River Primary School
Calculation Policy
Updated Jan 2022

Introduction

At River Primary School we aim to teach calculation with understanding, and not just as a process that is to be remembered. This Calculation Policy demonstrates the way the calculation works and supports both the development of mathematical concepts and closely links it to the mental strategies that are taught alongside the written methods. It follows the small steps detailed in the NCETM Professional Development Materials, ensuring progression of the key calculation skills

AIMS OF THE POLICY

• To ensure consistency and progression in our approach to calculation and enable a smooth transition between year groups and phases.

• To ensure that children develop an efficient, reliable, formal written method of calculation for all operations.

• To ensure that children can use these methods accurately with confidence and understanding.

• To ensure pupils understand important concepts and make connections within mathematics.

• To ensure pupils show high levels of fluency in performing written and mental calculations.

• To ensure that pupils are ready for the next stage of learning and have been given strong foundations in mental methods, the use of practical equipment, allowed to explore jottings in a range of forms and then to move onto more formal recording using a strong knowledge of place value, number lines labelled or blank, partitioning before eventually using compact written methods.

• To ensure that pupils are competent in fluency, reasoning and problem solving and can make informed and appropriate choices about the methods they wish to use (mental or written) to solve mathematical problems efficiently and effectively.

INTRODUCTION

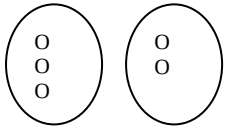
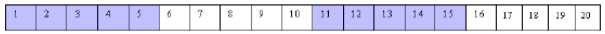
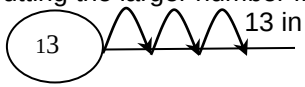
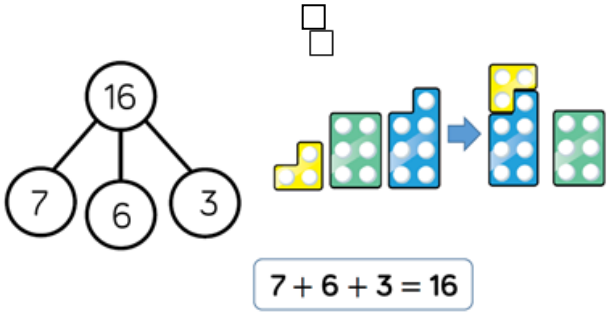
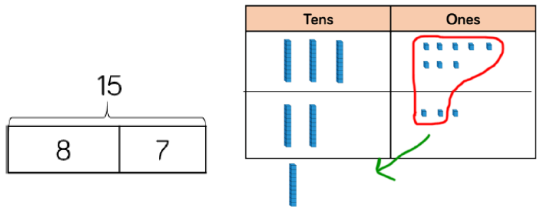
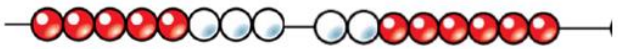
The policy is set out in subjects, addition, subtraction, multiplication and division. Within each specific area there is a progression of skills, knowledge and layout for written methods that has been agreed by all staff. The calculation strategies which will be used will reflect this ideology – moving from concrete to pictorial and then abstract recording leading to more formal written methods. Mental methods and strategies will work in partnership with these methods.

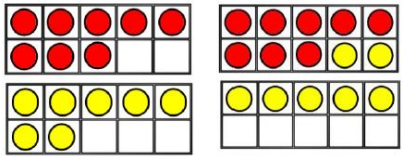
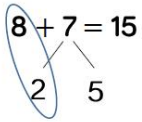
It has been agreed by all staff that a variety of mental calculation methods will be taught and the Key Instant Recall Facts overview is in Appendix 3.

The basis of our maths calculation policy is that mental and written methods are integral to each other and should not be seen as taking separate paths but developed in conjunction with each other. It is envisaged that the development of mental skills will lead to jottings, (which support mental calculation) and then into more formalised jottings in the form of number lines and partitioning which in turn leads to expanded column methods and ultimately compact algorithms.

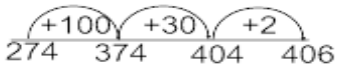
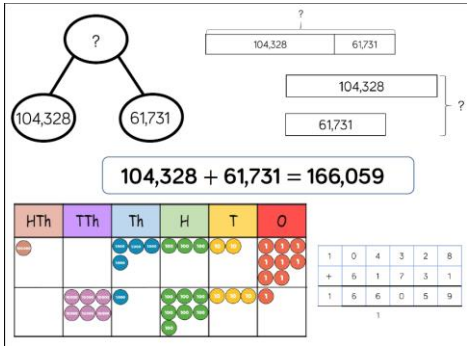
It is important to always show the links between operations and not teach them in isolation or without showing, in practical problem solving activities and across all mathematical topics, how these operations can be applied.
It is important that staff always use correct mathematical language and encourage this from every pupil. This will take place in class discussions – with a particular focus on the use of the NCETM Stem Sentences.

