Calculation Policy

This calculation policy has been produced to ensure consistency and progression in teaching throughout the school. This document outlines the different calculation strategies that should be taught and used from EYFS to Year 6 in line with the requirements of the 2014 Primary National Curriculum.

Each stage builds upon previous experience and understanding. They will develop calculation skills through a combination of practical, oral and mental activities using resources to develop a strong and secure sense of number.

Written calculation strategies will therefore be taught alongside mental calculation strategies and should be seen as complementary to and not as separate from them. Informal written recording will take place regularly and is an important part of learning and understanding. More formal written methods follow only when the child is able to use a wide range of mental calculation strategies.

The emphasis of our teaching will always to be to facilitate their reasoning and understanding and not simply to arrive at a correct answer.

Children will always be encouraged to look at a calculation/problem and then decide which, is the most efficient method to choose. Our aim is for children to be able to select an efficient method of their choice (whether this be mental, written or using a calculator) that is appropriate for a given task. They will do this by always asking themselves:

- 'Can I do this in my head?'
- 'Can I do this in my head using drawings or jottings?'
- 'Do I need to use a formal written method?'

The overall aim is that when children leave Bradley Green Primary school they will:

- have a secure knowledge of number facts and a good understanding of the four operations;
- are able to use this knowledge and understanding to carry out calculations mentally and to apply appropriate strategies when using larger numbers.
- have an efficient, reliable, compact written method of calculation for each operation that children can apply with confidence when undertaking calculations that they cannot carry out mentally.

Addition

Key mental strategies

- **Bridging**: partition small numbers, e.g. 8 + 3 = 8 + 2 + 1
- **Partition and combine:** tens and ones, e.g. 23 + 14 = 20 + 10 (30) and 3 + 4 (7)
- **Near doubles:** e.g. 5 + 6 = 5 + 5 + 1
- **Number bonds:** 5 + 7 + 5 becomes 5 + 5 + 7
- **Place value knowledge:** 70 + 90 = 160 using 7 + 9 = 16
- **Compensating:** 34 + 9 do 34 + 10 – 1

EYFS

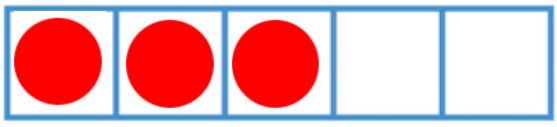
In EYFS, children at the expected level of development will:

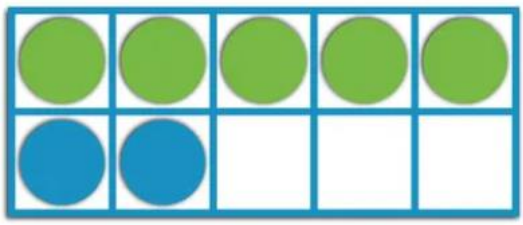
- have a deep understanding of number to 10, including the composition of each number
- subitise (recognise quantities without counting) up to 5,
- automatically recall (without reference to rhymes, counting or other aids) number bonds up to 5 (including subtraction facts) and some number bonds to 10, including double facts.

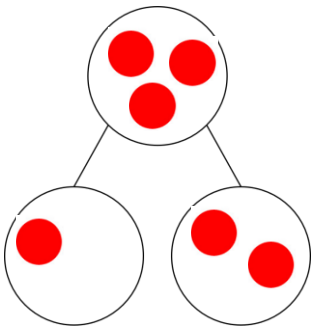
Subitising

Subitising is the absolute bedrock upon which all other mathematical understanding will be based. The first step in children's understanding of number is subitising up to 5 objects – seeing them as one complete collection. As the collection increases in size, we begin to move towards Conceptual Subitising – seeing the collection as being made up of groups or parts that add together to form the whole. So, in a collection of six items, we may see three and three; or three, two and one; or two, two and two maybe. This is the foundation of part whole understanding.

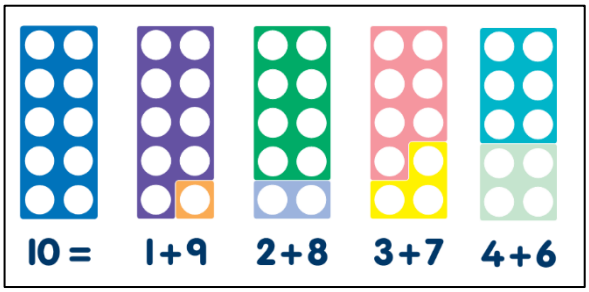
Children learn to represent numbers using five frames and tens frames alongside part-whole diagrams. When the children are ready to move on to work with numbers to 10, they use the '5 and a bit' structure.

