Holy Trinity Church of England Primary School

To be the best we can be: for God, for others and for ourselves

Calculation Policy

Multiplication and Division

Subject leader: H DANIELS

Agreed by Governors

Autumn 2020

Due for review

Summer 2023

Vision

At Holy Trinity Church of England Primary School, every child is recognised as a unique individual. We celebrate and welcome differences within our diverse school community, encouraging all to grow and flourish as precious children of God. Learning is centred around experiencing the joy of discovery. The ability to learn is underpinned by the teaching of basic skills, knowledge, concepts and values, with a vision to prepare our children to be life-long learners, rooted in our school motto: To be the best we can be: For God, for others and for ourselves.

Christian Values

Love	Hope	Forgiveness	Trust	Peace	Reverence	Justice

At Holy Trinity Primary we believe that children should be introduced to the processes of calculation through practical, oral and mental activities. As pupils begin to understand the underlying ideas they develop ways of recording to support their thinking and calculation methods, use particular methods that apply to special cases, and learn to interpret and use the signs and symbols involved.

Choosing the appropriate strategy, recording in mathematics and in calculation in particular is an important tool both for furthering the understanding of ideas and for communicating those ideas to others. A useful written method is one that helps children carry out a calculation and can be understood by others.

Written methods are complementary to mental methods and should not be seen as separate from them. The aim is that pupils use mental methods when appropriate, but for calculations that they cannot do in their heads they use an efficient written method accurately and with confidence. It is important pupils acquire secure mental methods of calculation and one efficient written method of calculation for addition, subtraction, multiplication and division which they know they can rely on when mental methods are not appropriate.

This document identifies progression in calculation strategies rather than specifying which method should be taught in a particular year group.

Children should not be made to go onto the next stage if:

1) they are not ready.

2) they are not confident.

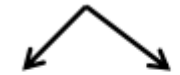
By the end of Year 6, children should be able to choose the most appropriate approach to solve a problem: making a choice between using jottings (an extended written method), an efficient written method or a mental method.

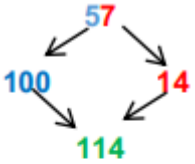
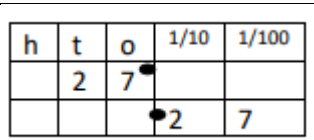
This policy contains the key pencil and paper procedures that will be taught within our school alongside practical resources. It has been written to ensure consistency and progression throughout the school and reflects a whole school agreement.

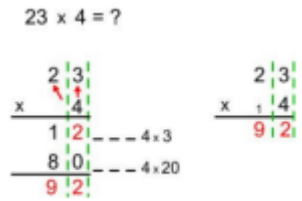
Holy Trinity Church of England Primary Calculation Policy

Multiplication and Division

Multiplication and Division Facts						
EYFS	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
	count in multiples of twos, fives and tens (copied from Number and Place Value)	count in steps of 2, 3, and 5 from 0, and in tens from any number, forward or backward (copied from Number and Place Value)	count from 0 in multiples of 4, 8, 50 and 100 (copied from Number and Place Value)	count in multiples of 6, 7, 9, 25 and 1000 (copied from Number and Place Value)	count forwards or backwards in steps of powers of 10 for any given number up to 1 000 000 (copied from Number and Place Value)	
		recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers	recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables	recall multiplication and division facts for multiplication tables up to 12 × 12		
Mental Calculation						
EYFS	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
			write and calculate mathematical statements for	use place value, known and derived facts to	multiply and divide numbers mentally	perform mental calculations, including

			multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods (grid method) (appears also in Written Methods)	multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers Multiplying by 10 and 100 e.g. 24 x 100 Th H T U 2 4 2 4 0 0	drawing upon known facts Partitioning 407 × 4 407 × 2 400 × 4 = 1600 0 × 4 = 0 7 × 4 = 28 1600 + 28 = 1628 Rounding and adjusting £3.99 × 6 £4 × 6 = £24 £24.00 – £0.06 = £23.94 28 × 19 28 × 10 × 2 = 560 560 – 28 = 532 Division as grouping drawing on known facts 196 ÷ 6 = 32r4 325 ÷ 3= 108r1  180 16 (6 x 30) (6 × 2 + 4)	with mixed operations and large numbers Partitioning 5.7 × 6 5 × 6 = 30 0.7 × 6 = 4.2 30 + 4.2 = 34.2 5.3 × 19 5.3 × 10 × 2 = 106 106 – 5.3 = 100.7
		show that multiplication of two numbers can be done in any order (commutative) and division of one number by	4 × 6 = 24 Use arrays and number lines to count in multiples Use empty number lines to demonstrate the idea of counting on in multiples of the divisor Develop the idea of chunking by grouping	recognise and use factor pairs and commutativity in mental calculations (appears also in Properties of Numbers)	multiply and divide whole numbers and those involving decimals by 10, 100 and 1000	associate a fraction with division and calculate decimal fraction equivalents (e.g. 0.375) for a simple fraction (e.g. 3 /8) (copied from Fractions)