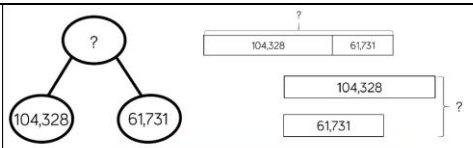
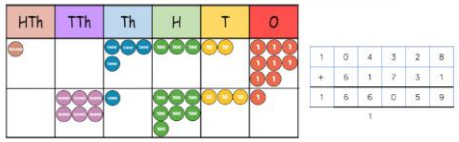
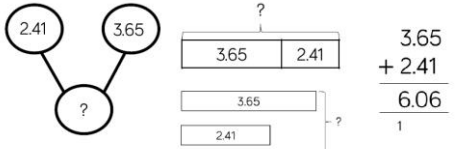
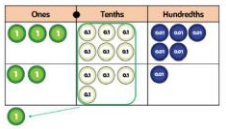
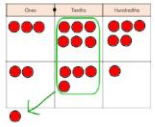
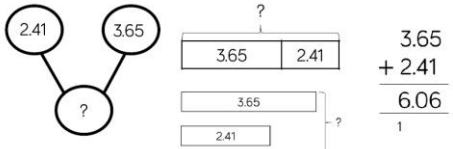
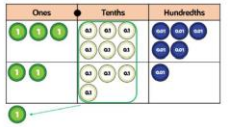
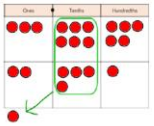
Addition

Foundation	Year 1	Year 2
-Say the number that is one more than a number from 1 to 20. **-Find the total number of items in two groups by counting all of them.** **-In practical activities and discussion, beginning to use the vocabulary involved in adding when combining two groups.** **-Count on and back from a number other than 0.**	**-Read, write and interpret mathematical statements involving addition (+) and (=) signs.** **-Represent and use number bonds within 20** **-Add and one-digit and two-digit numbers to 20, including zero** **-Solve one-step problems that involve addition using concrete objects and pictorial representations, and missing number problems such as 4 + □ = 7**	**-Solve addition problems using concrete objects and pictorial representations, including:** • **a two-digit number and ones** • **a two-digit number and tens** • **two two-digit numbers** • **adding three one-digit numbers** **-Recall and use addition facts to 20 fluently, and derive and use related facts up to 100** **-Show that addition of two numbers can be done in any order (commutative)** **-Use the inverse relationship between addition and subtraction to check calculations and solve missing number problems.** **-Start to recording addition in columns.**
Add, more, make, sum, total, altogether, one more, two more, ten more, how many more to make..?, how many more is…than…? Oral and practical work Songs and rhymes Dice and number games Number stories for combining sets eg 3 pigs in a field, 2 in a sty how many altogether? Teacher models 3+2=5 using a range of objects  Number track  Number bonds for numbers up to 10 Full number lines	Songs and rhymes Working with apparatus such as bead strings to 20, cubes, dienes, Numicon:  Use + and = signs and associated vocabulary. Adding more than 2 numbers Putting the larger number first 13+3=  13 in your head or on fingers Counting in 10s from multiples of 10 Number bonds of all numbers to 20 □+7=12 9+□=18	Counting in 10s from any number Rapid recall of all number bonds for all numbers to 20. Use of numicon, dienes, bar model, part whole model to demonstrate.   Structured number lines and bead strings to 100 

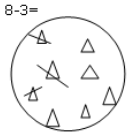
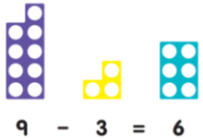
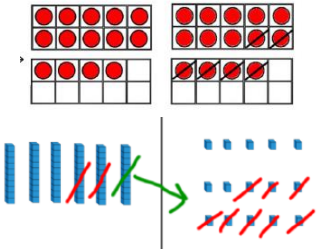
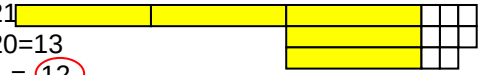
		Use of tens frames   Start to record addition in columns, using expanded methods 40+ 7 30+ 6 70+13 = 83 Can check by using inverse operation, use to solve missing box problems Eg ☐ + 5= 23

Addition

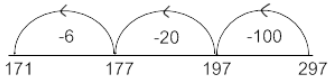
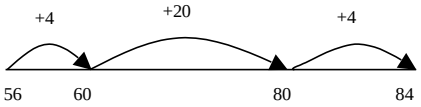
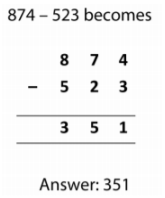
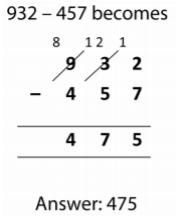
Year 3	Year 4	Year 5	Year 6
-Add a range of numbers mentally, including: ▪ **a three-digit number and ones** ▪ **a three-digit number and tens** ▪ **a three-digit number and hundreds** **-Add numbers with up to three digits, using formal written methods of columnar addition** **-Estimate the answer to a calculation and use inverse operations to check answers** **-Solve problems, including missing number problems, using number facts, place value, and more complex addition.** **-Add fractions with the same denominator within one whole (for example, $^5/_7 + {}^1/_7 = {}^6/_7$)**	**-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 fractions with the same denominator** **-Solve simple measure and money problems involving fractions and decimals to two decimal places**	**-Add whole numbers with more than 4 digits, including using formal written methods (columnar addition)** **-Add numbers mentally with increasingly large numbers (eg. 8 462 + 2300 = 10 762).** **-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, including to 3 decimal places, deciding which operations and methods to use and why.** **-Add and subtract fractions with the same denominator and denominators that are multiples of the same number**	**-Add whole numbers with more than 4 digits, including using formal written methods (columnar addition)** **-Perform mental calculations, including with mixed operations and large numbers** **-Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why** **-Add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions**
Use partitioning to support mental calculations. Using an empty number line to count on. 274 + 132  Add a near multiple of 10 to a two-digit number Continue as in Year 2 but with appropriate numbers e.g. 350 + 189 is the same as 350 + 190 – 1. Extend use of columnar addition, developing more compact recording to tackle larger numbers. 40+ 7 30+ 6 70+13 = 83	Using an empty number line to count on. 3587+1675  Extend use of expanded columnar addition to 4 digit numbers, leading to the use of the compact method. Extend to decimals, assigning values to Numicon and bar models to support. 	Use formal columnar addition for numbers with more than 4 digits. 21271 12243 + 33514 1 Including method were carrying is used. Extend to decimals. 42.432 12.713 + 55.145 1 Develop reasoning skills by using a range of representations including part whole models, number sentences, place value counter problems and bar models.	Use formal column addition for any numbers which cannot be added mentally (>1 million) 2353248 1254173 + 3607421 1 11 

