Mathematics Calculation Policy

Thomas Jolyffe Primary School

To be the best we can be!

Approved by: Darren Crocker	**Date:** October 2023
Last reviewed on: July 2022	
Next review due by: October 2024	

CALCULATION POLICY

This policy sets out how calculations should be taught at Thomas Jolyffe Primary School.

At each stage the children should develop a deep understanding of calculations by using models and images, such as: rekenreks (KS1 and EYFS); number lines, numicon, dienes, place value counters and cuisinaire. These must be used to support their mental, informal and formal written methods of calculation. After securing a practical understanding the children will move on to visual representations and finally the abstract written methods. Overtime the children should become more efficient and fluent so that by the end of Year 6, children should be secure in both mental and written methods and be able to decide which method is the most efficient depending on the context. They should have strategies to check the accuracy of their calculations.

This policy outlines the key mental and pencil/paper procedures that are taught throughout the school. These have been updated to link with the 2014 National Curriculum for Mathematics. It has been written to ensure consistency and progression. Mental calculation should be seen as complementary to written recording and, as such, it is practised and secured alongside children's understanding and use of each method. The policy is written according to what the children need to understand **by the end** of each year group.
Children should always be encouraged to consider whether they can solve a calculation mentally before relying upon a written method.

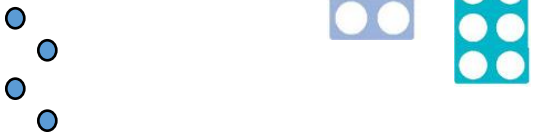
OVERALL AIMS

When children leave Thomas Jolyffe Primary School they:

- Have a secure knowledge of number facts and a good understanding of the four operations and place value.
- Are able to use this knowledge and understanding to carry out calculations mentally.
- Make use of diagrams and informal notes to aid mental methods.
- Have an efficient, reliable and compact written method of calculation for each operation that they can apply with confidence when undertaking calculations that they cannot carry out mentally.
- Can use these methods fluently to solve a variety of problems.

COUNTING – EYFS

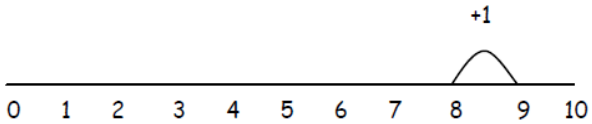
Alongside counting children should develop number sense through subitising using the Mastering Number Programme Scheme and the rekenreks

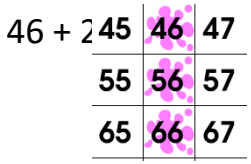
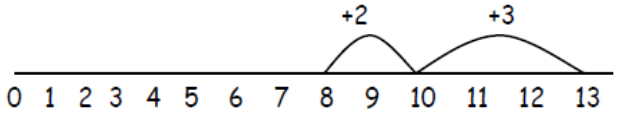
Knowledge	**Comprehension**	**Application Examples**
Have one-to-one correspondence	Understand that one number is used to represent one object and that object can only be counted once.	Using a variety of different objects on a regular basis. Touch each one and say a number. 
To know the names and the order of numbers (the stable-order principle)	Understand the names of the numbers and that they are said in the same order when counting.	Using a variety of different objects on a regular basis, recite the numbers in the correct order.
To know that when counting a set of objects they can be counted in any order (the order-relevance principle).	Understand that you can count from left to right; right to left or any other order as long as each object is counted only once	Experience counting objects in lines, on bead strings and objects laid out randomly.    

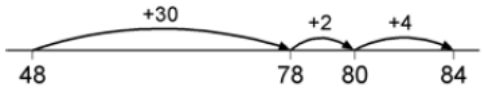
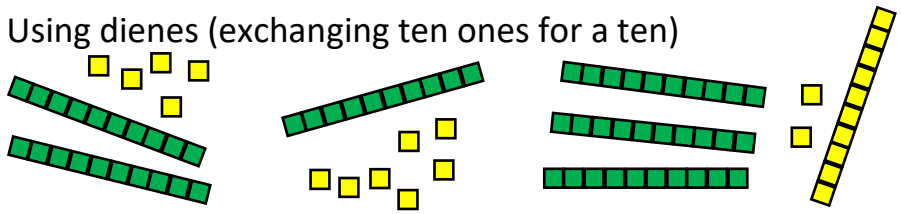
To know that the last item that is counted represents the size of the set (cardinal principle).	Understand that the last object counted represents that object's number in the set and the size of the set.	Experience counting objects in lines, on bead strings and objects laid out randomly. (as above).

