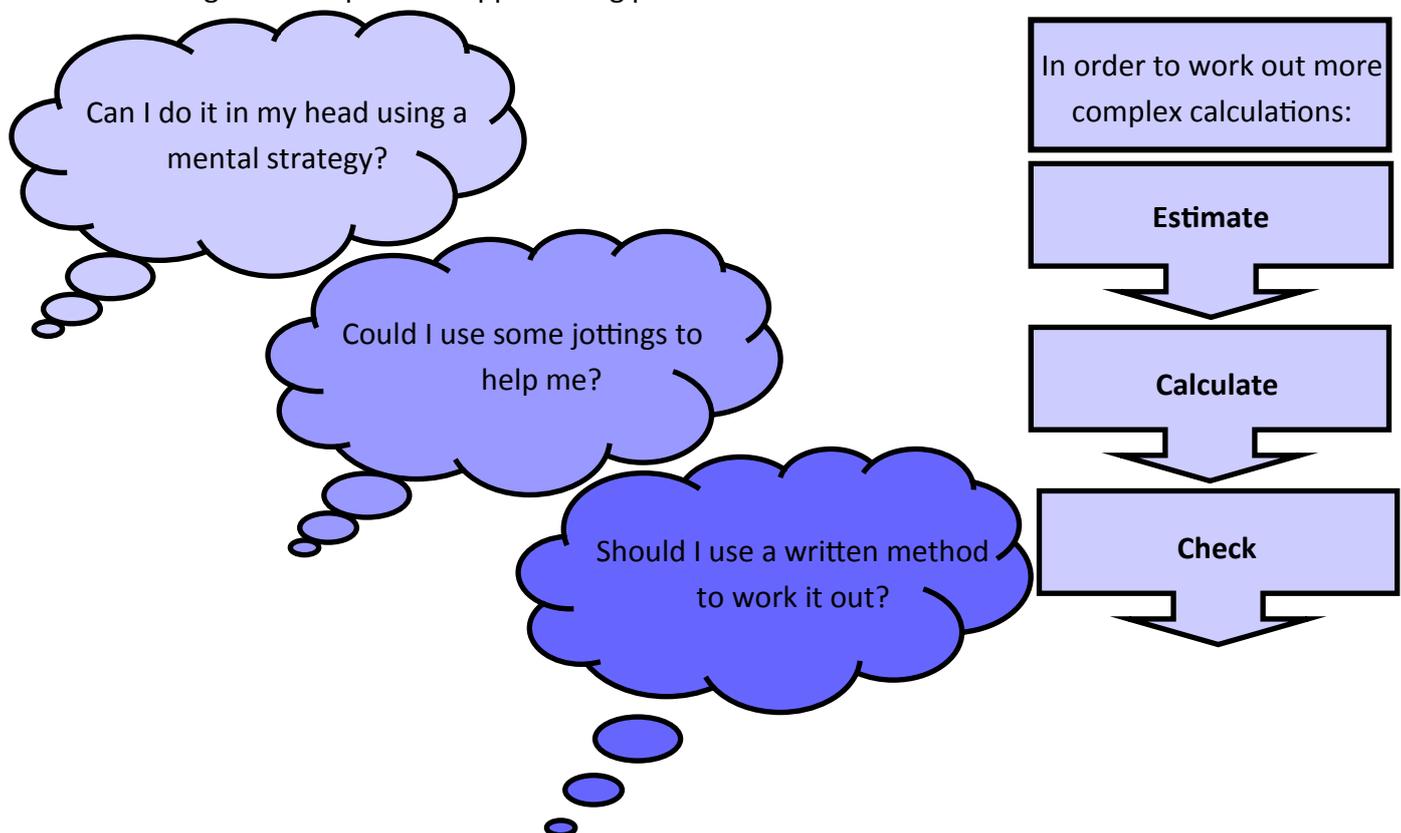
This calculation policy has been created to meet the expectations of the new National Curriculum but most importantly the learning needs of our children at Cheadle Primary School. The methods chosen match the National Curriculum but have also been specifically selected to give all pupils a consistent and smooth progression in our approach to the teaching and learning of mathematics.

Age Related Expectations:

The policy has been organised by year group, considering the national curriculum 2014 expectations. The new curriculum focuses on skills and mastery and is not about moving children on to the next method as soon as they can do the one before. Working and more complex and richer problems rather than new methods will support this 'mastering' of maths. However, some children will be working at levels well above their age and will require the introduction of new methods.

Mental Strategies:

The written methods in this document are important but they by no means replace the super mental methods that we have developed. Children will be taught and encouraged to decide upon the best approach for solving problems and to then select the appropriate method for the numbers involved. As children become more mature and confident with their methods of calculation, they will need to start following these steps when approaching problems:

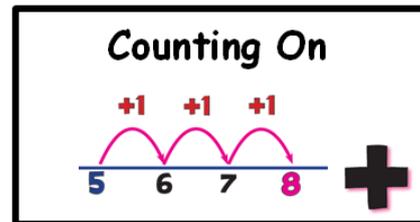
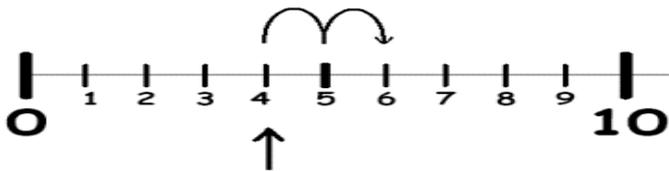




Addition ~ Year 1

Focus: Adding with numbers up to 20

Children should use number lines (with the numbers on) to add by counting in ones. Starting with the greatest number and counting on the smaller number.



In addition to using a number line, children in Year 1 need to also be able to:

- * Use a variety of equipment to solve addition problems, including counting equipment, everyday objects, number tracks, be shown numbers in different contexts, etc.
- * Read and write the addition (+) and equals (=) sign and use them in number sentences.
- * Solve addition number sentences and missing number problems, using concrete objects and number line addition to solve them: $7 + 4 = ?$, $1 + 2 + 1 = ?$, $15 + 4 = ?$, $? + ? = 9$ etc.
- * Use bead strings or bead bars to visualise bridging through 10s e.g. $8 + 5 =$ can be solved by counting on 2 then counting on. This builds on from prior learning of adding by combining two sets of objects into one group from the Early Years.



Key Vocabulary

Add, more, plus, and, make, altogether, total, equal to, equals, the same as, double, most, count on, number line

Key Skills:

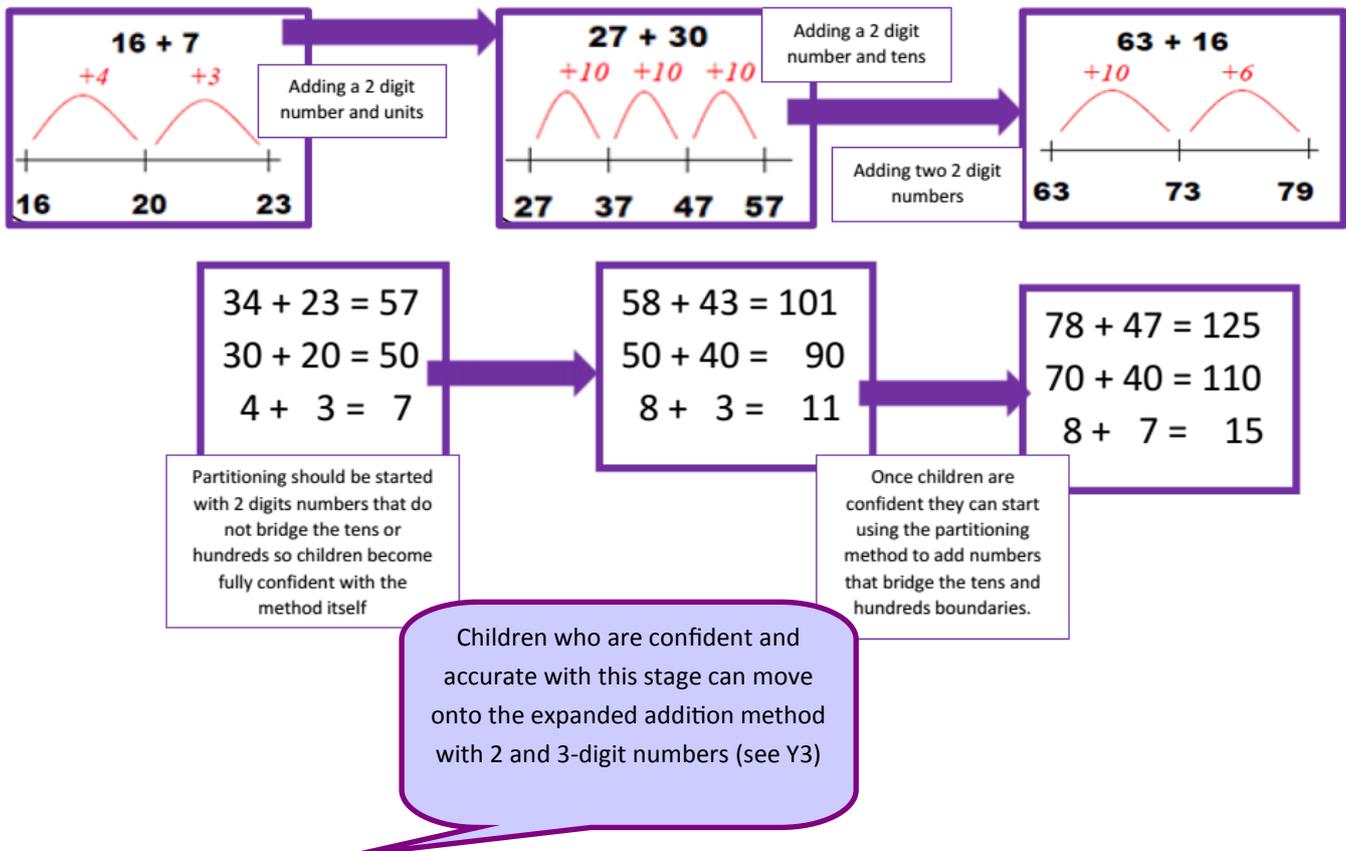
- * Reading and writing numbers to 100 in numerals.
- * Writing numbers to 20 in words including correct spelling.
- * Counting to and across 100 in ones.
- * Counting in multiples of 2, 5 and 10.
- * Solving simple one step addition problems: using objects, numberlines and images to support.



Addition ~ Year 2

Focus: Adding with 2-digit numbers

Children should explore and understand how to use blank number lines to add using their knowledge of place value and also of how to partition numbers in different ways. Once confident, children should then move onto written partitioning methods. Children will then explore activities which show that addition can be undertaken in any order.



Key Vocabulary

Add, more, plus, and, make, altogether, total, equal to, equals, the same as, double, most, count on, number line, sum, tens, units, partition, addition, column, tens boundary

Key Skills:

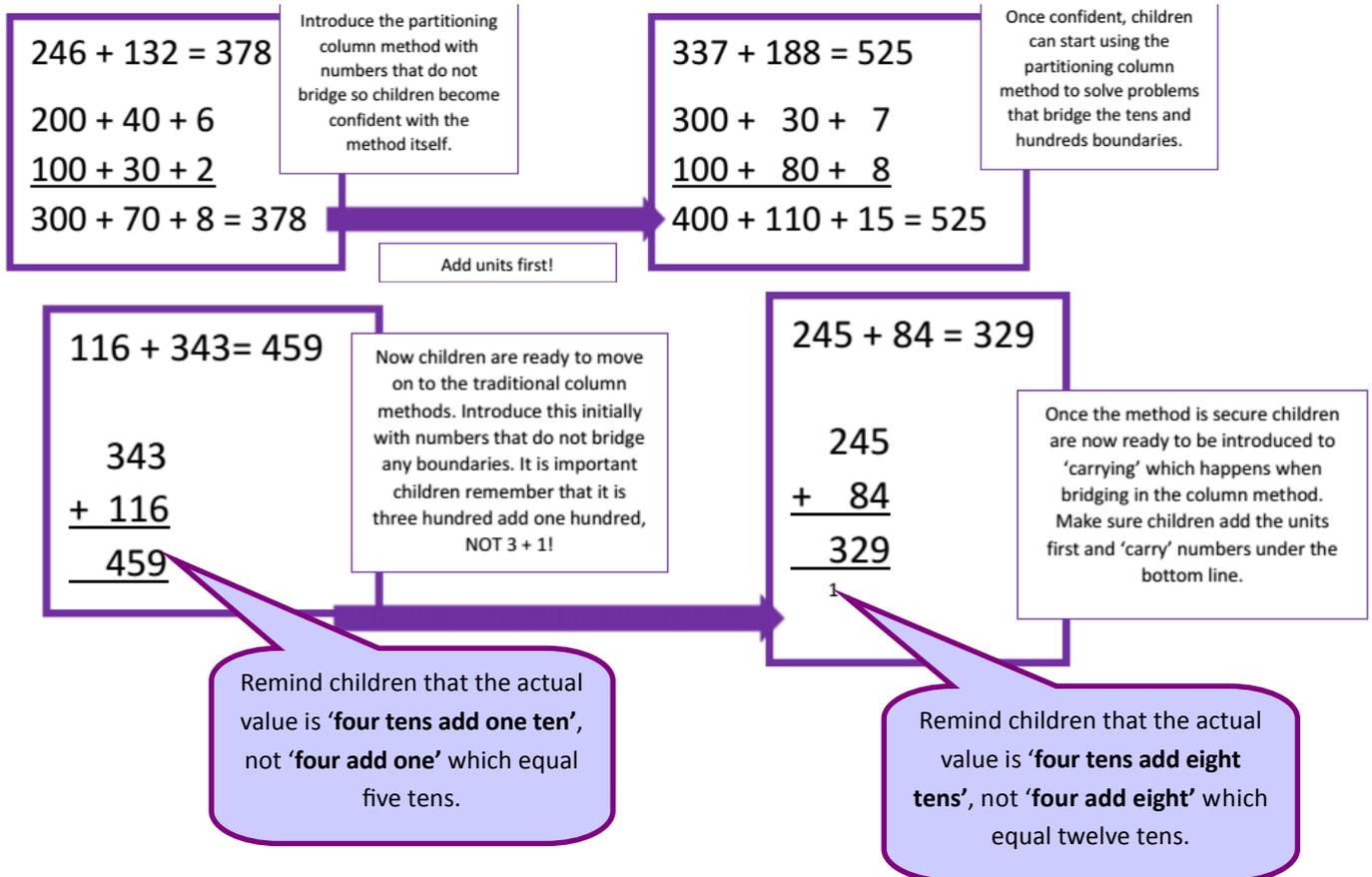
- * Add a 2 digit number and units and a 2 digit number and 10s.
- * Add pairs of 2 digit numbers.
- * Add three single digit number.
- * Know and show that adding can be done in any order (the commutative law).
- * Recall bonds to 20 and multiple of 10 bonds to 100.
- * Count in steps of 2, 3 and 5 and count in 10s from any number.
- * Understand the place value of 2–digit numbers (tens and ones).
- * Compare and order numbers to 100 using < > and = signs.
- * Read and write numbers to at least 100 in numerals and words.
- * Solve contextual addition problems.