		 104,328 + 61,731 = 166,059   3.65 + 2.41 = 6.06   Add fractions with the same denominator and multiples of the same number. $^{2}/_{3} + {}^{1}/_{6} = {}^{4}/_{6} + {}^{1}/_{6} = {}^{5}/_{6}$ Solve problems involving all of the above.	 3.65 + 2.41 = 6.06   Add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions $^{1}/_{3} + {}^{1}/_{5} = {}^{5}/_{15} + {}^{3}/_{15} = {}^{8}/_{15}$

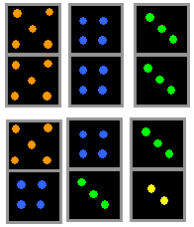
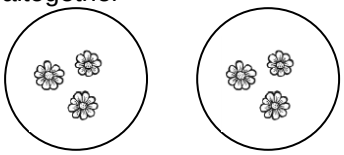
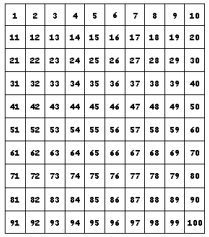
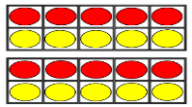
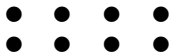
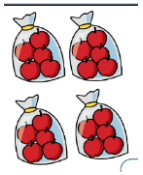
Subtraction

Foundation	Year 1	Year 2
-Say the number that is one less than a number from 1 to 20. **-In practical activities and discussion, beginning to use the vocabulary involved in subtraction when taking away objects groups.**	**-Read, write and interpret mathematical statements involving subtraction (-) and (=) signs.** **-Represent and use number bonds and related subtraction facts within 20** **-Subtract one-digit and two-digit numbers to 20, including zero** **-Solve one-step problems that involve subtraction using concrete objects and pictorial representations, and missing number problems such as 8 - □ = 5**	**-Solve subtraction problems using concrete objects and pictorial representations, including:** • **a two-digit number and ones** • **a two-digit number and tens** • **two two-digit numbers** **-Recall and use subtraction facts to 20 fluently, and derive and use related facts up to 100** **-Show that subtraction of one number from another cannot be done in any order.** **-Use the inverse relationship between addition and subtraction to check calculations and solve missing number problems.** **-Start to record subtraction in columns.**
Take (away), leave, how many are left/left over?, How many have gone? One less, two less, ten less, how many fewer is..? difference between, is the same as Oral and practical work Songs and rhymes Dice and number games, counting back, taking away. Use of number tracks.  Number stories using objects  How many are there? How many now? (after some have been removed) Teacher modelling number sentences, 8 take away 3 is 5	Songs and rhymes Working with apparatus Bead strings to 20. Cubes, dienes, bar model.  Subtraction with Numicon.  Physical and practical work on structured number lines eg jumping backwards Number stories, 15 people on a bus 3 get off, how many are left on? Putting a number in your head and counting back with fingers to help. 12-3=□ 15-□ = 4 □ -11=4 Counting back in 10s from multiples of 10s Giving change to 20p Finding the difference by counting on, comparing quantities 	Counting back in 10s from any number to 100 Jumping back on a structured number line. 76-34  Finding the difference between 2 towers of cubes leading to using the structured number line or fingers for numbers that are close together to calculate difference by counting on eg 42-39= 3 Use addition as the inverse operation to check and in empty box problems eg □ - 8=12 Start to record subtraction using expanded methods 33 – 21  33 – 20=13 13 – 1 = 12

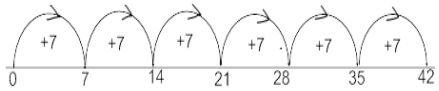
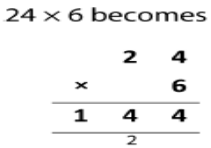
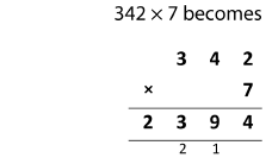
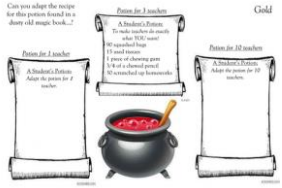
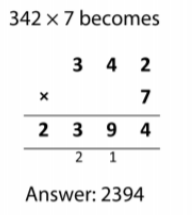
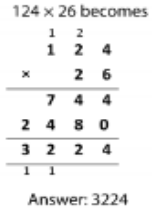
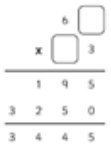
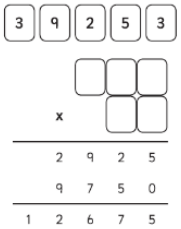
Subtraction