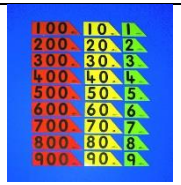
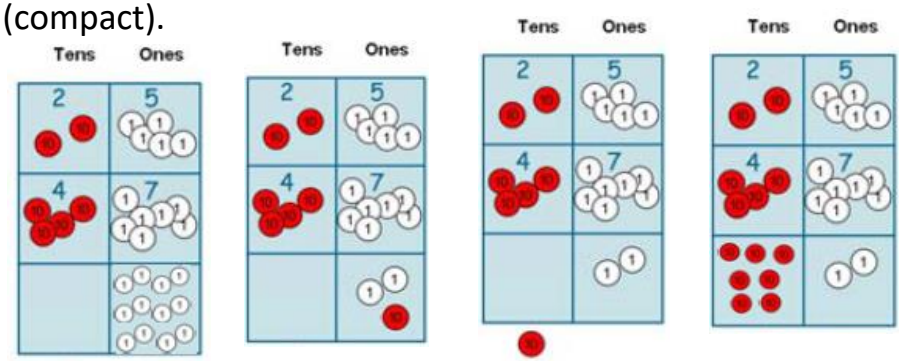
ADDITION

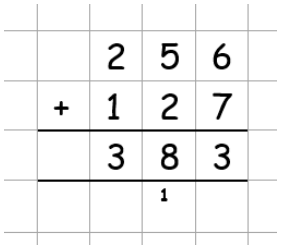
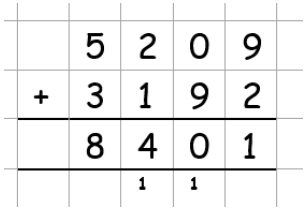
Knowledge	**Comprehension**	**Application Examples**
EYFS Count from 0 – 20.	Understand the principles of counting as outlined on page 3.	Frequent and varied practice.
Count all	Understand that addition is combining two sets of objects. Understand that 2 + 3 can be counted as 1,2. 1,2,3 1,2,3,4,5	Using objects and pictures, can add together two single digit numbers and count on to find the answer. For example: 2 + 3 = 5  1 2 1 2 3 (first attempt) 1 2 3 4 5 (second attempt)
Count on from first number	Relate addition to counting on from first number.	Using objects and pictures, can add together two single digit numbers and count on to find the answer. For 2 + 3  2 3,4,5 = 5

Count from larger number Read, write and interpret calculations using numbers and the addition symbol (+) Say what is one more than a given number (up to 20).	Understand that it is more efficient to count on from larger number. So 2 + 3 becomes 3 + 2 Be able to be able to read aloud a number sentence e.g. 2 + 3 = using the correct mathematical terms. Be able to write the calculation Be able to represent what it means using different models and images. Relate addition to counting on.	 3 4,5, = 5 Write as 2 + 3 = 5 or 2 + 3 5 Using number lines, dienes, numicon.  Using a number line to add two numbers together 8 + 1 = 9
Year 1 Know number bonds to 10	Understanding will only be achieved after using many and varied models and images over a period of time. Rote learning of number bonds without a	Using a range of models, images and games e.g. Numicon, dice, cubes, bead strings.

	practical understanding must be avoided.	
Count, read and write numbers to 100. Say what is one more than a given number (up to 100). Count in multiples of 2, 5 and 10	Begin to understand place value in numbers beyond 20. Understand the effect of adding zero.	Supported by, Numicon, dienes, bead strings, rekenreks, Using a 100 square to add in steps of 1, 2, 5 and 10.   Use number lines 1 - 100
Adding on using partitioning to bridge through 10 Know number bonds to 20.	Understanding will will only be achieved after using many and varied models and images over a period of time. Rote learning of number bonds without a	Splitting numbers to bridge through 10  8 + 5 = 13 Using a range of apparatus e.g. Numicon, bead strings, number lines, rekenreks

	practical understanding must be avoided.	
Year 2 Know related facts to 100, e.g. 3 + 7 = 10, 30 + 70 = 100. Be able to add mentally: • a two-digit number and ones • a two-digit number and tens • three one-digit numbers Relate and addition to subtraction Begin to use the formal written method for addition	. Understand place value in two-digit numbers and how zero is a placeholder. Understand that addition is commutative e.g. 48 + 36 = 36 + 48 Understand that subtraction is the inverse of addition. e.g. 48 + 36 = 84, 36 + 48 = 84, 84 – 36 = 48, 84 – 48 = 36 Build understanding first using numbers that don't require exchange. Then move understanding on to exchanging.	Using rekenreks from the Mastering Number Programme Using an empty number line to add two-digit numbers.  48 + 36 = 84 or:  Using dienes (exchanging ten ones for a ten) 