Addition ~ Year 3

Focus: Adding with numbers up to 3-digits

In year 3 we will move to the traditional column method and to support this, children will first apply their partitioning skills to use the expanded partitioning column method and then move on to compact column addition (traditional column method).



Key Vocabulary

Add, more, plus, and, make, altogether, total, equal to, equals, the same as, double, most, count on, number line, sum, tens, units, partition, addition, column, tens boundary, *hundreds boundary*, increase, vertical, carry, expanded, compact, traditional

Key Skills:

- * Read and write numbers to 1000 in numerals and words.
- * Add 2 digit number mentally including those that exceed 100.
- * Add a 3 digit number and ones, a 3 digit number and 10s and a 3 digit number and 100s mentally.
- * Estimate answers to calculations, using the inverse operation to check.
- * Solve problems, including missing number problems using number facts and place value.
- * Recognise the place value of each digit in a 3 digit number (hundreds, tens and units).
- * Continue to practise many different mental addition strategies including adding to the nearest multiple of 10, 100, 1000 and adjusting, using number bonds, using near doubles, partitioning and recombining etc.



Addition ~ Year 4

Focus: Adding with numbers up to 4 digits

In year 4 children will move from expanded addition and consolidate their use of the compact column method and will then be able to use it confidently to add numbers up to 4 digits. This could include 'carrying' units, tens and hundreds underneath the calculation. This will also use money and measures in contexts.

e.g. $3517 + 396 = 3913$

	3	5	1	7
+		3	9	6
<hr/>				
	3	9	1	3

Reinforce correct place value by reminding children that the actual value is **five hundreds** add **three hundreds** and not **five** add **three**

Teacher needs to model the compact method with carrying, asking children to discuss similarities and differences and establish how this is carried out.

2. 'Carry' numbers underneath the 'equals' line

1. Add the units first

Key Vocabulary

Add, more, plus, and, make, altogether, total, equal to, equals, the same as, double, most, count on, number line, sum, tens, units, partition, addition, column, tens boundary, hundreds boundary, increase, vertical, carry, expanded, compact, traditional, *thousands, hundreds, digits, inverse*

Key Skills:

- * Select most appropriate method: mental, jottings or written and explain why.
- * Recognise the place value of every digit in a 4 digit number.
- * Round any number to the nearest 10, 100 or 1000.
- * Estimate and use inverse operations to check answers.
- * Solve 2-step problems in different contexts, picking the correct operation to use.
- * Find 100 more or less than a number.
- * Continue to use a wide range of mental addition methods.
- * Add numbers with up to 4 digits using column addition.
- * Solve 2-step problems in contexts, deciding which operations and methods to use and why.
- * Estimate and use inverse operations to check answers to a calculation.



Addition ~ Year 5

Focus: Adding with more than 4 digits

In year 5, children will now use the column method to add decimal numbers in the context of money and measures. It is important that children have place value skills beyond 4 digits and fully understand what a decimal number represents as they will need to add numbers with different numbers of decimal places.

$$\begin{array}{r} \text{£} 23.59 \\ + \text{£} 7.55 \\ \hline \text{£} 31.14 \end{array}$$

The decimal point needs to be lined up just like all of the other place value columns and must be remembered in the answer column. It is important that children understand why this is and get into the habit very quickly.

$$\begin{array}{r} 23,481 \\ + 1,362 \\ \hline 24,843 \end{array}$$

Children should be working with numbers greater than 4 digits, including numbers in the ten thousands and hundred thousands

$$\begin{array}{r} 19.01 \\ 3.65 \\ + 0.70 \\ \hline 23.36 \end{array}$$

Children need to start using the column method to add more than two values, still considering place value very carefully

Remember...

It is important that the children say 6 tenths and 7 tenths so then they understand that they are adding parts of a number
Empty places should be filled with a zero to show it as a 'place holder'

Key Vocabulary

Add, more, plus, and, make, altogether, total, equal to, equals, the same as, double, most, count on, number line, sum, tens, units, partition, addition, column, tens boundary, hundreds boundary, increase, vertical, carry, expanded, compact, traditional, thousands, hundreds, digits, inverse, decimal place, decimal point, place holder, tenths, hundredths, thousandths.

Key Skills:

- * Add increasingly large numbers mentally using an expanding range of strategies.
- * Use rounding to check answers and make estimates.
- * Understand the place value of tenths and hundredths.
- * Solve multi step problems in different contexts, deciding which operations and methods to use and explaining why.
- * Read, write, order and compare number to 1 million.
- * Round any number to 1 million to the nearest 10, 100, 1000, 10 000 or 100 000.
- * Add numbers with more than 4 digits using column addition.



Addition ~ Year 6

Focus: Adding several numbers with an increasing level of complexity

In year 6, children need to use all of the previous addition skills which they have developed to add several numbers with a variety of different decimal places. Many of these problems will be in the context of money or measures.

	2	3	.	3	6	1
		9	.	0	8	0
	5	9	.	7	7	0
+		1	.	3	0	0
<hr/>						
	9	3	.	5	1	1
	2	1		2		

Empty decimal places can be filled with a zero to show the place value in each column

Adding several numbers, with different numbers of decimal places (to include money and measures):

Tenths, hundredths and thousandths should be correctly aligned, with the decimal point lined up vertically including the decimal point within the answer row.

Zeros can be included into any decimal places to show that there is no value to add.

	8	1	,	0	5	9	
		3	,	6	6	8	
		1	5	,	3	0	1
+		2	0	,	5	5	1
<hr/>							
	1	2	0	,	5	7	9
		1		1		1	

Key Vocabulary

Add, more, plus, and, make, altogether, total, equal to, equals, the same as, double, most, count on, number line, sum, tens, units, partition, addition, column, tens boundary, hundreds boundary, increase, vertical, carry, expanded, compact, traditional, thousands, hundreds, digits, inverse, decimal place, decimal point, place holder, tenths, hundredths, thousandths, *integer*

Key Skills:

- * Solve problems mentally, including those with mixed operations and large numbers, using all the mental strategies learnt in previous years.
- * Solve multi step problems in context, deciding which operations and methods to use and why
- * Use estimation to check answers to a calculation and determine, in the context of a problem, levels of accuracy.
- * Read, write, order and compare numbers to 10 million and understand the value of each digit.
- * Round any whole number to the nearest 10, 100, 1000, 10 000, 100 000, 1 000 000 or 10 000 000
- * Round decimal numbers to a required degree of accuracy.
- * Pupils understand how to add mentally with larger numbers and calculations of increasing complexity

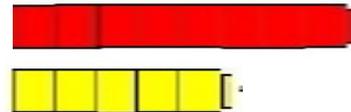
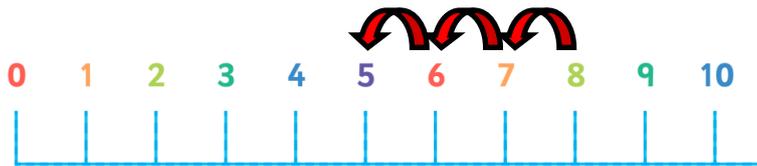


Subtraction ~ Year 1

Focus: Subtracting from numbers up to 20

Children will use number lines, objects and visual models to understand subtraction as taking away but also as the difference between, or distance between, two numbers.

e.g. for 8 take away 3, the child would start on the number line at 8 and count back three, in ones. This would give them the answer of 5.