		another cannot Introduce the idea of chunking by grouping (repeated subtraction) and not just sharing	(repeated subtraction) and not just sharing Using partitioning to multiply and divide 57 × 2 = 114 50 × 2 7 × 2 100 + 14 =114  **Scaling** Making a 5cm line 4 times longer *5cm × 4 = 20cm* 		 	
Written Calculation						
EYFS	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
		calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×),division (÷) and equals (=) signs	write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing toformal written methods (appears also in Mental Methods)	multiply two-digit and three-digit numbers by a one-digit number using formal written layout (grid method moving to short multiplication)	multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for twodigit numbers	multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication

			<table><tr><td>X</td><td>40</td><td>8</td></tr><tr><td>3</td><td>120</td><td>24</td></tr></table> 120 ÷ 24= 144 48 x 3 = 144	Stepping stone to formal written method 		
			Do not use formal columnar method except with children who can demonstrate they are ready. (see models and images part of policy for guidance of process using manipulatives) See SLT first.		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 Division leading to formal division 578 ÷ 7 8 2 r 4 7 | 5 7 8 5 6 0 1 8 1 4 4 Formal (short) division 638 ÷ 8 7 9 r 4	divide numbers up to 4-digits by a two-digit whole number using the formal written method of short division where appropriate for the context 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

					8 6 ^{6}3 $_{7}$8 6725 ÷ 7 0 9 6 0 r5 7$\overline{)6\,^{6}7\,_{4}2\,5}$	use written division methods in cases where the answer has up to two decimal places (copied from Fractions (including decimals)
Properties of a number: Multiples, Factors, Primes, Square and Cube Numbers						
EYFS	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
				recognise and use factor pairs and commutativity in mental calculations (repeated)	identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers know and use the vocabulary of prime numbers, prime factors	identify common factors, common multiples and prime numbers use common factors to simplify fractions; use common multiples to express fractions in the same denomination

					and composite (nonprime) numbers establish whether a number up to 100 is prime and recall prime numbers up to 19 recognise and use square numbers and cube numbers, and the notation for squared (2) and cubed (3)	(copied from Fractions) calculate, estimate and compare volume of cubes and cuboids using standard units, including centimetre cubed (cm3) and cubic metres (m3), and extending to other units such as mm3 and km3 (copied from Measures)
Order of operations						
EYFS	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
						BODMAS use their knowledge of the order of operations to carry out calculations involving the four operations

Inverse operations, estimating and checking answers						
EYFS	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
			estimate the answer to a calculation and use inverse operations to check answers (copied from Addition and Subtraction)	estimate and use inverse operations to check answers to a calculation (copied from Addition and Subtraction)		use estimation to check answers to calculations and determine, in the context of a problem, levels of accuracy
Problem solving						
EYFS	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
Solve practical problems including doubling, halving and sharing.	solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher	solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts	solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects	solve problems involving multiplying and adding, 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	solve problems involving multiplication and division including using their knowledge of factors and multiples, squares and cubes	solve problems involving addition, subtraction, multiplication and division
Solve practical problems that involve combining					solve problems involving addition,	

groups of 2, 5 or 10, or sharing into equal groups.					subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign	
					solve problems involving multiplication and division, including scaling by simple fractions and problems involving simple rates	solve problems involving similar shapes where the scale factor is known or can be found (copied from Ratio and Proportion)