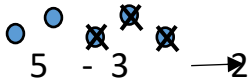
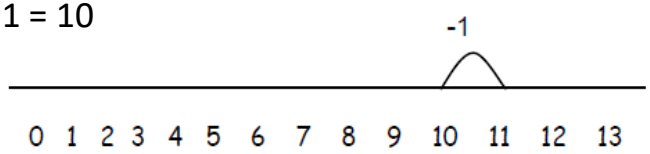
		25 + 17 = 42
Year 3 Count, read and write numbers to 1000. Be able to add mentally: • a three-digit number and ones • a three-digit number and tens • a three-digit number and hundreds • 2 two-digit numbers Consolidate formal written method for two digit numbers extend to three digit numbers.	Understand place value in three-digit numbers. Understand the concept of place value in addition. Understand the use of partitioning in mental calculations. Understand the principle of exchanging. Understand how the inverse can be used to check answers.	Using dienes, arrow cards, place value grids.  Build understanding using dienes, place value counters etc before moving onto abstract mental calculations without the support of concrete objects. 63 + 36 = (60 + 30) + (3 + 6) = 90 + 9 = 99 67 + 24 = (60 +20) + (7+4)= 80 +11 =91 Using dienes and/or counters on laminated grids to support column addition. Recording in book the same as Year 2 (compact). 

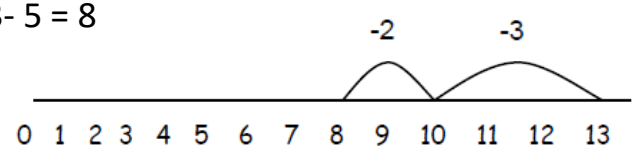
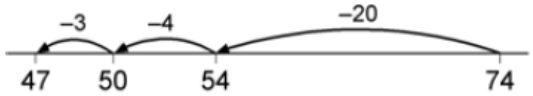
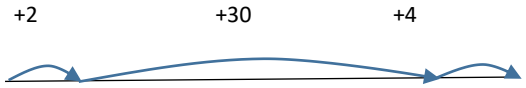
		Record using this compact method. Exchanged digits are recorded below the line. 
Year 4 Count, read and write numbers beyond 1000. Consolidate formal written method for three digit numbers extend to four digit numbers.	Understand place value in four-digit numbers and beyond. Understand how rounding can be used to estimate and check answers.	NOTE: By this stage child should be able to add two two-digit numbers mentally so should not be using the compact method to carry out these calculations.  Extended to decimals especially when relating to money and measures 3 8.3 6 + 2 7.9 5 6 6.3 1 1 1 1

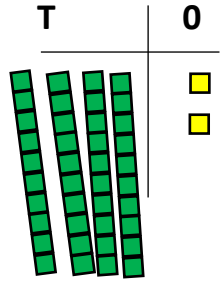
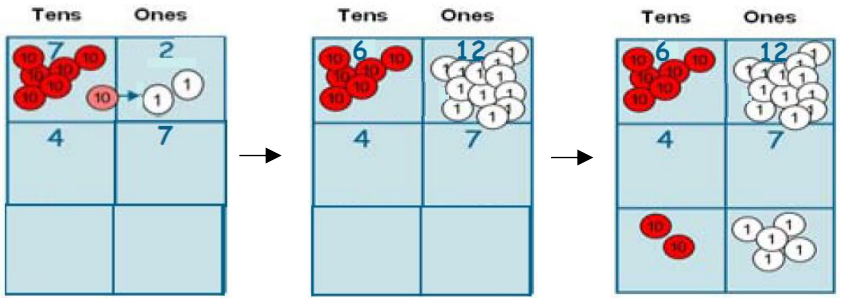
Be able to add mentally increasingly large numbers.		
Year 5 Count, read, write numbers up to 1 000 000 Count forwards and backwards in steps of powers of 10 for any given number up to 1 000 000		Layout of calculation as in Year 4 Calculate mentally 12 462 + 2300 = 14 762

