Saltaire Primary School – Calculations Policy – January 2017

Mathematics is a creative and highly inter-connected discipline that has been developed over centuries, providing the solution to some of history's most intriguing problems. It is essential to everyday life, critical to science, technology and engineering, and necessary for financial literacy and most forms of employment. A high-quality mathematics education therefore provides a foundation for understanding the world, the ability to reason mathematically, an appreciation of the beauty and power of mathematics, and a sense of enjoyment and curiosity about the subject.

Saltaire Primary School
- OUR LEARNING JOURNEY -

Our Purpose:

We build children's fluency and deep understanding of the four operations by following a clear and simple journey.

By using only the methods contained in this policy and by using models, images and concrete resources to represent learning along the journey, children develop their secure understanding of the four standard written methods by Year 6 – written addition, subtraction, short and long multiplication, and short and long division. All staff working with children must have their own secure understanding of the methods and representations used at Saltaire Primary School through each stage of their learning journey so that children are not confused by alternative or inappropriate methods.

This clear, robust and consistent approach will ensure that children are able to master the key concepts of mathematics with fluency, reasoning and problem solving skills for life.

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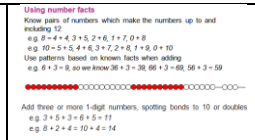
Operation: Addition	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
National Curriculum Programme of Study	Read, write and interpret mathematical statements involving addition (+) and equals (=) signs (using numbers from 0 to 20). Add 1 and 2 digit numbers to 20, including zero. Solve one-step problems that involve addition, using concrete objects and pictorial representations, and missing number problems such as 7= □ + 9.	Recall and use addition facts to 20 fluently, and derive and use related facts up to 100. Add numbers using concrete objects, pictorial representations, and mentally, including: ⍰ a two-digit number and ones ⍰ a two-digit number and tens ⍰ two two-digit numbers ⍰ adding three one-digit numbers (for all, without going across a boundary of 10 or 100). Show that addition can be done in any order (commutative). Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.	Add numbers with up to three digits, using formal written method of columnar addition. Estimate the answer to a calculation and use inverse operations to check answers. Solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction.	Add numbers with up to 4 digits using the formal written methods of columnar addition where appropriate. Estimate and use inverse operations to check answers to a calculation. Solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why.	Add whole numbers with more than 4 digits, including using formal written methods (columnar addition). Add numbers mentally with increasingly large numbers. Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy. Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.	Use their knowledge of the order of operations to carry out calculations involving the four operations. Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why. Solve problems involving addition, subtraction, multiplication and division. Use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.
Methods	Adding using concrete Objects. Number line for counting on – within 10, then beyond 10. Counting on from largest number. Numbered and then unnumbered number line. Missing numbers, e.g. 10 = □ + 4.	Crossing 10s using concrete resources – bead strings, counters, base 10, Numicon. Adding 10 – base 10, straw bundles, number line. Add by partitioning – base 10, straws, - on number line/ blank number line. Begin to use 'Swap Shop' method using base 10 initially. (See appendix).	Initially, using the swap shop method with base 10: 352+468= Base 10 to represent: 300 + 50+ 2 400 + 60 + 8 700 + 110 + 10 = 120 Then: 789 + 642 becomes 7 8 9 + 6 4 2 1 4 3 1 1 1 Answer: 1431	Continue to use the swap shop method with Base 10 (see appendix) where necessary, leading to the formal column method for up to four digit numbers and to two decimal places in the context of money and measure. 789 + 642 becomes 7 8 9 + 6 4 2 1 4 3 1 1 1 Answer: 1431	Consistent use of formal methods (with place value knowledge) as previously taught progressing to five or more digit numbers. Adding tree or more numbers. Using column addition and subtraction methods in context, e.g. with two decimal places with money. 789 + 642 becomes 7 8 9 + 6 4 2 1 4 3 1 1 1 Answer: 1431	Consistent use of formal methods (with place value knowledge) as previously taught. Extending to any number of digits; multiple decimal places. Use of BIDMAS to order operations.