1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

$$8 - 5 = 3$$

To answer problems such as how many more is 8 than 5 or, what is the difference between 8 and 5, cubes should be made into rods to enable children to see the problem visually. This method can also be used to answer 'find the distance' problems

Mental subtraction is equally important in year 2 and therefore children should practise recalling subtraction facts up to, and within, 10 and 20. In year 1 children should also be taught about subtracting zero.

Key Vocabulary

Equal to, take, take away, less, minus, subtract, leaves, distance between, difference between, how many more, how many fewer/less than, most, least, count back, how many left, how much less is_?

Key Skills:

- * Given a number, say one more or one less.
- * Count to and over 100, forward and back from any number in 1s.
- * Represent and use subtraction facts to 20 and within 20.
- * Subtract with one digit and 2 digit numbers to 20, including zero.
- * Solve one step problems that involve subtraction using objects, pictures and numbered lines.
- * Read and write numbers to 100 in numerals.
- * Write numbers in words to 20s, including correct spelling.



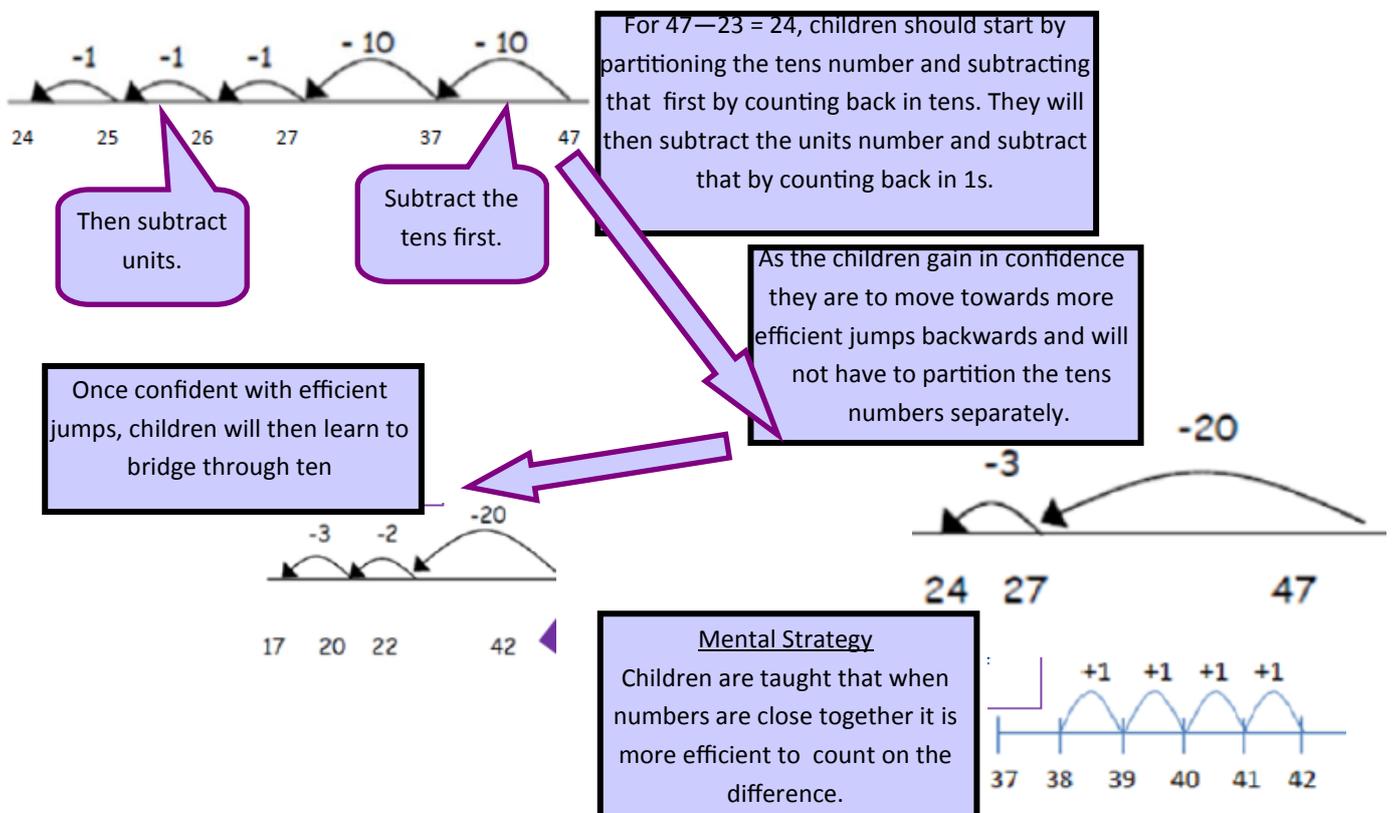
Subtraction ~ Year 2

Focus: Subtracting with 2 digit numbers

Whilst in year 2 children will start to use blank number lines to subtract by counting back which will greatly support the development of mental subtraction skills.

This strategy will be used for:

- * **2-digit numbers subtract units** (by taking away/ counting back) e.g. $36 - 7$
- * **2-digit numbers subtract tens** (by taking away/ counting back) e.g. $48 - 30$
- * **Subtracting pairs of 2-digit numbers** (see example below)



Key Vocabulary

Equal to, take, take away, less, minus, subtract, leaves, distance between, difference between, how many more, how many fewer/less than, most, least, count back, how many left, how much less is_?, count on, strategy, partition, tens, units

Key Skills:

- * Recognise the place value of each digit in a 2 digit number.
- * Recall and use subtraction facts to 20 fluently, use to derive related facts to 100.
- * Subtract using objects, images, 100 squares and mentally including a two digit number and ones, a two digit number and 10s and two 2 digit numbers.
- * Understand and show that subtraction calculations cannot be done in any order.
- * Use the inverse relationship between + and - to check calculations and solve missing number s.
- * Solve simple subtraction problems in context using written and mental methods.
- * Read and write numbers to at least 100 in numerals and words.

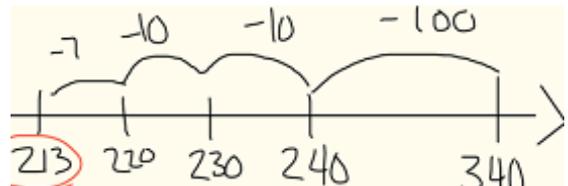


Subtraction ~ Year 3

Focus: Subtracting with 2 and 3 digit numbers

Children will consolidate their knowledge of counting back and counting on using a blank number line to subtract. They will use these methods both written and mentally. Once children become confident they will then move on to the partitioning method of subtraction.

Children will use efficient jumps on a number line and will then be able to apply it to 3 digit subtraction calculations, e.g. 340—127



Step 1
Introduce this method where no exchanging is required

$$89 - 35 = \underline{54}$$

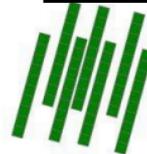
$$\begin{array}{r} 80 + 9 \\ - 30 + 5 \\ \hline 50 + 4 \end{array}$$

Step 2
Introduce exchanging through the practical exploration of subtraction. It is important that children recognise that the value hasn't changed but that the numbers have simply been partitioned in a different way.