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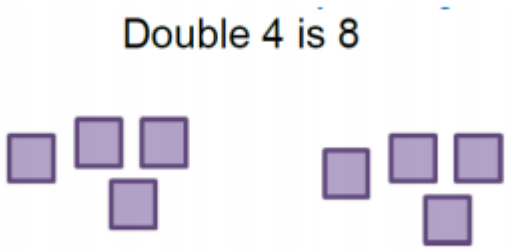
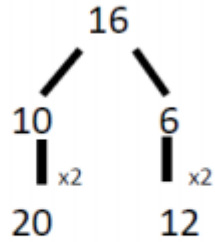
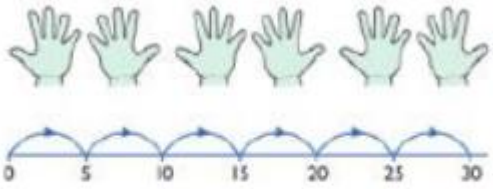
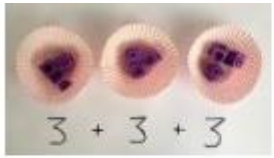
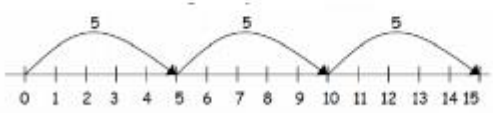
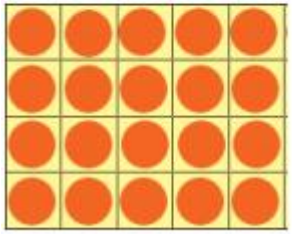
Multiplication

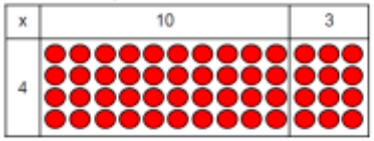
Objective and Strategies	Concrete	Pictorial	Abstract
Doubling	 Use practical activities to show how to double a number.	Draw pictures to show how to double a number. 	 Partition a number and then double each part before recombining it back together.
Counting in multiples	 	 Use a number line or pictures to continue support in counting in multiples.	Count in multiples of a number aloud. Write sequences with multiples of numbers. 2, 4, 6, 8, 10 5, 10, 15, 20, 25 , 30

	Count in multiples supported by concrete objects in equal groups.		
Repeated addition	   Use different objects to add equal groups.	There are 3 plates. Each plate has 2 star biscuits on. How many biscuits are there?  2 add 2 add 2 equals 6  5 + 5 + 5 = 15	Write addition sentences to describe objects and pictures.  2 + 2 + 2 + 2 + 2 = 10

Arrays showing communitive multiplication	Create arrays using counters/cubes to show multiplication sentences 	Draw arrays in different rotations to find **commutative** multiplication sentences.  4 × 2 = 8 2 × 4 = 8  2 × 4 = 8 4 × 2 = 8  Link arrays to area of rectangles.	Use an array to write multiplication sentences and reinforce repeated addition.  5 + 5 + 5 = 15 3 + 3 + 3 + 3 + 3 = 15 5 x 3 = 15 3 x 5 = 15

Grid Method

Show the link with arrays to first introduce the grid method.

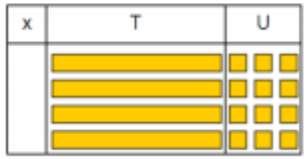


4 rows of 10

4 rows of 3

Move on to using Base 10 to move towards a more compact method.

4 rows of 13

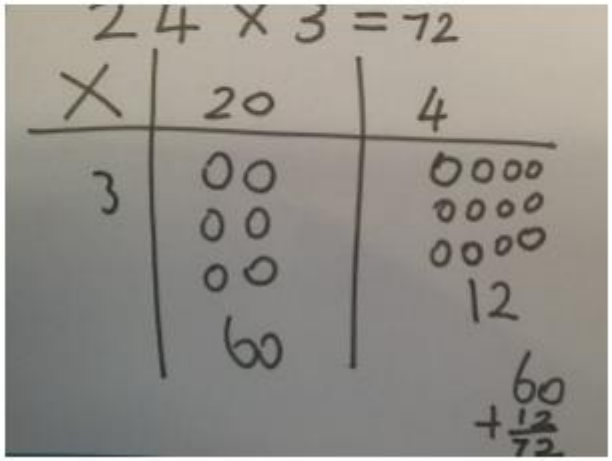


Move on to place value counters to show how we are finding groups of a number.We are multiplying by 4 so we need 4 rows.

Fill each row with 126.

Children can represent the work they have done with place value counters in a way that they understand.

They can draw the counters, using colours to show different amounts or just use circles in the different columns to show their thinking as shown below.



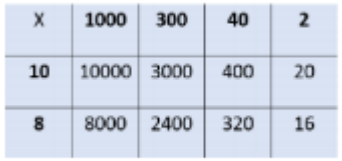
Start with multiplying by one digit numbers and showing the clear addition alongside the grid.