		 52+68= 50+ 2 60 + 8 _____ 110 + 10 = 120	Add and subtract numbers mentally, including: a 3 digit number and ones a 3 digit number and tens a 3 digit number and hundreds 100 + 32 (as can be done mentally using knowledge of complements recombining) Use a bead string to support the teaching of complements to 100 for addition and subtraction. Adhere to the swap shop and NCETM guidance for layout of standard written methods rather than the use of the coloured place value numbers used in Abacus.	Add fractions with the same denominator, e.g. 3/8 + 1/8 + 1/8 Children should be given opportunities to apply mental knowledge (including bonds) for addition to decide which is the most appropriate method to use. 3000 + 567 3472 + 1111 3456 + 1000 5634 + 100 6743 + 10 (as all of these can be done mentally referring to place value).	Add related fractions e.g. 3/4 + 1/8 = 7/8 Counting in, on and back decimal numbers including tenths and hundredths is an important skill to practise to support with adding and subtracting decimal numbers. Children need to realise that they cannot apply the number of digits to the size of the number with decimals in the same way as we can with whole numbers, e.g. 0.51 is less than 0.6.	Add unrelated fractions, including mixed numbers e.g. 1/4 + 2/3= 11/12 e.g. 2 1/4 + 1 1/3 = 3 7/12 Counting in, on and back with decimal numbers including tenths, hundredths and thousandths is an important skill to practise to support adding and subtracting decimal numbers. Children need to realise that they cannot apply the number of digits to the size of the number with decimals in the same way as we can with whole numbers, e.g. 0.006 is less than 0.06. They perform mental calculations, including with mixed operations and larger numbers. Undertake mental calculations with increasingly large numbers and more complex calculations.

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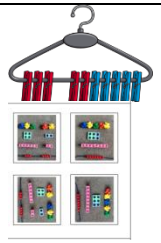
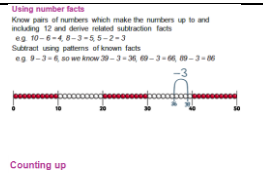
Operation: Subtraction	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
National Curriculum Programme of Study	Read, write and interpret mathematical statements involving subtraction (-) and equals (=) signs (using numbers from 0 to 20) Represent and use number bonds and related subtraction facts within 20. Subtract 1 and 2 digit numbers to 20, including zero. Solve one-step problems that involve subtraction, using concrete objects and pictorial representations, and missing number problems.	Recall and use subtraction facts to 20 fluently, and derive and use related facts up to 100 subtract numbers using concrete objects, pictorial representations, and mentally, including: □ a two-digit number and ones □ a two-digit number and tens □ two two-digit numbers □ adding three one-digit numbers (for all, without going across a boundary of 10 or 100) Show that subtraction of one number from another cannot be done in any order. Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.	Subtract numbers with up to three digits, using formal written method of columnar subtraction (where the smaller number contains digits greater than 5 so decomposition has to occur) Estimate the answer to a calculation and use inverse operations to check answers. Solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction.	Subtract numbers with up to 4 digits using the formal written methods of columnar subtraction where appropriate Estimate and use inverse operations to check answers to a calculation Solve subtraction two-step problems in contexts, deciding which operations and methods to use and why.	Subtract numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction) Subtract numbers mentally with increasingly large numbers Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.	Use their knowledge of the order of operations to carry out calculations involving the four operations Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why Solve problems involving addition, subtraction, multiplication and division Use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy
Methods	Using concrete objects within 20. Using number line progressing from within 10/ over 10/ within 20 Number problems represented by numicon and base 10 Recording using – and = Missing number problems	To support mental subtraction/ finding the difference: Number line counting from smaller to larger number – counting up. Partitioning numbers with base 10. Column subtraction within 100 represented by base 10 – no carrying	874 – 523 becomes 8 7 4 – 5 2 3 3 5 1 Answer: 351 932 – 457 becomes 8 12 1 9 3 2 – 4 5 7 4 7 5 Answer: 475 Above represented by base	Continue to use the swap shop method where necessary, leading the formal column method for up to four digits and up to two decimal places in the context of money/measure. 932 – 457 becomes 8 12 1 9 3 2 – 4 5 7 4 7 5 Answer: 475	Consistent use of formal methods (with place value knowledge) as previously taught. Extending to 5 digits and money and measurement to 2 decimal places	Consistent use of formal methods (with place value knowledge) as previously taught. Extending to any number of digits; multiple decimal places. Use of BIDMAS to order operations.

			10 Continue to support mental subtraction/ finding the difference: Number line counting from smaller to larger number/ counting back – depending on size of 'gap'. Counting in 10s/ units on number line	932 – 457 becomes 1 1 9 3 2 – 4 5 7 5 6 4 7 5 Answer: 475		
			Add and subtract numbers mentally, including: a 3 digit number and ones a 3 digit number and tens a 3 digit number and hundreds 100 – 35 (as can be done mentally using knowledge of complements of 100)	Subtract like fractions e.g. 3/8 – 1/8 = 2/8 Continue to support mental subtraction/ finding the difference: Number line counting from smaller to larger number – especially for finding the difference/ change/ money and time calculations when more efficient method than formal column.	Subtract related fractions e.g. 3/4 – 1/8 = 5/8 Counting in, on and back decimal numbers including tenths and hundredths is an important skill to practise to support with adding and subtracting decimal numbers. Children need to realise that they cannot apply the number of digits to the size of the number with decimals in the same way as we can with whole numbers, e.g. 0.51 is less than 0.6.	Subtract unlike fractions, including mixed numbers e.g. 3/4 – 1/3 = 5/12 e.g. 2 3/4 – 1 1/3 = 1 5/12 Counting in, on and back with decimal numbers including tenths, hundredths and thousandths is an important skill to practise to support adding and subtracting decimal numbers. Children need to realise that they cannot apply the number of digits to the size of the number with decimals in the same way as we can with whole numbers, e.g. 0.006 is less than 0.06. They perform mental calculations, including with mixed operations and larger numbers. Undertake mental calculations with increasingly large numbers and more complex calcluations.