Step 3
Once children are secure with exchanging they can then move on to the partitioning method of column subtraction

2	3	8	-	1	4	6	=	9	2	
		100			30	8				
		200	+							
		100	+			40	+			
				0	+			90	+	2

$$72 - 47$$



$$\begin{array}{r} 60 \\ 70 + 2 \\ - 40 + 7 \\ \hline 20 + 5 = \underline{25} \end{array}$$

Before subtracting '7' from the 72 blocks, they will need to exchange a row of 10 for ten units. Then subtract 7, and subtract 4 tens.

Key Vocabulary

Equal to, take, take away, less, minus, subtract, leaves, distance between, difference between, how many more, how many fewer/less than, most, least, count back, how many left, how much less is_?, count on, strategy, partition, tens, units, exchange, decrease, hundreds, value, digit

Key Skills:

- * Subtract mentally: a 3 digit number and 1s, a 3 digit number and 10s and a 3 digit number and 100s.
- * Estimate answers and use the inverse to check.
- * Solve problems in different contexts, including missing number problems.
- * Find 10 or 100 more or less than a given number.
- * Recognise the place value in a 3 digit number, 100s, 10s and 1s.
- * Solving finding the difference problems using counting on.
- * Reading and writing numbers up to 1000 in numerals and words.
- * Practise and develop mental strategies including subtracting near multiples of 10 and adjusting, counting on etc.



Subtraction ~ Year 4

Focus: Subtracting with numbers up to 4 digits

Children will consolidate their knowledge of the partitioning column method for subtraction with 4 digit numbers including those where exchanging is required. Once they are secure with this they will move on to the compact (traditional) method of column subtraction.

Partitioned column subtraction with exchanging (decomposition):

$$\begin{array}{r}
 2754 - 1562 = 1192 \\
 \hline
 2000 + \cancel{700} + 50 + 4 \\
 - 1000 + 500 + 60 + 2 \\
 \hline
 1000 + 100 + 90 + 2
 \end{array}$$

As introduced in Y3, but moving towards more complex numbers and values. Use place value counters to reinforce 'exchanging'.

$$\begin{array}{r}
 2\overset{6}{\cancel{7}}54 \\
 - 1562 \\
 \hline
 1192
 \end{array}$$

Once confident children are ready to move on to the compact method of subtraction.

Key Vocabulary

Equal to, take, take away, less, minus, subtract, leaves, distance between, difference between, how many more, how many fewer/less than, most, least, count back, how many left, how much less is_?, count on, strategy, partition, tens, units, exchange, decrease, hundreds, value, digit, *inverse*

Key Skills:

- * Subtract by counting on where numbers are close together or they are near to multiples of 10, 100 etc.
- * Children select a mental, written or jotting method depending on what the problem requires.
- * Children estimate and use the inverse operation to check a problem.
- * Children solve 2 step problems involving + and -, picking the correct operation and method.
- * Children solve simple money and measure problems with fractions and decimals.
- * Find 1000 more or 1000 less than a given number.
- * Count backwards through zero including negative numbers.
- * Recognise the place value of each digit in a 4 digit number.
- * Round any number to the nearest 10, 100 or 1000.
- * Solve number and practical problems that involve increasingly large positive integers.



Subtraction ~ Year 5

Focus: Subtracting with numbers beyond 4 digits including decimals

Children will continue to use the compact column method of subtraction to solve problems including those where exchanging is required. They will subtract larger integers and begin to subtract decimal amounts.

$$\begin{array}{r} \overset{2}{\cancel{8}} \overset{10}{\cancel{1}} \overset{0}{\cancel{0}} \overset{4}{\cancel{8}} \overset{6}{\cancel{6}} \\ - \quad \quad 2 \quad 1 \quad 2 \quad 8 \\ \hline 2 \quad 8, \quad 9 \quad 2 \quad 8 \end{array}$$

Children will come across problems where exchanging will need to take place several times to complete the problem.

$$\begin{array}{r} \overset{6}{\cancel{7}} \overset{10}{\cancel{1}} \overset{6}{\cancel{6}} \overset{8}{\cancel{8}} \overset{0}{\cancel{0}} \\ - \quad \quad 3 \quad 7 \quad 2 \quad \cdot \quad 5 \\ \hline 6 \quad 7 \quad 9 \quad 6 \quad \cdot \quad 5 \end{array}$$

Once confident with large integers, children will now be ready to move onto decimal numbers including lots in the context of measures and money. Just like addition, it is important that the children line up the decimal point and understand why they are doing this.

Key Vocabulary

Equal to, take, take away, less, minus, subtract, leaves, distance between, difference between, how many more, how many fewer/less than, most, least, count back, how many left, how much less is_?, count on, strategy, partition, tens, units, exchange, decrease, hundreds, value, digit, inverse, *tenths*, *hundredths*, *decimal place*, *decimal*

Key Skills:

- * Subtract mentally with increasingly large numbers.
- * Use rounding and estimation to check answers to calculations.
- * Solve addition and subtraction multi step problems, deciding which operations to use and why.
- * Read, write, order and compare numbers to at least 1 million and understand the value of each digit.
- * Count forwards or backwards in steps of powers of 10 up to 1 million.
- * Understand negative numbers in context and count forwards and backwards through 0.
- * Round any number up to 1 million to the nearest 10, 100, 1000, 10 000 and 100 000.



Subtraction ~ Year 6

Focus: Subtracting with increasingly complex numbers including decimals

Children will need to use mental methods and the compact column method of subtraction to solve an increasingly complex range of calculation including those with integers, those with decimals and those with mixed numbers.

	7	8	0	,	6	9	9
-		8	9	,	9	4	9
<hr/>							
		6	0	,	7	5	0

Children will use the compact method to solve problems involving integers up to 6 digits and beyond and solve problems where they will need to use 'exchanging' several times.

They will also solve problems in context involving increasingly large decimals. They will need to continue using their knowledge of decimal points to line up their numbers and place zeroes in any empty places so they fully understand the value of that column.

	7	0	5	.	4	1	9
-		3	6	.	0	8	0
<hr/>							
		6	9	.	3	3	9

Key Vocabulary

Equal to, take, take away, less, minus, subtract, leaves, distance between, difference between, how many more, how many fewer/less than, most, least, count back, how many left, how much less is_?, count on, strategy, partition, tens, units, exchange, decrease, hundreds, value, digit, inverse, tenths, hundredths, decimal place, decimal

Key Skills:

- * Solve addition and subtraction multi step problems in context, deciding which operations to use and why.
- * Read, write, order and compare numbers to at least 10 million and understand the value of each digit.
- * Round any whole number up to 10 million to the nearest 10, 100, 1000, 10 000, 100 000, or 1 million.
- * Use negative numbers in context and calculate intervals across zero.
- * Look at a calculation and decide whether you need to use a mental method, a jotting, a written method or a calculator to solve.



Multiplication ~ Year 1

Focus: Repeated addition with objects, arrays and pictorial representations.

Children will be exposed to many different multiplication based activities in a variety of contexts. Much of this will be repeated addition activities or be linked to counting in 2s, 5s or 10s.



How many legs will 2 dogs have?

$$4 + 4 = 8$$



There are five fish in each tank. How many fish are there altogether?

$$5 + 5 + 5 = 15$$

Children use images and pictorial representations to solve simple problems that involve repeated addition. They may wish to use the picture to support or use other equipment.

Adult support at this stage is to be expected. Some children may start to see the link between the problem above and counting in 5s and be able to use mental skills to solve the problem.