Be able to add numbers containing more than four digits. Add and subtract numbers mentally with increasingly large numbers. Be able to calculate number sentences that contain brackets.	Understand the use of brackets and the associative law of addition. e.g. (a + b) + c = a + (b + c) (1 + 2) + 5 = 1 + (2 + 5) Begin to understand the order of operations – BODMAS. B = Brackets O = Orders (powers and square roots) DM = Division and Multiplication AS = Addition and Subtraction e.g. 50 + 15 ÷ 5 (÷ before +) 50 - 3 = 53	

SUBTRACTION

Knowledge	Comprehension	Application
EYFS Say what is one less than a given number. Subtract two single-digit numbers	Understands subtraction as removing or taking away one set of items from a larger set.	Using objects and pictures, can subtract two single digit numbers and count back to find the answer.  5 - 3 → 2 Using rekenreks Putting one Numicon over the other to compare and counting on to find the difference. 
Year 1 Say what is one less than a given number (up to 100) Know subtraction facts within 10.	Understand subtraction as taking away **and** counting on to find the difference.	1) Number line to take away/subtract. 11 - 1 = 10  The number line should also be used to show that the difference between two numbers is how many jumps they are apart. 2) Number tracks 

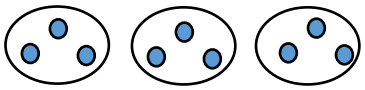
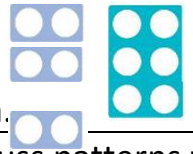
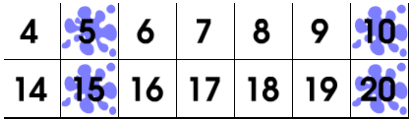
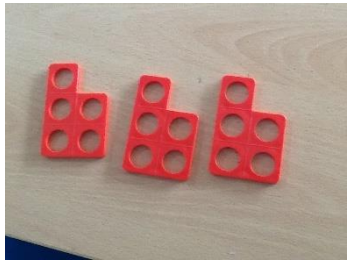
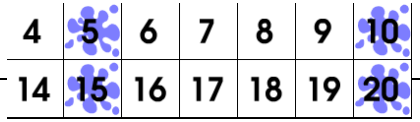
Begin to know subtraction facts within 20.	Understand that numbers can be partitioned to bridge through 10. Understand the effect of subtracting zero. Understand and use the symbols – and = Understand that addition and subtraction are related operations	3) Bead strings  4) Partitioning numbers to bridge through 10. 13- 5 = 8  5) Using rekenreks
Year 2 Know number facts to 20. Know related facts to 100, e.g. 10-3 = 7, 100 – 30 = 70. Be able to subtract **mentally**: • a two-digit number and ones • a two-digit number and tens Begin to subtract **mentally:** • 2 two-digit numbers using a number line.	Understand relationship between addition and subtraction through use of models and images. Understand how to use partitioning to subtract e.g. 74 – 27 can be done as 74 - 20 – 4 - 3 Understand place value in two-digit numbers and how zero is a place holder. Understand that subtraction is **not** commutative e.g. 48 - 36 ≠ 36 - 48	1) Using rekenreks 2) Using an empty number line to subtract two-digit numbers.  '4 - 27 = 47 3) Using a number line to find the difference through counting on. 

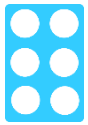
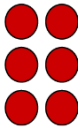
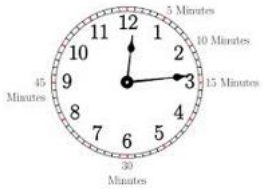
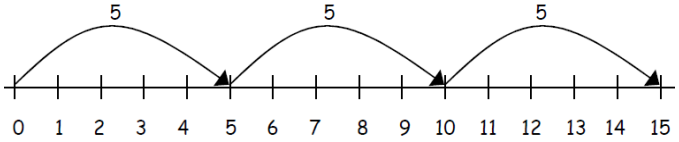
Begin to record calculations in columns using models to support understanding	Understand that calculations can be done mentally or as a pen/paper method Children to begin to make choices about whether counting on or back is more efficient for different calculations.	84 – 48 = 36 In books: $^{3}4\,\not{1}\,\not{2}$ - 2 7 1 5 This calculation to be supported by the use of dienes and place value boards. 
Year 3 Count, read and write numbers to 1000. Be able to subtract mentally: • two two-digit numbers • a three-digit number and ones • a three-digit number and tens	Understand place value in three-digit numbers. Understand how the inverse can be used to check answers. Understand that subtraction is the inverse of addition. e.g. 48 + 36 = 84, 36 + 48 = 84, 84 – 36 = 48, 84 – 48 = 36.	Children need to understand the formal written methods through the use of concrete objects. Dienes should be used initially followed by place value counters if appropriate to consolidate understanding Recording in book the same as Year 2 (compact). 