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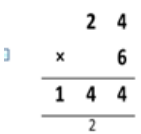
Operation: Multiplication	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
National Curriculum Programme of Study	Solve one-step problems involving multiplication by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher	Recall and use multiplication facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers Calculate mathematical statements for multiplication within the multiplication tables and write them using the multiplication (×) and equals (=) signs Show that multiplication of two numbers can be done in any order (commutative)	Recall and use multiplication and facts for the 3, 4 and 8 multiplication tables Write and calculate mathematical statements for multiplication using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods	Recall multiplication for multiplication tables up to 12 × 12 Use place value, known and derived facts to multiply mentally, including: multiplying by 0 and 1; multiplying together three numbers Recognise and use factor pairs and commutativity in mental calculations Multiply two-digit and three-digit numbers by a one-digit number using formal written layout	Solve problems involving multiplication where larger numbers are used by decomposing them into their factors 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 numbers mentally drawing upon known facts Multiply whole numbers and those involving decimals by 10, 100 and 1000	Multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long Multiplication Use estimation to check answers to calculations and determine, in the context of a problem, levels of accuracy
Methods	5 groups of 2 is 10.  4 groups of 5 is 20 	Repeated addition of 2,5,10 Represent on arrays and number line Use x= to record Accompany number sentence with array representation (eg 2x4 Progress to written methods when ready	Represent on arrays and number line as repeated addition and then multiplication to record Count in 3s,4s,8s, 50s, 100s Accompany number sentence with array representation and find related sentences (eg 4x5 and 5x4) Formal method using Base 10 representations (see appendix)	24 × 6 becomes  Answer: 144	Short multiplication 342 × 7 becomes  Answer: 2394	Consistent use of formal methods (with place value knowledge) as previously taught. Multiply decimals by whole numbers, starting with the simplest cases, such as 0.4 × 2 = 0.8, and in practical contexts, such as measures and money. Continue to teach short multiplication with decimals, e.g. £13.72 x 6. Long multiplication (multiplying where both numbers are two digits or more):

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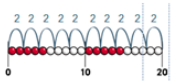
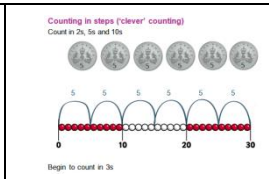
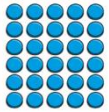
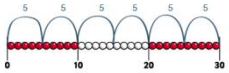
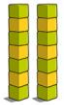
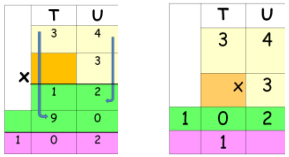
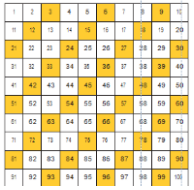
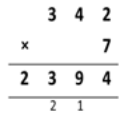
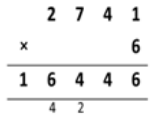
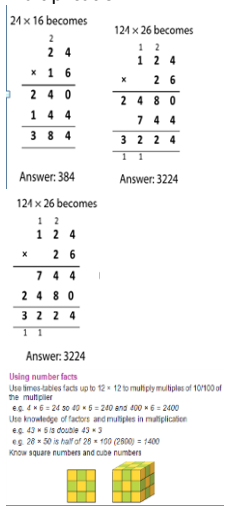
	Counting in steps ('clever' counting) Count in 2s  **Doubling and halving** Find doubles to double 5 using fingers e.g. *double 3*  **Grouping** Begin to use visual and concrete arrays and sets of objects to find the answers to 'three lots of four' or 'two lots of five' e.g. *three lots of four* 	 Begin to count in 3s **Grouping** Use arrays to find answers to multiplication and relate to 'clever' counting e.g. *3 × 4 as three lots of four things* e.g. *6 × 5 as six steps in the 5s count as well as six lots of five*   Understand that 5 × 3 can be worked out as three 5s or five 3s **Using number facts** Know doubles to double 20 e.g. *double 7 is 14*  Start learning ×2, ×5, ×10 tables, relating these to 'clever' counting in 2s, 5s, and 10s e.g. *5 × 10 = 50, and five steps in the 10s count = 10, 20, 30, 40, 50* 	 5x4 and 3x10: these can be done mentally. Pupils continue to practise their mental recall of multiplication tables when they are calculating mathematical statements in order to improve fluency. Through doubling, they connect the 2, 4 and 8 multiplication tables. Pupils develop efficient mental methods, e.g. using commutativity and associativity (for example, 4 × 12 × 5 = 4 × 5 × 12 = 20 × 12 = 240) and multiplication and division facts (for example, using 3 × 2 = 6, 6 ÷ 3 = 2 and 2. Counting in groups and recognising rules and relationships  **At Saltaire Primary School, we use the short multiplication method shown in appendix one of the NC as opposed to the grid method. (See appendix)**	342 × 7 becomes  Answer: 2394 97x100 and 242÷2: these can be done mentally. use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers. recognise and use factor pairs and commutativity in mental calculations 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).	2741 × 6 becomes  Answer: 16 446 Leading to long multiplication:  Encourage to use known facts when calculating, e.g. x10, x100, x1000 and vice versa, 600x70 (use knowledge of 6x7).	Multiply pairs of fractions, e.g ¾ x ½ = 3/8 Multiply fractions by whole numbers, e.g ¾ x 3 = 9/4 = 2 ¼ Pupils continue to use all the multiplication tables to calculate mathematical statements in order to maintain their fluency. Pupils round answers to a specified degree of accuracy, for example, to the nearest 10, 20, 50 etc. Pupils explore the order of operations using brackets; e.g. 2 + 1 x 3 = 5 and (2 + 1) x 3 = 9. Common factors can be related to finding equivalent fractions. Identify common factors, common multiples and prime numbers. .