Key Vocabulary

Groups of, lots of, times, array, altogether, multiply, count

Key Skills:

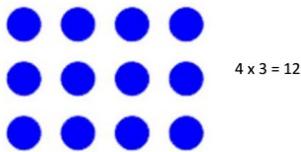
- * Count in multiples of 2, 5 and 10.
- * Solve 1 step problems involving multiplication using objects, arrays or pictures with support.
- * Make connections between arrays and counting in 2s, 5s and 10s.
- * Begin to understand doubling using objects and pictorial representations.
- * Solve practical problem solving activities counting equal sets or groups.
- * Have lots of practice counting and bundling groups of objects into 2s, 5s and 10s.



Multiplication ~ Year 2

Focus: Multiplying using arrays and repeated addition- 2,3,4,5,10x table facts

Children will be aware of simple arrays and pictorial representations and understand what they mean. In year 2 children will develop the knowledge of how to make their own arrays to solve a problem and also how repeated addition on a number line can get them to a solution.

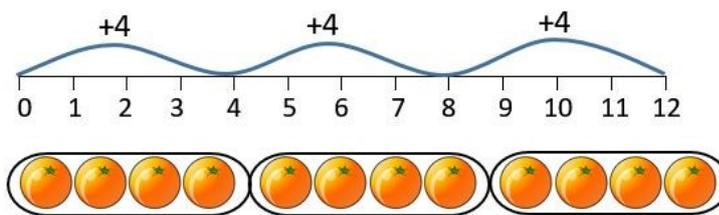


$3 \times 4 = 12$

$3 \times 4 = 4 + 4 + 4 = 12$
 $4 \times 3 = 3 + 3 + 3 = 12$

THE 'LOTS OF' MODEL

3×4 is the same as $4 + 4 + 4$



Arrays are super for children to solve the answer to simple problems. They are also great for showing children the commutative law, for example, if you turned this array for $3 \times 4 = 12$ sideways you would see that 4×3 also equals 12.

Repeated addition is a good progression from arrays. It encourages the children to use addition facts on a blank number line and count up to their answer as shown on the example to the left which models that $3 \times 4 = 12$.

Key Vocabulary

Groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, commutative, sets of, equal groups, times as big as, once, twice, three times

Key Skills:

- * Count in steps of 2, 3 and 5 from zero and in 10s from any number.
- * Recall and use multiplication facts for the 2, 5 and 10 times tables.
- * Recognise odd and even numbers.
- * Write and calculate number statements using the x and = signs.
- * Show that multiplication can be done in any order (the commutative law).
- * Solve a range of multiplication problems using objects, arrays, repeated addition, mental methods and multiplication facts.
- * Use and become familiar with all of the above multiplication language.



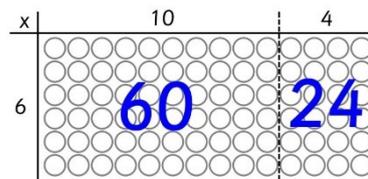
Multiplication ~ Year 3

Focus: Multiplying 2 digit numbers by 1 digit numbers

Children will move on from arrays and start using the grid method of multiplication. It is essential that before children move onto the grid method they are completely confident with all previous methods and have a solid grounding with mental methods and partitioning.

To do this, children must be able to:

- * Partition numbers into tens and units
- * Multiply multiples of ten by a single digit (e.g. 20×4) using their knowledge of multiplication facts and place value
- * Recall and work out multiplication facts in the 2, 3, 4, 5, 8 and 10 times tables.
- * Work out multiplication facts not known by repeated addition or other taught mental strategies (e.g. by commutative law, working out near multiples and adjusting, using doubling etc.) Strategies to support this are: repeated addition using a number line, bead bars and arrays:



X	10	4	
6	60	24	60
			+ 24
			84

Multiplication grid method requires good organisation but also a solid understanding of partitioning and multiplication facts, as you can see in the example to the above for 14×6 . The children need to remember that once they have multiplied the partitioned parts of the number, they then need to add the two totals together.

Key Vocabulary

Groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, commutative, sets of, equal groups, times as big as, once, twice, three times, partition, grid method, multiple, product, tens, units, value

Key Skills:

- * Recall and use multiplication facts for the 2, 3, 4, 5, 6 and 10 multiplication tables and multiply multiples of 10.
- * Write and calculate number sentences using known x tables.
- * Answer 2 digit x 1 digit problems using mental and written methods.
- * Solve multiplication problems in context including missing number problems.
- * Develop mental strategies using commutativity (e.g. $4 \times 12 \times 5 = 4 \times 5 \times 12 = 20 \times 12 = 240$) and for missing number problems.



Multiplication ~ Year 4

Focus: Multiplying 2 and 3 digit numbers by 1 digit numbers

Children need to use the grid method confidently to solve problems where a 2 or 3 digit number is multiplied by a one digit number. They need to move on to the use of short multiplication to solve 3 digit number multiplied by 1 digit problems.

$$613 \times 5 =$$

We partition 613 into 600 and 10 and 3 and put it in a table.

x	600	10	3
5	3000	50	15

Add up 3000, 50 and 15 to make 3065.

$$613 \times 5 = 3065$$

The grid method is extended in year 4 so children will now multiply 3 digit numbers by 1 digit numbers. When adding the 3 answers up to create a total, column addition could be used to ensure accuracy, especially where bridging through ten will be needed.

Short multiplication

24 x 6 becomes

$$\begin{array}{r} 24 \\ \times 6 \\ \hline 144 \\ \hline \end{array}$$

Answer: 144

342 x 7 becomes

$$\begin{array}{r} 342 \\ \times 7 \\ \hline 2394 \\ \hline \end{array}$$

Answer: 2394

Move on to 'short multiplication' (Y5) if children are confident in the grid method. This compact, 'short multiplication' method is tricky and needs to be approached carefully. At first children should solve a problem using the grid method and then observe the adult solve a problem using short multiplication and make comparisons. How are they similar? Children need to go through it very slowly and carefully, unpicking each step until they are fully confident.

Key Vocabulary

Groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, commutative, sets of, equal groups, times as big as, once, twice, three times, partition, grid method, multiple, product, tens, units, value, *inverse*

Key Skills:

- * Count in multiples of 6, 7, 8, 9, 25 and 1000.
- * Recall multiplication facts for all multiplication tables up to 12 x 12.
- * Recognise place value of digits in up to 4 digit numbers.
- * Multiply large numbers and multiple values mentally using place value, known facts and derived facts.
- * Use commutativity mentally to solve problems.
- * Solve problems in a range of contexts that are increasingly complex.



Multiplication ~ Year 5

Focus: Multiplying up to 4 digits by 1 or 2 digits

Children will continue to use short multiplication to solve increasingly richer problems that involve multiplying by 1 digit. They will then move on to long multiplication for problems that involve multiplying by 2 digits. Approximation and estimation will play an important factor with children making approximations and estimations before using long multiplication to help check that their answer is correct.

	2	3	6	8						
x				9						
			7	2	(9	x	8)			
		5	4	0	(9	x	6	0)		
	2	7	0	0	(9	x	3	0	0)	
1	8	0	0	0	(9	x	2	0	0	0)
¹ 2	¹ 1	¹ 3	1	2						

When multiplying by more than 1 digit, children need to use long, or expanded, multiplication. Like with short multiplication, they will solve the problem using the grid method first and then make comparisons until their understanding is secure. In the example to the left the brackets show the calculation broken down into steps. The final row shows the total of all four calculations.