Year 3	Year 4	Year 5	Year 6
-Subtract a range of numbers mentally, including: • **a three-digit number and ones** • **three-digit number and tens** • **a three-digit number and hundreds** **-Subtract numbers with up to three digits, using formal written methods of columnar subtraction** **-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.** **-Subtract fractions with the same denominator within one whole (for example, $^5/_7 - {}^1/_7 = {}^4/_7$)**	**-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 addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why.** **-Subtract fractions with the same denominator** **-Solve simple measure and money problems involving fractions and decimals to two decimal places**	**-Subtract whole numbers with more than 4 digits, including using formal written methods (columnar subtraction)** **-Subtract numbers mentally with increasingly large numbers (eg. 10 462 - 2300 = 8 162).** **-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, including to 3 decimal places, deciding which operations and methods to use and why.** **-Add and subtract fractions with the same denominator and denominators that are multiples of the same number**	**-Subtract whole numbers with more than 4 digits, including using formal written methods (columnar subtraction)** **-Perform mental calculations, including with mixed operations and large numbers** **-Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why** **-Add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions**
Develop confidence in counting back in 100s, 10s and 1s from any number. Use an empty number line to count back. 297-126=  Count on to find the difference using empty numberline 84-56=  Expanded method of decomposition for numbers too large to do mentally. 572-158= 60 12 500 ~~70~~ ~~2~~ 100 50 8 – 400 10 4 = 414	Using an empty number line to both count back, and find the difference between two numbers by counting on. (Up to 4 digits) Extend to decimals to 2 decimal places.  Support by re-assigning values to Numicon.  Expanded method of decomposition, leading to more compact recording. 2757-1259= 6 14 17 ~~2~~ ~~7~~ ~~5~~ ~~7~~ 1 2 5 9 - 1 4 9 8 Extend to decimals.	Formal method used for both calculations with and without borrowing   Move towards compact decomposition, including decimals. 2 1 ~~3~~6.57 17.46 – 19.11 Subtract fractions with the same denominator and multiples of the same number. $^2/_3 - {}^1/_6 = {}^4/_6 - {}^1/_6 = {}^3/_6$	Use formal method of compact decomposition. 2 1 ~~3~~6.573 18.462 – 18.111 Apply to problem solving contexts eg money and measures Subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions $^1/_3 - {}^1/_5 = {}^5/_{15} - {}^3/_{15} = {}^2/_{15}$ Revert to expanded methods if the children experience any difficulty.

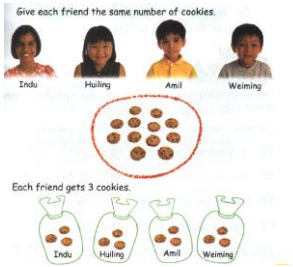
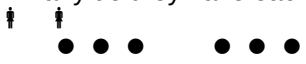
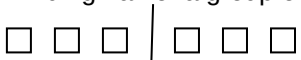
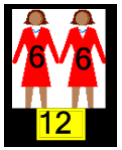
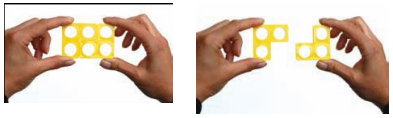
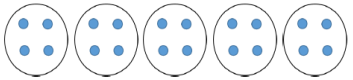
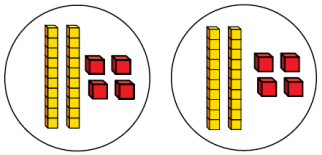
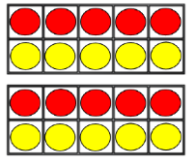
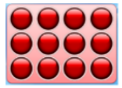
Multiplication

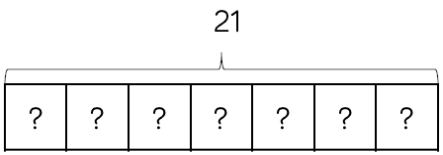
Foundation	Year 1	Year 2
Start to solve problems involving doubling.	**-Solve one-step problems involving multiplication by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.** **-Make connections between arrays, number patterns, and counting in twos, fives and tens.**	**-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)** **-Solve problems involving multiplication using materials, arrays, repeated addition, mental methods and multiplication and including problems in contexts.**
Counting in ones, twos, tens Odd and even numbers Matching pairs eg socks Noahs ark    Songs and rhymes Finding doubles in dominoes Doubles in practical contexts. Groups of objects with the same number, counting how many in each group, and finding how many altogether 	Counting in twos, fives and tens (using fingers to help count in multiples) Knowing doubles of numbers to 10 Dice and domino games with doubles Finding patterns of numbers using a 100 square and make connections with arrays.   Repeated addition of sets of objects, teacher modelling 2+2+2 = 6 Use coins for repeated addition  and model using Numicon.  5 + 5 + 5 = 15 Stem sentences are introduced.	Counting in 3s Doubles of all numbers up to 10 and doubles of multiples of 10 to 100 Recognise odd and even numbers, supported by Tens frames.  Arrays and repeated addition this links to commutative law below. Use visual and concrete methods below as long with fingers for counting. Additional language introduced including “lots of” for problem solving.  4 x 2 or 4 + 4 2 x 4 or 2 + 2 + 2 + 2  Commutative law 4 x 3 = 12 3 X 4 = 12 Stem sentences used.