×	30	5
7	210	35

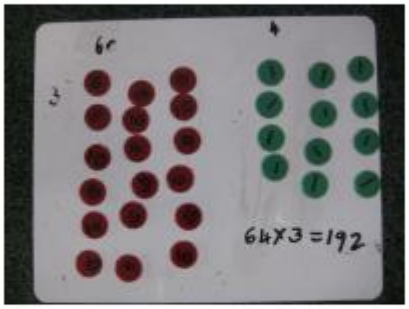
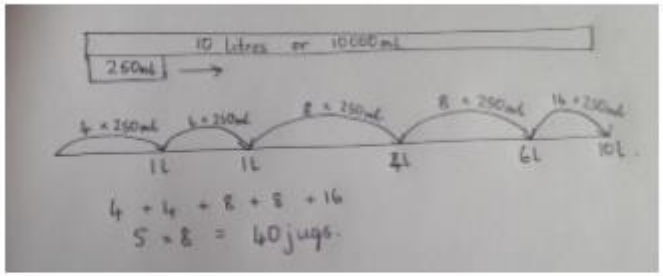
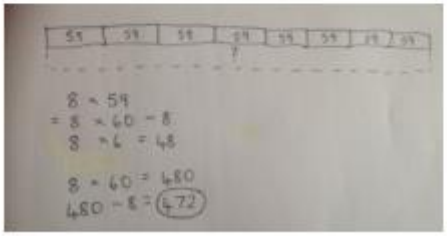
210 + 35 = 245

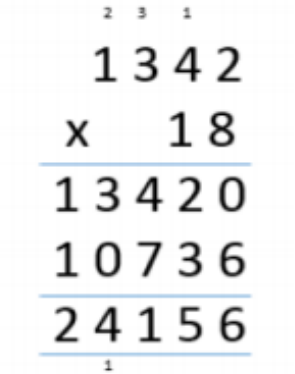
Moving forward, multiply by a 2 digit number showing the different rows within the grid method.

	10	8
10	100	80
3	30	24

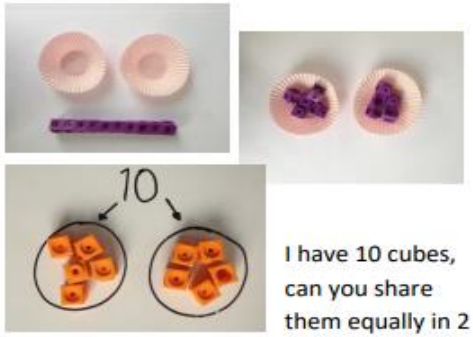
X	1000	300	40	2
10	10000	3000	400	20
8	8000	2400	320	16

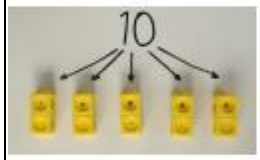
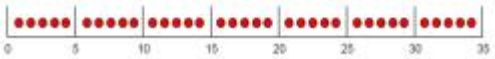
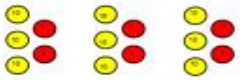
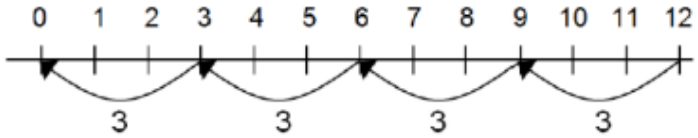
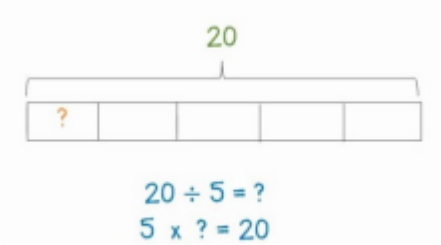
Column Multiplication	Children can continue to be supported by place value counters at the stage of multiplication.  It is important at this stage that they always multiply the ones first and note down their answer followed by the tens which they note below.	Bar modelling and number lines can support learners when solving problems with multiplication alongside the formal written methods.   	Start with long multiplication, reminding the children about lining up their numbers clearly in columns. If it helps, children can write out what they are solving next to their answer. 32 x 24 8 (4 x 2) 120 (4 x 30) 40 (20 x 2) 600 (20 x 30) 768 74 × 63 12 210 240 + 420 0 4662