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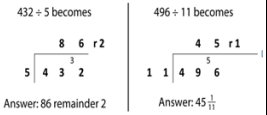
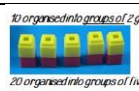
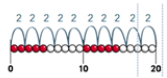
Operation: Division	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
National Curriculum Programme of Study	Solve one-step problems involving division by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.	Recall and use division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers. Calculate mathematical statements for division within the multiplication tables and write them using the division and equals (=) signs. Show that division of one number by another cannot be done in any order.	Recall and use division facts for the 3, 4 and 8 multiplication tables. Write and calculate mathematical statements for division using the multiplication tables that they know using mental and progressing to formal written methods.	Recall division facts for multiplication tables up to 12 × 12. Use place value, known and derived facts to divide mentally, including: dividing by 1. Recognise and use factor pairs and commutativity in mental calculation.	Solve problems involving division where larger numbers are used by decomposing them into their factors. Divide numbers up to 4-digits by a 1-digit number using the formal written method of short division and interpret the remainders appropriately for the context. Divide numbers mentally drawing upon known facts. Divide whole numbers and those involving decimals by 10, 100 and 1000.	Use estimation to check answers to calculations and determine, in the context of a problem, levels of accuracy. Divide numbers up to 4-digits by a 2-digit whole number using the formal written method of long division and interpret remainders as whole number remainders, fractions, or by rounding as appropriate for the context.
Methods: Written Mental [Examples of pictorial representations and use of concrete resources].	Sharing using concrete apparatus – quantities up to 20. Grouping in 2s,5s,10s, Represent as counter Arrays.	Represent with counter arrays for known times tables. Introduce concept of remainders when grouping with counters. Repeated addition on a number line.	Represent times table division facts using arrays Repeated addition on number line using larger numbers and using chunking. Short division using Base 10 (see appendix) - no remainders for two digit divided by 1 digit: 98 ÷ 7 becomes 1 4 7 | 9 2 8	Represent new times table division facts using arrays . Repeated addition on number line using larger numbers, using chunking, identifying remainders. Short division no remainders for three digit divided by 1 digit. Progressing to remainders	Repeated addition on number line using larger numbers, using chunking, identifying remainders. Short division with remainder interpretation for up to 4 digits divided by 1 digit. 432 ÷ 5 becomes 8 6 r2 5 | 4 3 3 2	Short division (where the divisor is a single digit and greater than the first integer): please see the step-by-step guidance in Appendix  Long division (where the divisor has two digits or more):



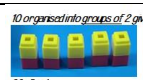
Counting in steps ('clever' counting)

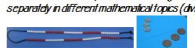
Count in 2s



Doubling and halving

Find half of even numbers up to 12, including realizing that it is hard to halve an odd number





Doubling and halving

Find half of numbers up to 40, including realising that half of an odd number gives a remainder of 1 or an answer containing a 1/2

e.g. 1/2 of 11 = 5 1/2

Begin to know half of multiples of 10 to 100

e.g. half of 70 is 35

Grouping

Relate division to multiplication by using arrays or towers of cubes to find answers to division

e.g. 'How many towers of five cubes can I make from twenty cubes?' as _ × 5 = 20 and also as 20 ÷ 5 = _

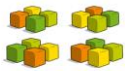
Relate division to 'clever' counting and hence to multiplication

e.g. 'How many fives do I count to get to twenty?'