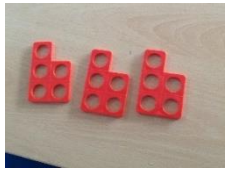
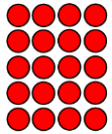
Subtract numbers upto three digits using the formal written method.		932 – 457 becomes 8 12 1 ~~9~~ ~~3~~ 2 – 4 5 7 4 7 5 Answer: 475 Use compact ('decomposition') method and the vocabulary **'exchange'**
Year 4 Count, read and write numbers beyond 1000. Be able to subtract mentally increasingly large numbers Extend understanding of the formal written method to numbers containing decimals.	Understand place value in four-digit numbers and beyond. Understand how rounding can be used to estimate and check answers.	$^{7}\cancel{8}\ ^{1}6.^{2}\cancel{3}^{1}0$ $-\quad 1\ \ 9.\ 0\ \ 4$ $6\ \ 7.\ 2\ \ 6$
Year 5	Understand the use of brackets in subtraction calculations. Begin to understand the order of operations – BODMAS. B = Brackets O = Orders (powers and square roots) DM = Division and Multiplication AS = Addition and Subtraction	Layout of calculation as in Year 4 Calculate mentally 12 462 - 2300 = 10 162

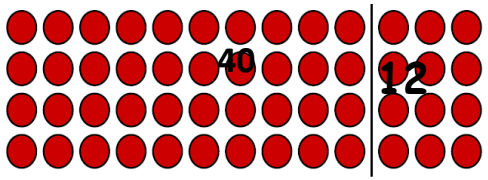
	e.g. 50 - 15 ÷ 5 (÷ before -) 50 - 3 = 47	

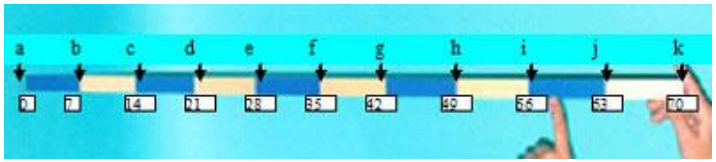
MULTIPLICATION

Knowledge	Comprehension	Application
EYFS Count from 0 – 20. Understand doubling	Understands that a pair is a group of 2. Understands that doubling is adding the same again.	Can put objects and pictures into groups and can count repeated groups of the same size.    Matching groups of Numicon.
Year 1 Count, read and write numbers to 100. Count in 2s, 5s and 10s	Supported by dienes/numicon, begin to understand place value in numbers beyond 20.	1) Using a 100 square to discuss patterns when counting.   2) Using Numicon 3) Using a counting stick 
Year 2 Count in 2s, 3s, 5s and 10s forwards and backwards	Make connections between the 10 times table and place value.	1) Using a 100 square to discuss patterns when counting. 

Know multiplication facts (the times tables) for the 2, and 10 times table. Know multiplication facts (the times table) for the 5 times tables.	Understand what the times tables represent 'lots' of the same thing. Understand multiplications as repeated addition and arrays. Understand that multiplication can be done in any order (it is communicative) Understand the relationship between divisions on a clock face and the five times table. Understand and use the symbols × and =	2) Using a counting stick  3) Use arrays to represent a multiplication calculation.    3 × 5 = 15 5 × 3 = 15 3 × 2= 6 2 × 3 = 6 4)  5) Solve multiplication through repeated addition.  5 + 5 + 5 = 3 × 5 

		6) Using Numicon  **NOTE:** In addition to using models and images to support children's understanding of the times tables, they **must** practise reciting them in order 1 x 5 = 5, 2 x 5 = 10, 3 x 5 = 15, 4 x 5 = 20 etc. using mnemonic methods. They must also be able to recall facts in a random order e.g. 3 x 5 = 15, 8 x 5 = 40
Year 3 Count on from 0 in multiples of 4 ,8, 50 and 100. Know multiplication facts for the 3, 4 and 8 times tables.	Understand the relationships through doubling of the 2, 4 and 8 times table Understand that multiplication is commutative e.g. 4× 3 = 3× 4 Understand that division is the inverse of multiplication. e.g.4 × 3 = 12, 3 × 4 = 12, 12 ÷ 3 = 4, 12 ÷ 4 = 3.	Using a number stick  Using arrays   5 x 4 = 20 and 4 x 5 = 20