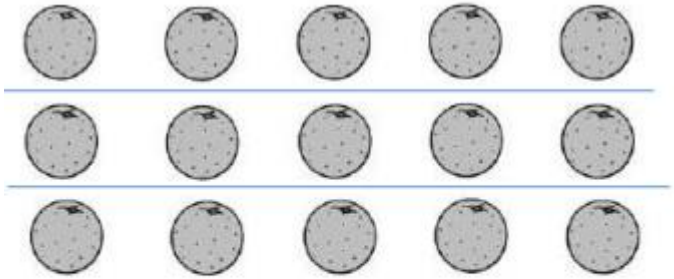
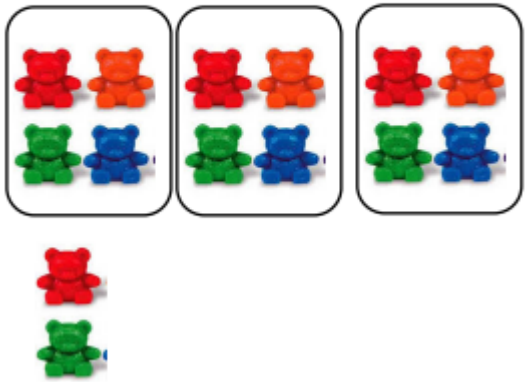
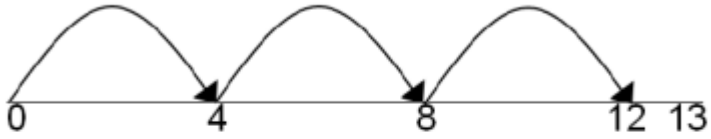
			This moves to the more compact method. 

Holy Trinity Church of England Primary Calculation Policy

Division

Objectives and Strategies	Concrete	Pictorial	Abstract
Sharing objects into groups	 I have 10 cubes, can you share them equally in 2 groups?	Children use pictures or shapes to share quantities.   $8 \div 2 = 4$	Share 9 buns between three people. $9 \div 3 = 3$

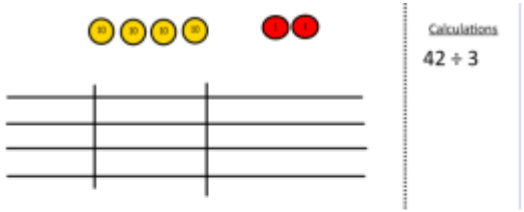
Division as grouping	Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.    96 ÷ 3 = 32 	Use a number line to show jumps in groups. The number of jumps equals the number of groups.  Think of the bar as a whole. Split it into the number of groups you are dividing by and work out how many would be within each group. 	28 ÷ 7 = 4 Divide 28 into 7 groups. How many are in each group?

Division within an array	 Link division to multiplication by creating an array and thinking about the number sentences that can be created. Eg 15 ÷ 3 = 5 5 x 3 = 15 15 ÷ 5 = 3 3 x 5 = 15	 Draw an array and use lines to split the array into groups to make multiplication and division sentences.	Find the inverse of multiplication and division sentences by creating four linking number sentences. 7 x 4 = 28 4 x 7 = 28 28 ÷ 7 = 4 28 ÷ 4 = 7
Division with a remainder	14 ÷ 3 = Divide objects between groups and see how much is left over? 	Jump forward in equal jumps on a number line then see how  many more you need to jump to find a remainder. Draw dots and group them to divide an amount and clearly show a remainder. 	Complete written divisions and show the remainder using r. 

Short Division

96 ÷ 3 = 32

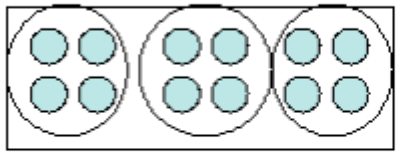
Use place value counters to divide using the bus stop method alongside



42 ÷ 3=

Start with the biggest place value, we are sharing 40 into three groups. We can put 1 ten in each group and we have 1 ten left over.

Students can continue to use drawn diagrams with dots or circles to help them divide numbers into equal groups.



Encourage them to move towards counting in multiples to divide more efficiently.

Begin with divisions that divide equally with no remainder.

$$\begin{array}{r} 218 \\ 4\overline{)872} \\ 3 \end{array}$$

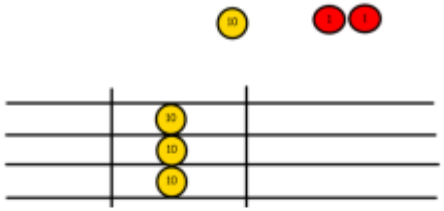
Move onto divisions with a remainder.

$$\begin{array}{r} 86\ r\ 2 \\ 5\overline{)432} \\ 3 \end{array}$$

Finally move into decimal places to divide the total

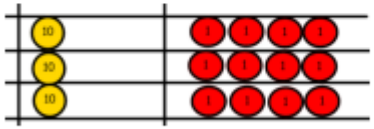
$$\begin{array}{r} 14.6 \\ 35\overline{)511.0} \\ 16\quad 21 \end{array}$$

accurately.



Then exchange the ten into ones and share the ones equally among the groups.

We look how much in 1 group so the answer is 14.



We look how much is in one group across so the answer is 14