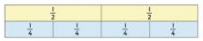
Sharing

Begin to find half or a quarter of a quantity using sharing

e.g. find a quarter of 16 cubes by sorting the cubes into four piles



Find 1/4, 1/2, 3/4 of small quantities



24÷4: this can be done mentally by using known times tables.

Pupils develop efficient mental methods, e.g. using commutativity and associativity (for example, 4 × 12 × 5 = 4 × 5 × 12 = 20 × 12 = 240) and multiplication and division facts (for example, using 3 × 2 = 6, 6 ÷ 3 = 2 and 2.

Use halving as a strategy in dividing by 2

e.g. 36 ÷ 2 is half of 36 = 18

Find half of odd numbers

Using number facts

Know half of even numbers to 40

Know half of multiples of 10 to 200

e.g. *half of 170 is 85*

Know ×2, ×3, ×4, ×5, ×8, ×10 division facts

At Saltaire Primary School, we use the short division method shown in appendix one of the NC as opposed to the grid method. See appendix.

Short division (where the divisor is a single digit) with EXACT answers (see Appendix). Use bundles of straws or Base 10 to teach. Questions should require regrouping and be based on 2 and 3 digit numbers.

Short division

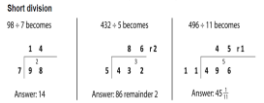
98 ÷ 7 becomes

$$\begin{array}{r} 1\ 4 \\ 7\overline{)\ 9\ 8} \\ \end{array}$$

Answer: 14

Only begin to teach remainders when ready: this comes in Year 5.

Short division (where the divisor is a single digit):



Yr5 progresses from no remainder in Yr4 (picture one) into remainders (pictures two and three). Remainders should be recorded as fractions, decimals or rounding (context dependent). 138÷6 could be modelled using the appendix 2 method.

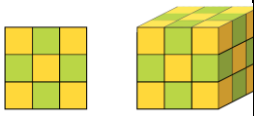
Children who are ready can be extended to using the long division method.

Using number facts

Use division facts from the times-tables up to 12 × 12 to divide multiples of powers of 10 of the divisor

e.g. 3600 ÷ 9 using 36 ÷ 9

Know square numbers and cube numbers



Turn improper fractions into mixed numbers and vice versa

432 ÷ 15 becomes

$$\begin{array}{r} 2\ 8\ \text{r}\ 12 \\ 1\ 5\overline{)\ 4\ 3\ 2} \\ 3\ 0\ 0 \\ \hline 1\ 3\ 2 \\ 1\ 2\ 0 \\ \hline 1\ 2 \end{array}$$

Answer: 28 remainder 12

432 ÷ 15 becomes

$$\begin{array}{r} 2\ 8 \\ 1\ 5\overline{)\ 4\ 3\ 2} \\ 3\ 0\ 0 \quad 15\times 20 \\ \hline 1\ 3\ 2 \\ 1\ 2\ 0 \quad 15\times 8 \\ \hline 1\ 2 \end{array}$$

$\frac{12}{15} = \frac{4}{5}$

Answer: $28\frac{4}{5}$

432 ÷ 15 becomes

$$\begin{array}{r} 2\ 8\cdot 8 \\ 1\ 5\overline{)\ 4\ 3\ 2\cdot 0} \\ 3\ 0 \\ \hline 1\ 3\ 2 \\ 1\ 2\ 0 \\ \hline 1\ 2\ 0 \\ 1\ 2\ 0 \\ \hline 0 \end{array}$$

Answer: 28·8

Use division facts from the times-tables up to 12 × 12 to divide decimal numbers by 1-digit numbers e.g. 1·17 ÷ 3 is 1/100 of 117 ÷ 3 (39)

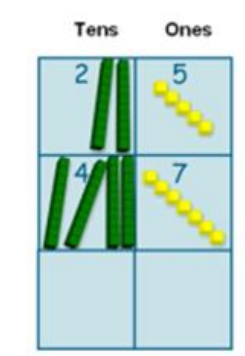
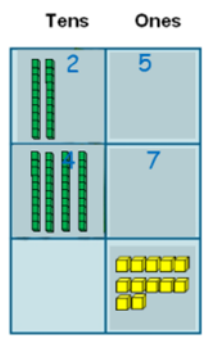
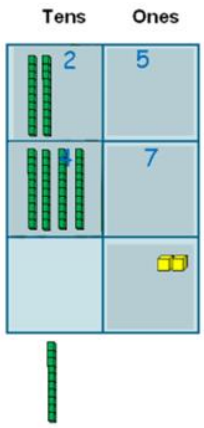
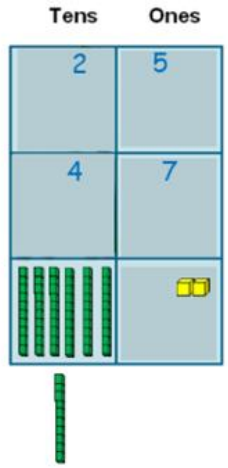
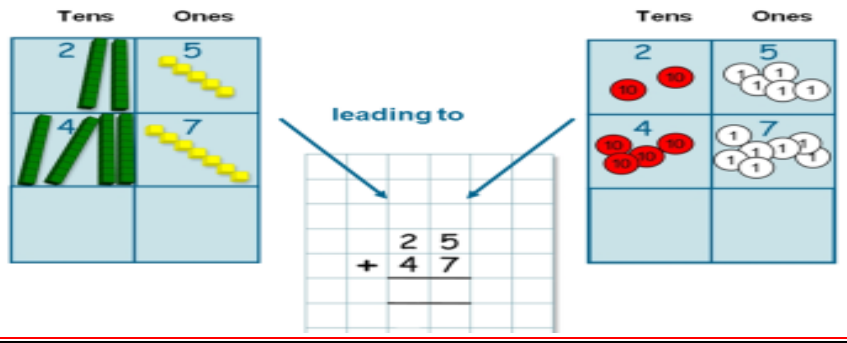
Know tests of divisibility for numbers divisible by 2, 3, 4, 5, 9, 10 and 25.