Once long multiplication methods are secure, children are ready to move on to more challenging problems which require greater levels of mental calculation. The second problem to the left shows 1234×6 on the top line, 1234×10 on the bottom line and the total of both. Children can use brackets but once they understand the concept the brackets can be omitted.

$$\begin{array}{r}
 1234 \\
 \times 16 \\
 \hline
 7404 \quad (1234 \times 6) \\
 12340 \quad (1234 \times 10) \\
 \hline
 19744
 \end{array}$$

Key Vocabulary

Groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, commutative, sets of, equal groups, times as big as, once, twice, three times, partition, grid method, multiple, product, tens, units, value, inverse, square, factor, integer, decimal, short/long/expanded multiplication, carry

Key Skills:

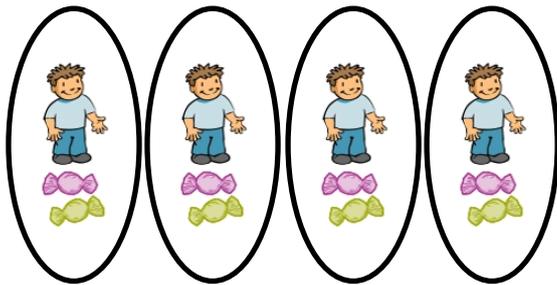
- * Identify multiples and factors, using secure \times table facts to 12×12 .
- * Solve problems where larger numbers are decomposed into their factors.
- * Multiply and divide integers and decimals by 10, 100 and 1000.
- * Recognise and use square and cube numbers and their notation.
- * Solve problems that have different combinations of operations, picking the most useful methods.



Division ~ Year 1

Focus: Grouping and sharing small quantities without remainders

Children will be introduced to division to solve problems in familiar and relevant contexts where they have to group or share. They will use a range of objects and pictorial representations to solve problems and they will begin to use counting in 2s, 5s and 10s to support their problems solving.



How many groups of 2 can be made with 8 sweets?
4 groups of 2.



There are 15 fish that need to be shared equally among 3 tanks. How many fish in each tank?
 $15 \text{ shared by } 3 = 5$

Children need to learn grouping and sharing alongside each other to ensure that they understand how they are linked. Grouping will also help children understand how multiplication can be used to solve division problems. Contextual problems will strengthen children's understanding of division.

Key Vocabulary

Share, share equally, one each, two each..., group, groups of, lots of, array

Key Skills:

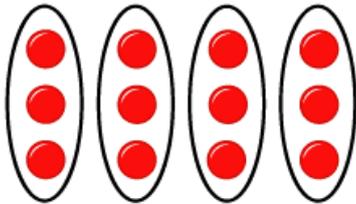
- * Solve one step problems involving multiplication and division using concrete objects with support from adults.
- * Children use grouping and sharing to understand division and to begin to understand finding simple fractions.
- * Children make connections between arrays and counting in 2s, 5s and 10s.
- * Children use halving and understand that this is the same as sharing into 2 equal groups.



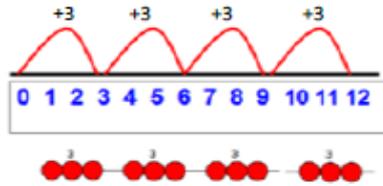
Division ~ Year 2

Focus: Grouping and sharing larger quantities using written methods and symbols

Children will continue to use the methods of sharing and grouping in division with objects to support their understanding of arrays for sharing and grouping and the division number line for grouping.



$$12 \div 3 = 4$$



$$12 \div 3 = 4$$

Division as sharing

- Division is the operation you can use to find how many groups or how many are in each group.
- Division always starts with the BIGGEST number first-the total!

$$12 \div 3 = 4$$

↓ ↓ ↓
 TOTAL Number of equal groups Number in each group

This represents $12 \div 3$, posed as how many groups of 3 are in 12? Pupils should also show that the same array can represent $12 \div 4 = 3$ if grouped horizontally.

Group from zero in equal jumps from the divisor to find out "how many groups of _ in _?". Pupils could use a bead string or practical apparatus to work out problems like "A CD costs £3. How many CDs can I buy with £12?" **This is an important method to develop understanding of division as grouping.**

Sharing or Grouping?

A teacher had 24 pencils. She put them in pencil cups. Each pencil cup held 4 pencils. How many pencil cups did she have?

2

Sharing or Grouping?

A teacher gave out 15 pencils to 5 students. Each student got the same number of pencils. How many pencils did each student get?

Key Vocabulary

Share, share equally, one each, two each..., group, groups of, lots of, array, *divided by*, *divided into*, *division*, *grouping*, *number line*, *left*, *left over*

Key Skills:

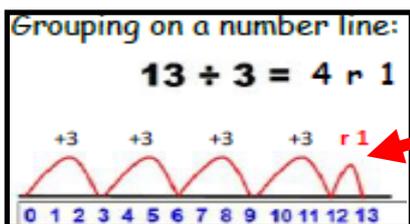
- * Count in steps of 2, 3 and 5 from 0.
- * Recall and use x and ÷ facts for the 2,5 and 10 times tables.
- * Solve division problems and write division number sentences for problems.
- * Understand that division is not commutative unlike multiplication.
- * Solve increasingly challenging division problems using concrete objects, arrays, and simple written methods such as grouping on a number line.



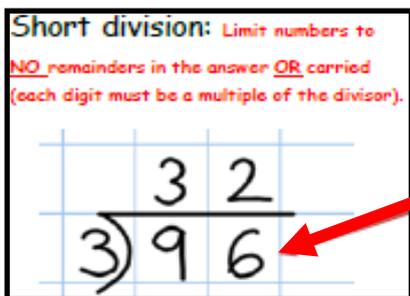
Division ~ Year 3

Focus: Dividing 2 digit numbers by 1 digit numbers moving from number line methods to short division

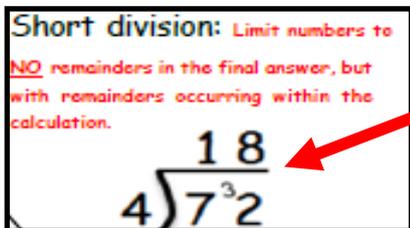
Children will continue to use a number line to solve division problems and will begin to jump more than one step at a time in the style of 'chunking'. Once confident they will move on to short division without any remainders, moving on to remainders when their knowledge is secure.



STEP 1: Children continue to work out unknown division facts by **grouping on a number line from zero**. They are also now taught the concept of **remainders**, as in the example. This should be introduced practically and with arrays, as well as being translated to a number line. Children should work towards calculating some basic division facts with remainders mentally for the 2s, 3s, 4s, 5s, 8s and 10s, ready for **carrying** remainders across within the short division method.



STEP 2: Once children are secure with division as grouping and demonstrate this using number lines, arrays etc., **short division** for larger 2-digit numbers should be introduced, initially with carefully selected examples requiring no calculating of remainders at all. It will begin by introducing the layout of short division by comparing it to an array. **Remind children of correct place value, that 96 is equal to 90 and 6, but in short division, pose:**
 How many 3's in 9? = 3, and record it above the **9 tens**.
 How many 3's in 6? = 2, and record it above the **6 units**.



STEP 3: Once children demonstrate a full understanding of remainders, and also the short division method taught, they can be taught how to use the method when remainders occur within the calculation (e.g. $96 \div 4$), and be taught to **carry** the remainder onto the next digit. **If needed, children should use the number line to work out individual division facts that occur which they are not yet able to recall mentally.**

Key Vocabulary

Share, share equally, one each, two each..., group, groups of, lots of, array, divided by, divided into, division, grouping, number line, left, left over, *inverse*, short division, carry, remainder, multiple

Key Skills:

- * Recall and use and \div facts for the 2, 3, 4, 5, 6, 8 and 10 x tables (using doubling to connect the 2, 4 and 8 x tables)
- * Solving division problems where a 2 digit number is divided by a 1 digit number using mental and written.
- * Solve problems in a variety of contexts including missing number problems.
- * Pupils begin to derive related facts e.g. $9 \div 3 = 3$ means $90 \div 3 = 30$ or $90 \div 30 = 3$.
- * Pupils develop confidence in written methods, moving from number lines to short division.