Using known facts be able to calculate <u>mentally</u> two-digit numbers times a one-digit number. Begin to use a formal method for two-digit numbers times one digit.	Understand the mental calculation by partitioning to be able to multiply two digit numbers by one digit Understand effect of multiplying by 10 and 100 (shifting digits to the left).	Extend the use of arrays to solve two-digit multiplied by one-digit 13 × 4 = (10 × 4) + (3 × 4) × 10 3 4  In books: 3 8 x 4 1 5 2 3
<u>Year 4</u>		Use the counting stick

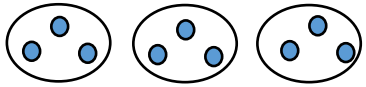
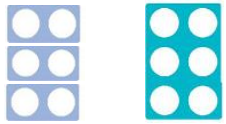
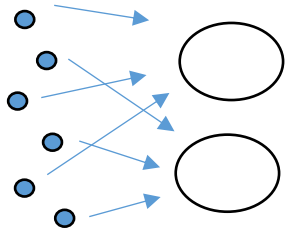
Count from 0 in multiples of 6, 7, 9, 25 and 1000		
Know multiplication facts for the 6, 9, 11 and 12 times tables	Know all the times table facts up to 12 x 12 and understand how these can be represented in arrays.	
	Understand how the 2, 4 and 8 times tables and the 3 and 6 times tables are connected through doubling.	
Know doubles to 50.	Understand how to multiply by 10 and 100 (shifting digits to the left).	Use arrays 
Can multiply mentally three numbers.	Understand how to multiply larger numbers by using related facts, e.g. 400 × 3 = 1200 by using 4 × 3 = 12	
Extend their understanding of short multiplication as a formal written method.	Understand the associative law e.g. (2 x3) x 4 = 2 (3 x 4)	

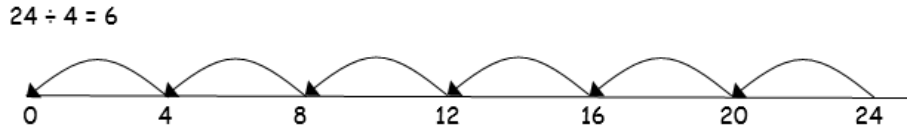
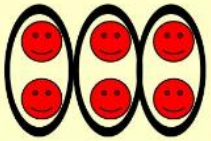
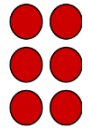
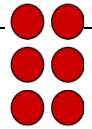
	Understand how to multiply three and four- digit numbers by one-digit.
	
	Understand how rounding can be used to estimate and check answers.
		Children must continue reciting the times table facts in order <u>and</u> recall answers to facts when asked randomly.
		
		In books:
		
		342 × 7 becomes
		
		  3 4 2
		× 7
		2 3 9 4
		  2 1
		
		Answer: 2394
		
		2741 × 6 becomes
		
		  2 7 4 1
		× 6
		1 6 4 4 6
		  4 2
		
		Answer: 16 446

Year 5 Multiply whole numbers and decimals by 10, 100 and 1000. With greater fluency be able to multiply mentally two-digit by one-digit numbers. Be able to multiply a two-digit number by a two-digit number. Find common factors and multiples.	Understand effect of multiplying whole numbers and decimals by 10, 100 and 1000 (shifting digits to the left). Understand the distributive law 39 x 7 = 30 x 7 + 9 x 7	Link to understanding of place value that each column to the left is 10 times greater than the previous one. In books: $\begin{array}{r} 24 \\ \times\ 16 \\ \hline 144 \\ 240 \\ \hline 384 \end{array}$ $\begin{array}{r} 36 \\ \times\ 24 \\ \hline 288 \\ 1440 \\ \hline 1728 \\ {\scriptstyle 1} \end{array}$
Year 6 Extend understanding of formal written method to three-digit numbers times two-digit numbers.	Understand the use of brackets and algebra in expressing the associative and distributive laws.	In books: $\begin{array}{r} 124 \\ \times\ 16 \\ \hline 744 \end{array}$