Multiplication

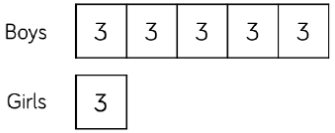
Year 3	Year 4	Year 5	Year 6
-Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables **-Write and calculate mathematical statements for multiplication using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods of short multiplication** **-Solve problems, including missing number problems, involving multiplication, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects.**	**-Recall multiplication and division facts for multiplication tables up to 12 × 12** **-Use place value, known and derived facts to multiply mentally, including: multiplying by 0 and 1 and multiplying together three numbers** **-Recognise and use factor pairs and commutativity in mental calculations** **-Multiply two-digit and three-digit numbers by a one-digit number using formal written layout** **-Solve problems involving multiplying including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects.**	**-Identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers** **-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, including multiplying whole numbers and those involving decimals by 10, 100 and 1000** **-Recognise and use square numbers and cube numbers, write the notation for both [(^{2}) and (^{3})] and solve problems involving multiplication using knowledge of factors and multiples, squares and cubes** **-Solve problems involving scaling by simple fractions.** **-Multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams**	**-Multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication** **-Multiply one-digit numbers with up to two decimal places by whole numbers** **-Perform mental calculations, including with mixed operations and large numbers** **-Multiply simple pairs of proper fractions** **-Identify common factors, common multiples and prime numbers**
Doubling multiples of 5 up to 50 by partitioning 15 x 2 = 30 10 + 5 ↓ ↓ 20 + 10 = 30 Know that division is inverse of multiplication and multiplication is inverse of division Understand multiplication as repeated addition Use a number line to solve 6x7  Continue to use arrays Use expanded column method as a step tow short multiplication. 24 x 6 = 20 4 X 6 120 + 24 = 144 Progress towards formal short multiplication  	Multiplication by using known facts. Eg to multiply by 60, multiply by 6 then X10 Doubling all numbers to 50, multiples of 10 to 500 Multiply decimals and integers by 10, 100 and1000. Use the grid method 342 x 7= Extend use of formal short multiplication  Missing number type problems e.g .12 x ? = 9 x 8, Use methods within problem solving contexts such as money and measures. Eg apply scaling to problems such as recipes and ingredients. 	Use short multiplication when multiplying by 1 digit.  Use formal long multiplication for up to 4 digit x2 digit  Multiply proper fractions, ½ x $^2/_5$ Missing number problems eg 	Use formal long multiplication for up to 4 digits x 2 digits. Eg 1354 x 24 1 2 1 1 1354 X 24 5416 27080 32496 1 Extend to decimals. Multiply simply pairs of proper fractions. $\frac{2}{3} \times \frac{2}{5} = \frac{4}{15}$ Missing number problems Eg using the given digit cards once, complete the calculation 

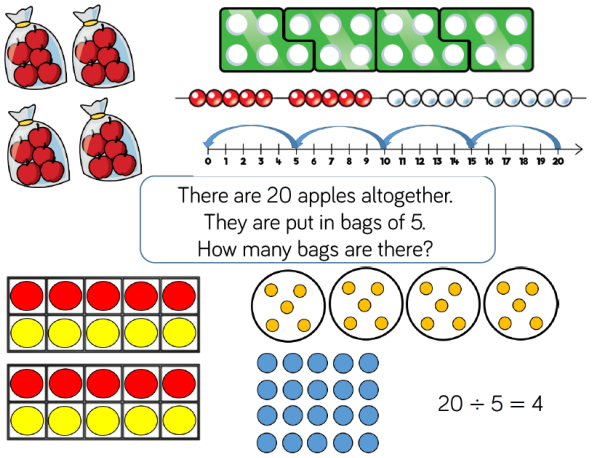
Division

Foundation	Year 1	Year 2
-Start to solve problems involving halving and sharing	**-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** **-Solve problems involving division, using materials, arrays, repeated subtraction, mental methods, and multiplication and division facts, including problems in contexts.**
Practical activities, songs and rhymes. 10 fat sausages..  Sharing during snack time by giving 1 each Is there an easier way of sharing a larger amount? Eg 2 at a time  Making groups/piles of 2, finding partners Eg in PE grouping in 2s, how many pairs are there? 1 ball for each pair, how many balls do I need to get out?	Practical activities, songs, and games. **Sharing** – 6 sweets are shared between 2 people. How many do they have each?  **Grouping** – There are 6 sweets. How many people can have 2 each? (How many 2's make 6?)  Cutting cakes/ pizza in half, sharing related to fractions Finding half of a group of objects  Knowing halves of even numbers to 20  Use Numicon and bar model as a representation  Bar model used for representation of groups in a whole	Relate division to fractions ½ or ¼ of 12, 20. Half of 12 is 12÷2=. Introduction of fact families and making equal groups Understand division as sharing and grouping and link to multiplication facts 12÷ 3 = 4 12÷ 4 = 3 3 X 4 = 12 4 X 3 = 12  20 ÷ 5 = 4 **48 ÷ 2 = 24**     Counting on and back in 2s, 5s, 10s How many 2s in 10?



21 ÷ 7 = 3





Counting on fingers also used at this stage.