Appendix I – Swap Shop method at Saltaire Primary School

How to teach 'Swap shop' using bundles of straws or Base 10:

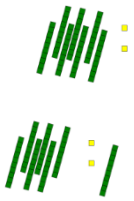
Addition: the children play a 'Swap shop' game with the teacher where they swap a ten stick for ten 'units' and vice versa. When the children have an understanding of the method shown, they practise on a prepared grid using concrete resources such as bundles and/ base 10/ and or counters. This supports with understanding the concepts that underpin the column addition method.

25+47 as a written method (reference to NCETM):

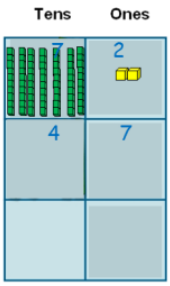
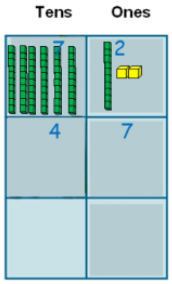
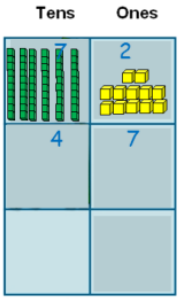
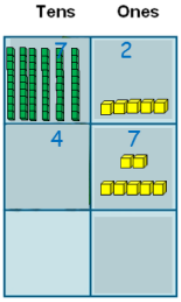
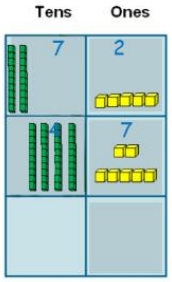
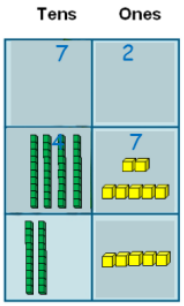
<table>
<tr><td>Step One</td><td>Step Two</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>Step Three</td><td>Step Four</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td colspan="2">Step Five: the written method for addition
 
</td></tr>
</table>

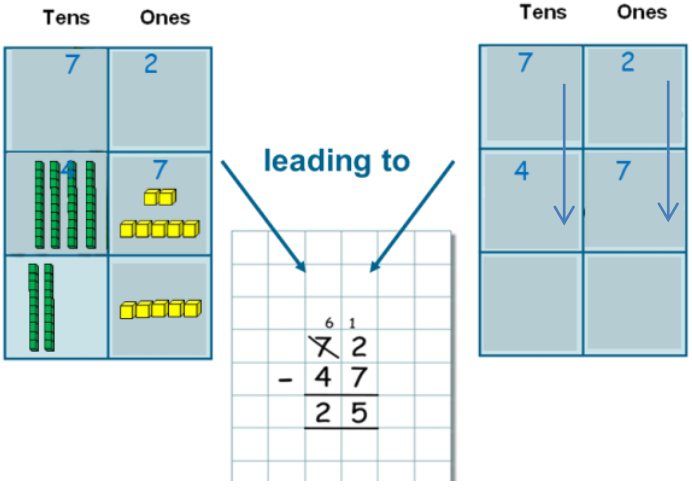
Subtraction:

1. Start with the children playing a 'Swap shop' game with the teacher where they swap a ten stick for ten 'units' and vice versa then the children understanding the method shown and practised on a prepared grid using concrete resources such as bundles and/ base 10/ and or counters leading to the decomposition method that can be visualised:



2. Partitioning numbers in different ways using base 10 equipment as the resource needs to be explored:

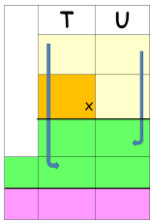
Step One	Step Two	Step Three
		
Step Four	**Step Five**	**Step Six**
		

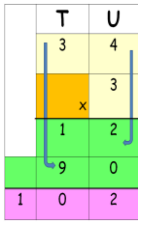


Teaching short multiplication using concrete resources

Expanded short multiplication

When beginning to teach short multiplication it is useful to give the answers separately first and then combine. So, multiply the digit in the Units column first and write the product underneath then multiply the tens digit and write the product underneath that. Finally total the two amounts. Use the following scaffold to help with the layout and use Base Ten resources to build as you go.