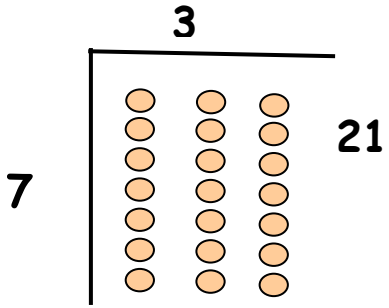
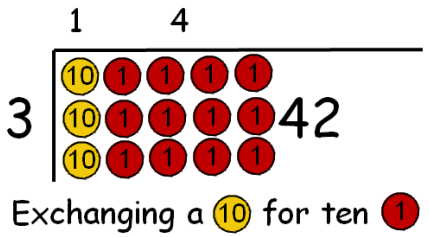
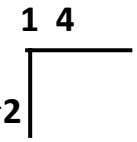
Be able to express the associative and distributive laws in algebraic form.	e.g. Associative: (a × b) × c = a × (b × c) (1 × 2) × 5 = 1 × (2 × 5) Distributive: a × (b + c) = a × b + a × c 3 × (2 + 5) = 3 × 2 + 3 × 5 Begin to understand the order of operations – BODMAS. B = Brackets O = Orders (powers and square roots) DM = Division and Multiplication AS = Addition and Subtraction e.g. 50 - 15 **x** 2 (**x** before -) 50 - 30 = 20	2 4 8 0 3 2 2 4 1 1

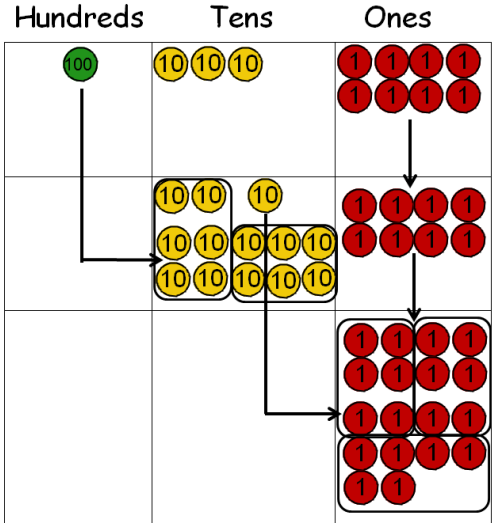
DIVISION

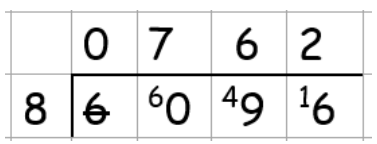
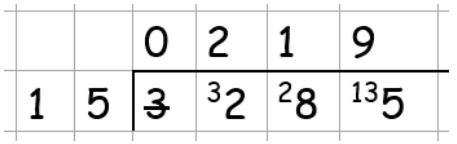
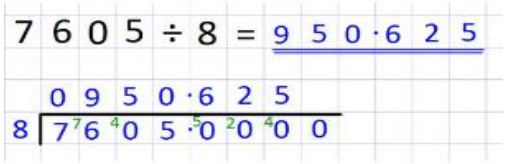
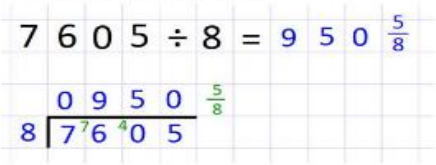
Knowledge	Comprehension	Application
EYFS Count from 0 – 20. Share equally Halve a set of objects and/or a single object (e.g. a cake)	Understand equal groups. Understand that halving is splitting into two equal groups.	Using objects and pictures, can solve practical division problems e.g. cutting a cake in half and sharing objects.   Matching groups of Numicon. 
Year 1 Count forward and backwards in 2s, 5s and 10s Understand division practically. Understand how to find a half and a quarter of a number, shape and quantity.	Supported by dienes/Numicon, begin to understand place value in numbers beyond 20. Understand and use the symbols ÷ and = Use grouping and sharing so pupils develop and understanding of division.	1) Using jottings to record both sharing equally and grouping. 6 sweets are shared between 2 people. How many do they get each? Sharing: 