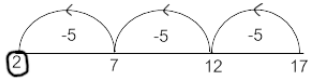
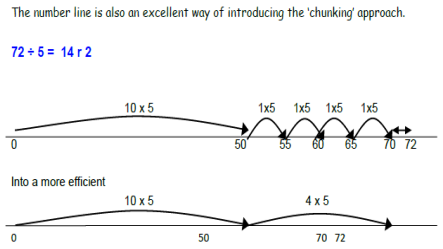
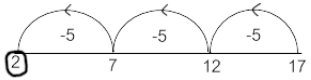
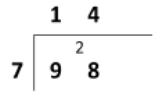
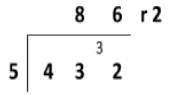
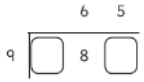
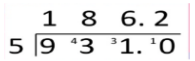
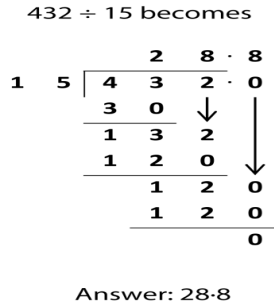
÷ = signs and missing numbers

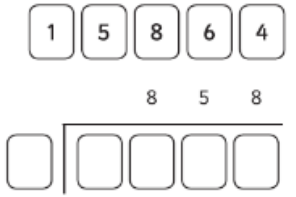
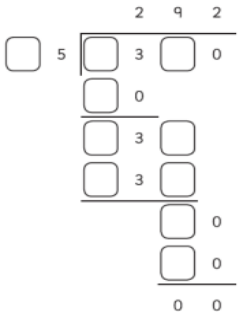
6 ÷ 2 = □ □ = 6 ÷ 2

6 ÷ □ = 3 3 = 6 ÷ □

□ ÷ 2 = 3 3 = □ ÷ 2

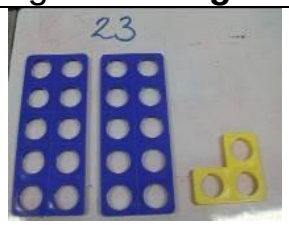
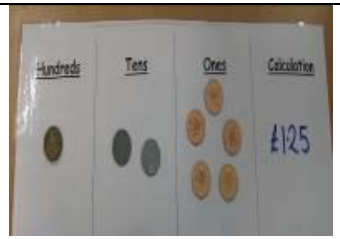
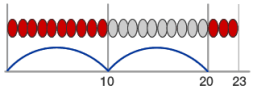
Division

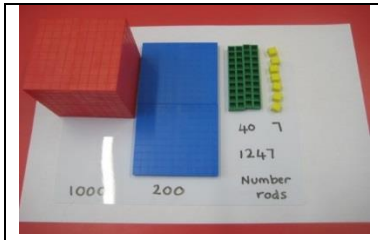
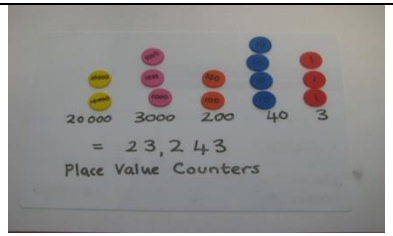
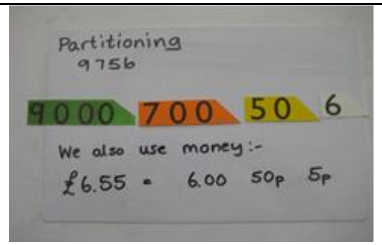
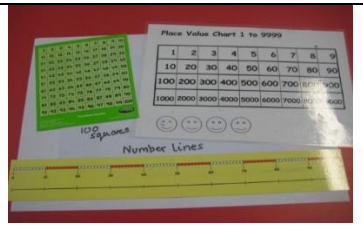
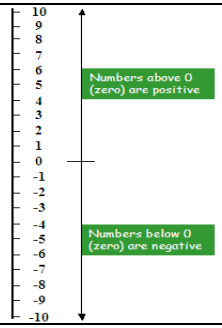
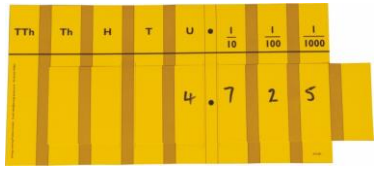
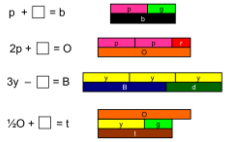
Year 3	Year 4	Year 5	Year 6
-Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables **-Write and calculate mathematical statements for division using the multiplication tables that they know, including for two-digit numbers divided by one-digit numbers, using mental and progressing to formal written methods** **-Solve problems, including missing number problems, involving multiplication and division** **-Calculate simple remainders after division**	**-Recall multiplication and division facts for multiplication tables up to 12 × 12** **-Recognise and use factor pairs in mental calculations** **-Divide two-digit and three-digit numbers by a one-digit number using formal written layout** **-Divide a one- or two-digit number by 10 and 100, identifying the value of the digits in the answer as ones, tenths and hundredths**	**-Divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context** **-Divide whole numbers and those involving decimals by 10, 100 and 1000** **-Know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers** **-Establish whether a number up to 100 is prime and recall prime numbers up to 19**	**-Divide numbers up to 4 digits by a two-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** **-Identify common factors, common multiples and prime numbers** **-Divide proper fractions by whole numbers (for example, $^1/_3 \div 2 = {}^1/_6$)** **-Associate a fraction with division and calculate decimal fraction equivalents (for example, 0.375) for a simple fraction (for example, $^3/_8$)**
¼ or ½ of 24 , 40.. etc Understand division as grouping and as sharing. *e.g. If there are 14 sweets in a bag, how many people can have 2 each?* Practically demonstrate repeated subtraction to find how many groups. Remainders 17÷5= 3r2  Make clear links between x and ÷ ÷ = signs and missing numbers Divide by 10 and 100 Extend to pencil and paper procedures which reflect mental methods.  	Sharing and grouping Continue to understand division as both sharing and grouping (repeated subtraction). Remainders 17÷5= 3r2  Approximate first. Use informal or pictorial methods relating to the child's mental methods moving onto short formal method when ready. 98 ÷ 7 becomes  	Consolidate formal short division 432 ÷ 5 becomes  Complete missing number calculations  Quotients can be expressed as fractions or decimal fractions 61 ÷ 4 = 15 ¼ or 15.25	Formal short division for 4 digit ÷ 1 digit (remainders shown as a decimal)  This method can also be used for decimals. Introduce formal long division  Division of fractions building up to **keep, change, flip.** $\frac{3}{5} \div \frac{2}{8} = \frac{3}{5} \times \frac{8}{2} = \frac{24}{10} = 2\frac{4}{10}$ $\frac{3}{5} \div 2 = \frac{3}{5} \div \frac{2}{1} = \frac{3}{5} \times \frac{1}{2} = \frac{3}{10}$ $2\frac{3}{4} \div \frac{1}{4} = \frac{11}{4} \div \frac{1}{4} = \frac{11}{4} \times \frac{4}{1} = \frac{44}{4} = 11$ Continued…