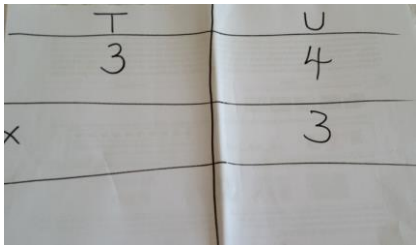


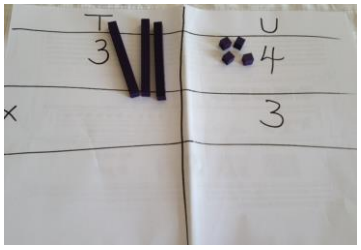
Standard Written Method of Short Multiplication

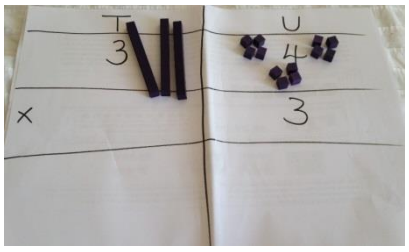
The following will demonstrate how this method can be taught to children with conceptual understanding related to place value.

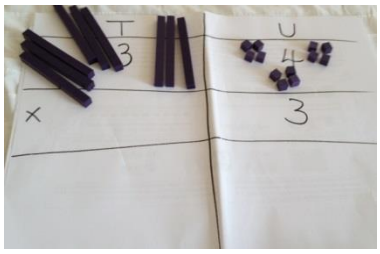
The following uses the example of 34 x 3 ('thirty-four multiplied by three'; 'thirty-four, three times'):

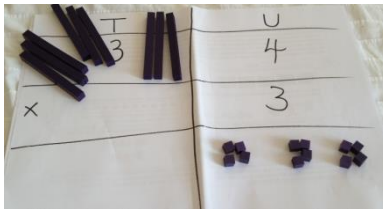
Draw a grid labeled with tens and ones and then build the number being multiplied (called the multiplicand) which is usually the larger amount of the two for ease:

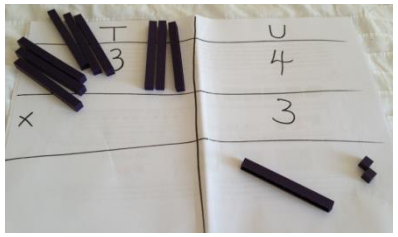




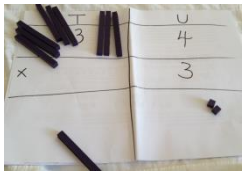






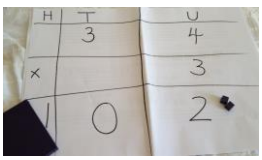


Move the product of the two Units into the Units answer box: If that product exceeds 9 then it will need to be reorganised in relation to its place value and then 'carried' over:

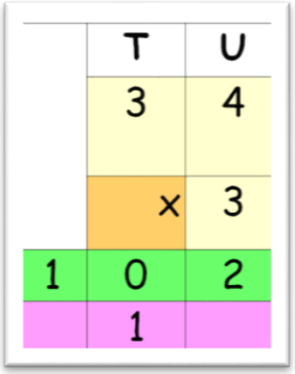


Combine the product for the Tens column with the carried amount and consider if it needs to be 'carried'

again (i.e. if the total of the carried amount and the product exceeds nine of them):

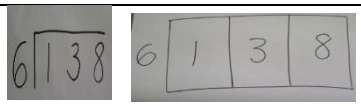
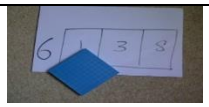
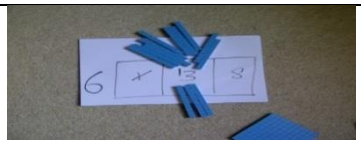
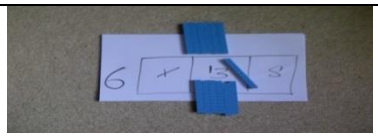
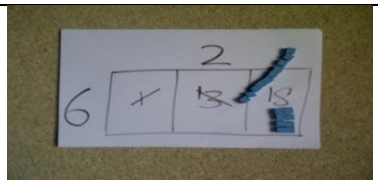
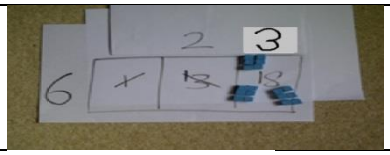
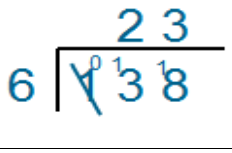