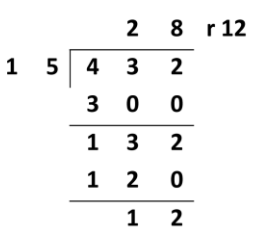
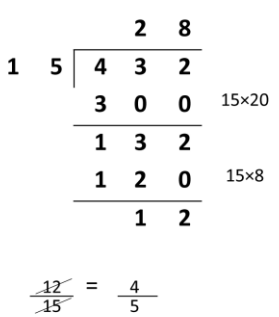
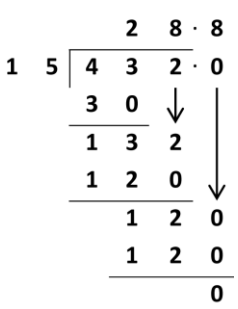
		Grouping: There are 6 sweets. How many people can have 2 sweets each?  2) Grouping: solve division on a number line by explaining that the number line is being divided into groups e.g. of 4.  3) Use arrays to model grouping  This can be split into three groups of two.
Year 2 Count forwards and backwards in steps of 2,3, 5 and 10 Know division facts for the 2, 5 and 10 times table Calculate mathematical statements for division using the ÷ and = signs	Understand the division facts as both grouping and sharing.	Work practically with counters, Numicon, dienes, number lines, bead strings and arrays.   For grouping, use the following sentence and work orally and practically: "I have ___ counters. I divide them into sets of _____. I have ____ groups." For example: "I have 6 counters. I divide them into sets of 3. I have 2 groups. Only when this sentence is practised and understood, introduce the mathematical symbols for the sentence **6 ÷ 3 = 2** 

		Use arrays to model Write in books 6 ÷ 3 = 2

Year 3 Count forward and backward in 2, 4, 5, 8, 10 and 100s Know division facts for the 2, 3, 4, 5, 8 and 10 times tables. Know division facts for the 2,3,4, 5, 8 and 10 times tables. Begin to use the formal written method for division.	Understand place value in two-digit numbers and how zero is a place holder. Understand that division is **not** commutative e.g. 12 ÷ 3 ≠ 3 ÷ 12 Understand that division is the inverse of multiplication. e.g. 4 × 3 = 12, 3 × 4 = 12, 12 ÷ 3 = 4, 12 ÷ 4 = 3. Understand how to divide larger numbers by using related facts, e.g. 60 ÷ 3 = 20 by using 6 ÷ 3 = 2 Understand how the inverse can be used to check answers.	1) Solve division through grouping and sharing that involves remainders, e.g. 13 ÷ 4 = 3 r1 Use counters, bead strings, numicon, number lines, dienes. 2) Use arrays 21 ÷ 3 = 7 and 21 ÷ 7 = 3  Write is books as 21 ÷ 3 = 7 1) Use arrays to help visualise division and to introduce the standard algorithm. 43 ÷ 3 =14  Written as 3 4 ¹2 

Year 4 Count from 0 in multiples of2, 3, 4, 5. 6, 7, 8, 9, 25, 50, 100 and 1000. Count, read and write numbers beyond 1000. Recall division facts for times tables up to 12 × 12. Be able to divide mentally increasingly large numbers. Find common factors and multiples. Extend understanding of short method of division.	Understand place value in three-digit numbers. Understand how to divide larger numbers by using related facts, e.g. 600 ÷ 3 = 200 by using 6 ÷ 3 = 2 Understand how to divide by 10 and 100 (shifting digits to the right). Understand how the inverse can be used to check answers.	Using dienes/counters on laminated grids to support long division. 138 ÷ 6 = 23  In books: **2 3** **6 1 ^{1}3 ^{1}8** Interpret remainders appropriately for the context.

Year 5 Extend understanding of short written method of division to four digit numbers and decimals.	Understand place value in four-digit numbers and beyond. Understand how rounding can be used to estimate and check answers. Understand how to divide whole numbers and decimals by 10, 100 and 1000 (shifting digits to the right).	Divide numbers up to four-digit by two-digit number using the short written method   Extend to write remainders as decimals and fractions In books: (with decimal answer)  (with fraction answer)  : Interpret remainders as whole number remainders, fractions, or by rounding, depending on the context.
Year 6 Understand the standard written method of long division.	Understand that division is the inverse of multiplication and how multiplication helps to solve long division questions.	

Extend to writing remainders as fractions and decimals (see stages 2 and 3). Solve calculations with division that use brackets.	Understand the use of brackets. e.g. (10 + 2) ÷ 3 = 1 + (2 + 5) Begin to understand the order of operations – BODMAS. B = Brackets O = Orders (powers and square roots) DM = Division and Multiplication AS = Addition and Subtraction e.g. 50-15÷ 5 (÷ before -) 50- 3 = 47	Stage 1 432 ÷ 15 becomes  Answer: 28 remainder 12 Stage 2 432 ÷ 15 becomes  Answer: 28 $\frac{4}{5}$ Stage 3 432 ÷ 15 becomes  Answer: 28·8