			Y6 division cont Missing number questions eg Using the digit cards given, complete the calculation  Leading to long division with missing numbers: 

Appendix 1
Representations for place value and calculation

In line with the National Curriculum Aims manipulatives should be used to develop an understanding of the mathematical concept and to build a really firm foundation in calculations. Some children will prefer some representations more than others and may not use all of them. They all will progress at different rates. Practical handling of resources is essential to aid secure understanding **at all stages**.

				
Initially objects, counters cubes etc are used to reinforce the link between counting, one to one correspondence, the verbal cardinal and written number. Numicon is introduced as a pictorial representation of a number. 	Once 1:1 correspondence is well established, children can recognise one item to represent a number other than one – such as Numicon or Cuisenaire. Children soon learn what number each colour represents and use these to make numbers. Numicon is very useful for seeing which numbers are odd, because they always have an extra piece sticking up whereas the even numbers are flat across both ends.	Numbers can be made out of straws and children learn to bundle the straws into piles of 10 with an elastic band to be able to make numbers quicker. They need to make lots of bundles of 10 before they know a bundle is always 10. 20 bead strings are also useful to see the groups of tens and individual beads. 	Once the place value of 10 is secure with straws, number rods can be used to make numbers, where the ten rod cannot be broken into ones. 100 bead strings are useful at this stage. 	Once children understand that a 10p coin is the same as ten 1p coins, and a £1 coin is 100 pennies, they can make amounts over £1. Money is often the easiest way to introduce decimals to children once they get into KS2.

				
Lots of practice using number rods and blocks help children appreciate the relevant size of each number in its place value position.	When children are very secure with using number blocks and rods they can progress onto using Place Value Counters. Each colour counter represents a place value and to help these are also written on each colour. They start by building numbers and exploring bigger numbers; how to write and say them.	Breaking the number into its parts or partitioning helps secure understanding of place value and is an important step in beginning calculations. Sliders for multiplying and dividing by 10 are very useful to reinforce place value. 	Hundreds squares, number lines and place value charts to help children understand the value of the digit in each position. The versatility of a number line is that, although the divisions are usually initially numbered in ones, they can represent any concept such as counting in 10s, 100s, decimals or fractions.	Number lines can show the value of negative as well as positive numbers. Cuisenaire rods are very useful when introducing the bar model as a pictorial representation. These should be used whenever a new concept is represented in this way. Eg algebra 

The manipulatives are not to be used sequentially but as and when they are appropriate.

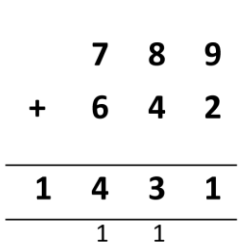
As a new concept is introduced the use of a previously abandoned representation may help clarify and aid understanding eg using straws for fractions, where the bundle represents 1 instead of 10 and therefore each straw represents 1/10th.

Appendix 2.

Examples of formal written methods for addition, subtraction, multiplication and division (National Curriculum 2013).

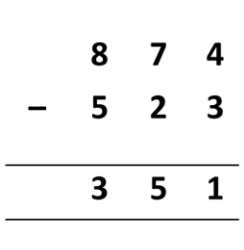
Addition and Subtraction

789 + 642 becomes



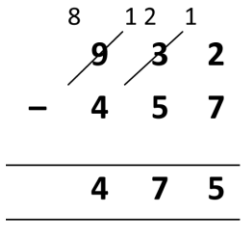
Answer: 1431

874 – 523 becomes



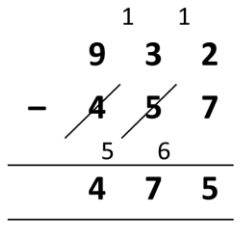
Answer: 351

932 – 457 becomes



Answer: 475

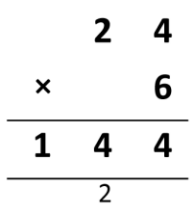
932 – 457 becomes



Answer: 475

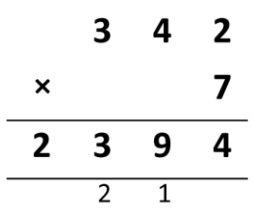
Short multiplication

24 × 6 becomes



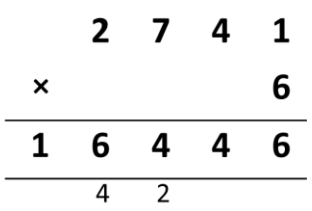
Answer: 144

342 × 7 becomes



Answer: 2394

2741 × 6 becomes



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

$$\begin{array}{r} 14 \\ {\scriptstyle 2} \\ 7\overline{)\,98} \end{array}$$

Answer: 14

432 ÷ 5 becomes

$$\begin{array}{r} 86\ r2 \\ {\scriptstyle 3} \\ 5\overline{)\,432} \end{array}$$