This can be modelled and calculated using the grid here:



How to teach short division:

The method could be demonstrated in a guided session using 'Base 10' or 'bundles of straws', describing that each of the pieces of equipment cannot be PHYSICALLY split into groups , as follows: 138 ÷ 6

When exploring how the method works, write the calculation so that the digits are separated:	
Work through a section at a time being aware of the place value;	 *How many groups of sixes can I physically break this 100 flat into?' 'None.'*
So move the digit not used across and then build the new number (which is now thought of as thirteen tens because it is in the tens column) with ten sticks:	
'How many groups of six can you physically make out of thirteen tens?' 'Two groups of six tens each with one ten stick left over (remaining)':	
'Carry the remaining digit over to the next section and then build the new number':	
'How many groups of six can you make with eighteen units?' 'Three groups of six':	
'So the answer to one hundred and thirty-eight divided by six is twenty-three groups of six':	

Appendix 2 – National Curriculum Guidance

Mathematics Appendix 1: Examples of formal written methods for addition, subtraction, multiplication and division

This appendix sets out some examples of formal written methods for all four operations to illustrate the range of methods that could be taught. It is not intended to be an exhaustive list, nor is it intended to show progression in formal written methods. For example, the exact position of intermediate calculations (superscript and subscript digits) will vary depending on the method and format used.

For multiplication, some pupils may include an addition symbol when adding partial products. For division, some pupils may include a subtraction symbol when subtracting multiples of the divisor.

Addition and subtraction

789 + 642 becomes

$$\begin{array}{r} {\scriptstyle 1\ 1\ \ } \\ 789 \\ +\ 642 \\ \hline 1431 \end{array}$$

Answer: 1431

874 – 523 becomes

$$\begin{array}{r} \\ 874 \\ -\ 523 \\ \hline 351 \end{array}$$

Answer: 351

932 – 457 becomes

$$\begin{array}{r} {\scriptstyle 8\ 12\ 1\ \ } \\ 9\not{3}\not{2} \\ -\ 457 \\ \hline 475 \end{array}$$

Answer: 475

932 – 457 becomes

$$\begin{array}{r} {\scriptstyle \ 1\ \ 1\ \ } \\ 9\ 3\ 2 \\ -\ 4\not{5}\not{7} \\ \hline 475 \end{array}$$

Answer: 475

Short multiplication

24 × 6 becomes

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

Answer: 144

342 × 7 becomes

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

Answer: 2394

2741 × 6 becomes

$$\begin{array}{r} \\ 2741 \\ \times\ \ \ 6 \\ \hline 16446 \end{array}$$

Answer: 16 446

Long multiplication

24 × 16 becomes

$$\begin{array}{r} {\scriptstyle 2\ \ } \\ 24 \\ \times\ 16 \\ \hline 240 \\ 144 \\ \hline 384 \end{array}$$

Answer: 384

124 × 26 becomes

$$\begin{array}{r} {\scriptstyle 1\ 2\ \ } \\ 124 \\ \times\ \ 26 \\ \hline 2480 \\ 744 \\ \hline 3224 \\ {\scriptstyle 1\ 1\ \ } \end{array}$$

Answer: 3224

124 × 26 becomes

$$\begin{array}{r} {\scriptstyle 1\ 2\ \ } \\ 124 \\ \times\ \ 26 \\ \hline 744 \\ 2480 \\ \hline 3224 \\ {\scriptstyle 1\ 1\ \ } \end{array}$$

Answer: 3224

Short division

98 ÷ 7 becomes

$$7\overline{)\,98}\ =\ 14$$

Answer: 14

432 ÷ 5 becomes

$$5\overline{)\,432}\ =\ 86\ \text{r}\ 2$$

Answer: 86 remainder 2

496 ÷ 11 becomes

$$11\overline{)\,496}\ =\ 45\tfrac{1}{11}$$

Answer: $45\frac{1}{11}$

Long division

432 ÷ 15 becomes

$$\begin{array}{r} 28\ \text{r}\ 12 \\ 15\overline{)\,432} \\ 300 \\ \hline 132 \\ 120 \\ \hline 12 \end{array}$$

Answer: 28 remainder 12

432 ÷ 15 becomes

$$\begin{array}{r} 28 \\ 15\overline{)\,432} \\ 300 \quad 15\times 20 \\ \hline 132 \\ 120 \quad 15\times 8 \\ \hline 12 \end{array}$$

$\frac{12}{15} = \frac{4}{5}$

Answer: $28\frac{4}{5}$

432 ÷ 15 becomes

$$\begin{array}{r} 28{\cdot}8 \\ 15\overline{)\,432{\cdot}0} \\ 300 \\ \hline 132 \\ 120 \\ \hline 120 \\ 120 \\ \hline 0 \end{array}$$

Answer: 28·8