Division ~ Year 4

Focus: Consolidating and extending the use of short division

Children will continue to use short division to solve division problems. They will work on remainders, initially including problems where there are remainders in the first numbers within the workings, moving onto remainders in the final answer.

Short division: Limit numbers to
NO remainders in the final answer, but
with remainders occurring within the
calculation.

$$\begin{array}{r} 18 \\ 4 \overline{) 72} \end{array}$$

$$\begin{array}{r} 218 \\ 4 \overline{) 872} \end{array}$$

$$\begin{array}{r} 037 \\ 5 \overline{) 185} \end{array}$$

Pupils must be secure with the process of short division for dividing 2-digit numbers by a single digit (those that do not result in a final remainder — see steps in Y3), but must understand how to calculate remainders, using this to carry remainders within the calculation process (see example above).

Pupils move onto dividing numbers with up to **3-digits** by a single digit, however, problems and calculations provided should **not result in a final answer with remainder** at this stage. Children who exceed this expectation may progress to Y5 level.

When the answer for the **first column** is zero ($1 \div 5$, as in example), children could initially write a zero above to acknowledge its place, and must always **carry** the number (1) over to the next digit as a remainder.

Key Vocabulary

Share, share equally, one each, two each..., group, groups of, lots of, array, divided by, divided into, division, grouping, number line, left, left over, inverse, short division, carry, remainder, multiple, *divisible by*, factor

Key Skills:

- * Recall multiplication and division facts for all numbers to 12×12 .
- * Use place value and known facts to derive facts mentally- including multiplying and dividing by 100, 10 and 1.
- * Practise mental methods and extend this to three digit numbers using derived facts- e.g. $100 \div 5 = 20$ so $20 \times 5 = 100$.
- * Solve two step problems with increasingly harder numbers in a range of contexts, using language to identify the correct operation.
- * Correspondence problems should be introduced such as 3 cakes are shared equally between 10 children, 1 man has 6 cats so how many cats do 3 men have etc.



Division ~ Year 5

Focus: Extending use of short division to 4 digits and remainders and the introduction of long division (chunking)

Children will use short division to solve problems up to 4 digits long that are divisible by a single digit. For the first time they will be introduced to long division using the 'chunking' method. In the first instance of 'chunking', the calculations will not have any remainders.

$$\begin{array}{r} 0663 \text{ r } 5 \\ 8 \overline{) 5309} \end{array}$$

These division problems need to be contextual so the children learn how to express the remainders as a number, fraction or decimals, rounded up or rounded down.

$$\begin{array}{r} 196 \div 6 = 32 \text{ r } 4 \\ \text{H T U} \\ 6 \overline{) 196} \\ \underline{60} - (10 \times 6) \\ 136 \\ \underline{60} - (10 \times 6) \\ 76 \\ \underline{60} - (10 \times 6) \\ 16 \\ \underline{12} - (2 \times 6) \\ 4 \end{array}$$

As children begin to use their knowledge of multiplication tables, particularly with multiples of ten for each table, they can progress from taking 10 chunks of a divisor to $30 \times 6 = 180$ and subtract this larger chunk.

$$10 + 10 + 10 + 2 = 32$$

4 remaining

$$\begin{array}{r} 27 \\ 36 \overline{) 972} \\ \underline{- 720} \\ 252 \\ \underline{- 252} \\ 0 \end{array}$$

Answer : 27

20x
7x

Key Vocabulary

Share, share equally, one each, two each..., group, groups of, lots of, array, divided by, divided into, division, grouping, number line, left, left over, inverse, short division, carry, remainder, multiple, divisible by, factor, quotient, prime number, prime factors, composite number (non-prime), chunking

Key Skills:

- * Multiply and divide numbers mentally, using known facts.
- * Identify multiples and factors, including all factor pairs of a number and common factors between 2 numbers.
- * Solve \times and \div problems where larger numbers are decomposed into their factors.
- * Multiply and divide whole numbers and decimals by 10, 100 and 1000.
- * Use vocabulary of prime numbers, prime factors and composite numbers.
- * Work out whether a number up to 100 is prime and know all prime numbers to 30.
- * Use and understand multiplication and division as inverses.
- * Present division with remainders answers differently, showing the remainder as a fraction, decimal or whole number by rounding.
- * Solve problems with a combination of all four operations including fraction scaling problems and problems involving simple rates.



Division ~ Year 6

Focus: Using division to divide 4 digit numbers and express remainders as fractions and/or decimals and long division for dividing 2 digit numbers

Children will use short division to divide decimal numbers by single digit numbers. The final step of division will be long division which will be used to divide numbers by 2 or more digits.

$$\begin{array}{r} 0812.125 \\ 8 \overline{)6497.0^20^40} \end{array}$$

The focus is not so much the method of short division but how the remainders are expressed. Children need to express remainders as decimals and fractions depending on the context of the question. The remainder in this answer would have been 1 but it has been expressed as a decimal. To do this, children need to insert a decimal point next to the units and carry the remainder over the decimal point. Zeroes are inserted to the right of the decimal point to show that there was no value.

To divide by 2 digit numbers, the children will use the method of long division. The example below shows the method in the 'Burger' steps, whereas the example to the right shows what a completed method would look like. Any remainders would need to be expressed in a way that matched the context of the problem.

$$\begin{array}{r} 291 \\ 45 \overline{)13095} \\ \underline{90} \\ 409 \\ \underline{405} \\ 45 \\ \underline{45} \\ 0 \end{array}$$

Divide: $\begin{array}{r} 2 \\ 3 \overline{)75} \end{array}$ $\left\{ \begin{array}{l} 3 \text{ goes into } 7 \\ 2 \text{ times...} \\ \text{with some extra!} \end{array} \right.$

Multiply: $\begin{array}{r} 2 \\ 3 \overline{)75} \\ \underline{6} \end{array}$ $2 \times 3 = 6$

Subtract: $\begin{array}{r} 2 \\ 3 \overline{)75} \\ \underline{-6} \\ 1 \end{array}$

Bring Down: $\begin{array}{r} 2 \\ 3 \overline{)75} \\ \underline{-6} \\ 15 \end{array}$

Repeat: $\begin{array}{r} 25 \\ 3 \overline{)75} \\ \underline{-6} \\ 15 \\ \underline{-15} \\ 0 \end{array}$ $15 \div 3 = 5$
 $5 \times 3 = 15$

Key Vocabulary

Share, share equally, one each, two each..., group, groups of, lots of, array, divided by, divided into, division, grouping, number line, left, left over, inverse, short division, carry, remainder, multiple, divisible by, factor, quotient, prime number, prime factors, composite number (non-prime), chunking, common factor

Key Skills:

- * Use multiplication and division facts up to 12 x 12 to solve more complex problems.
- * Decide when to use short or long division and interpret remainders in a way that is appropriate to the problem.
- * Perform mental calculations for problems involving large numbers and mixed calculations.
- * Identify common factors, common multiples and prime numbers.
- * Use estimation to check answers to calculations and determine accuracy.
- * Use written methods of division to solve decimal problems up to 2 decimal places.
- * Solve problems which require rounding to 10, 100, 1000 and beyond.