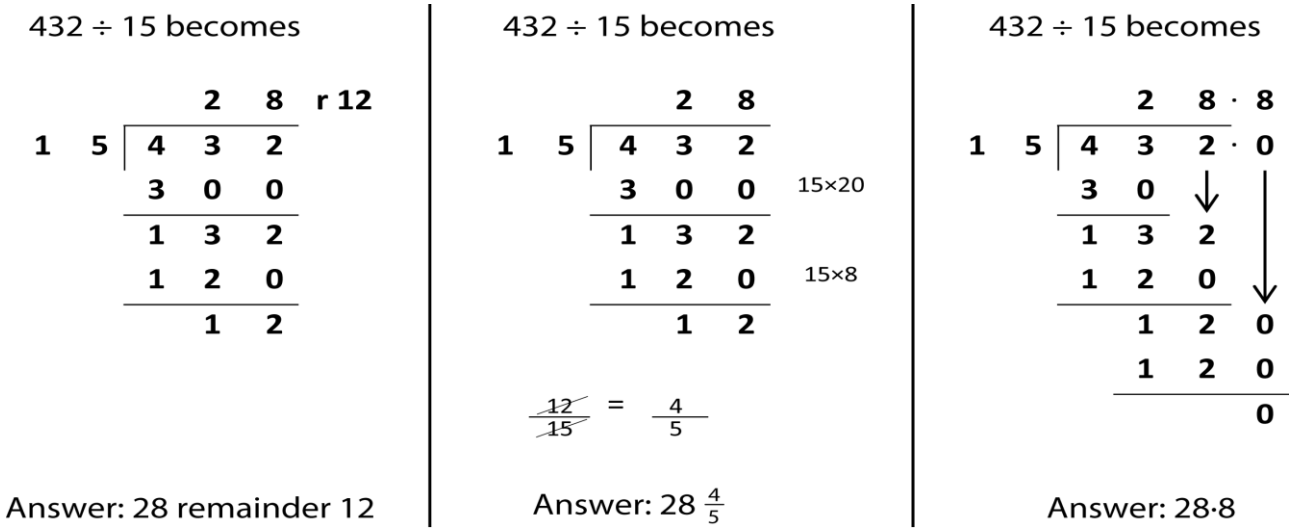
Answer: 86 remainder 2

496 ÷ 11 becomes

$$\begin{array}{r} 45\ r1 \\ {\scriptstyle 5} \\ 11\overline{)\,496} \end{array}$$

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

Long division



Appendix 3 - Key Instant Recall Facts Overview

- KIRFs (Key Instant Recall Facts) are designed to support the development of the mental fluency skills that underpin much of the mathematics curriculum. They are particularly useful when calculating, be it adding, subtracting, multiplying or dividing.
- Each year group is allocated up to six facts to focus on throughout the year, in line with the National Curriculum and age-related expectations. Time is to be dedicated at least 3 times each week, possibly in smaller, regular bursts (good for warm ups) to ensure that the KIRF is practiced and learnt so that children grow in confidence to recall their facts instantly.
- Instant recall of facts helps enormously with mental agility in mathematics; when children move onto written calculations and abstract methods, knowing these key facts is crucial. For children to become more efficient in recalling them easily, they need to be practised frequently and in short bursts.

EYFS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
I can say the numbers from 0 to 5 and back from 5 to 0 in order	I can read and write numbers 1-10 in numerals and words	I know number bonds for each number to 20	I know number bonds to 100	I can count in multiples of 1000 and 25	I know one and two decimal place number bonds for numbers between 1 and 10	Derive multiplication and division facts using decimal numbers (e.g. 8 x 0.7 = 5.6)
I can say the numbers from 0 to 10 and back from 10 to 0 in order	I know number bonds for each number to 6	I know the multiplication and division facts for the 2 times table	I know multiplication and division facts for the 3 times table	I know multiplication and division facts for the 6 times table	I know the multiplication and division facts for all times tables up to 12 × 12	I can identify common factors of a pair of numbers
I can partition numbers, to 5, into two groups	I know doubles and halves of numbers to 10	I know doubles and halves of numbers to 20	I can find 10 or 100 more or less than a given number	I know multiplication and division facts for the 9 and 11 times tables	I can find factor pairs of a number	I know common fraction, decimal and percentage equivalences
I can say which number is one more or one less than a given number to 20	I know number bonds to 10 and number bonds for each number to 10	I know multiplication and division facts for the 10 times table	I know multiplication and division facts for the 4 times table	I can recognise decimal equivalents of fractions	I can identify prime numbers up to 50	I know the first 5 cube numbers
I can count, read and write numbers to 20	I can read and write numbers 1-20 in numerals and words	I can count, read and write numbers to 100 in numerals	I can count in multiples of 50 and 100	I know multiplication and division facts for the 7 times table	I can recall square numbers up to 12^2 and their square roots	Know doubles and halves of 2-digit decimals
I can say the numbers from 0 to 20 and back from 20 to 0 in order	I know number bonds to 20	I know multiplication and division facts for the 5 times table	I know multiplication and division facts for the 8 times table	I can multiply and divide single-digit numbers by 10 and 100	I can count forwards or backwards in steps of powers of 10 for any given number up to 1,000,000	I know the formulae for finding the area of different shapes