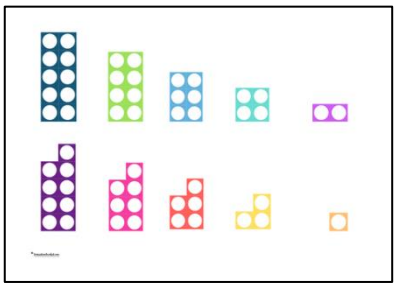






Numicon is also used to understand the composition of numbers, number bonds as well as identifying odd and even numbers.

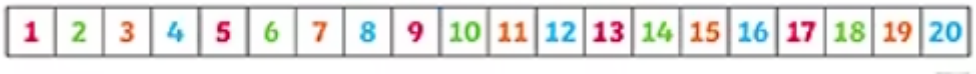




Cardinality

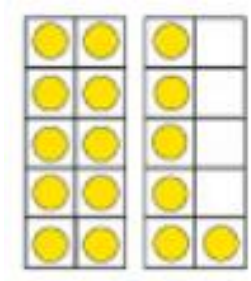
The cardinal value of a number refers to the quantity of things it represents. When children understand the cardinality of numbers, they know what the numbers mean in terms of knowing how many things they refer to. Counting is one way of establishing how many things are in a group, because the last number you say tells you how many there are. Children enjoy learning the sequence of counting numbers long before they understand the cardinal values of the numbers.

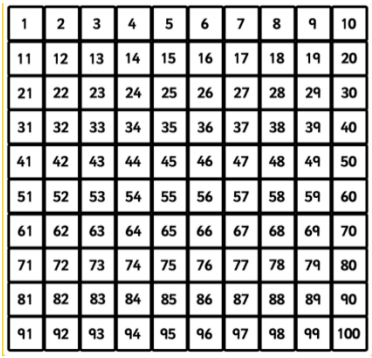
Children in EYFS also use a number track when counting to 20 and to help them to identify one more and one less.



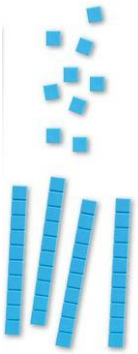
Year 1

In year 1 children continue to use part-whole diagrams and multiple tens frames working up to 100. They also represent numbers on a number line and use hundred squares. They represent numbers using base 10 and use these to identify the number of tens and ones in a number. They also use tens and ones grid and part-whole diagrams. Children are introduced to rekenreks to help children develop confidence and fluency with number.

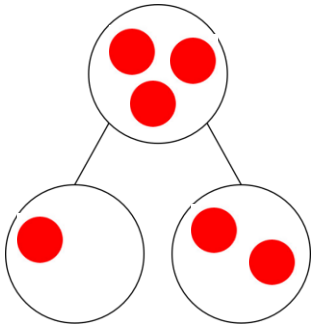


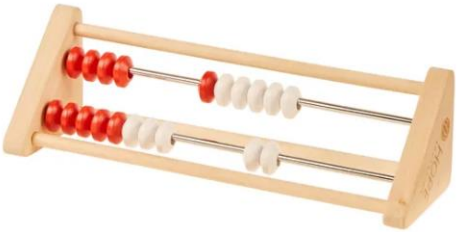


1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100



Tens	Ones





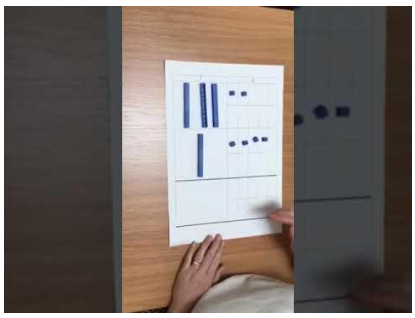
Year 2

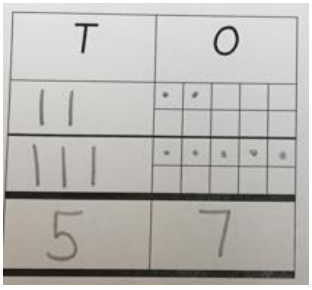
In year 2 children progress on to the layout of formal addition. They use base 10 equipment first, then represent these pictorially before moving on to the abstract form.

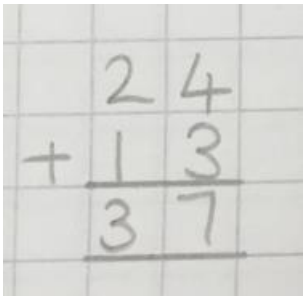
Ensure that the equipment is in rows of 5 to help with subitising.

Column with no exchanges (mainly 2 digit numbers)

concrete representation pictorial representation abstract representation

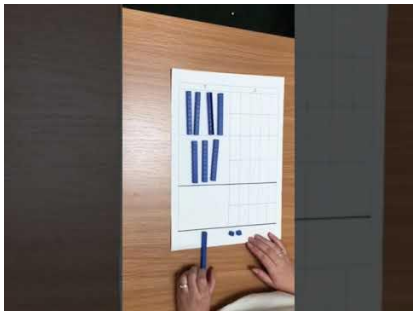


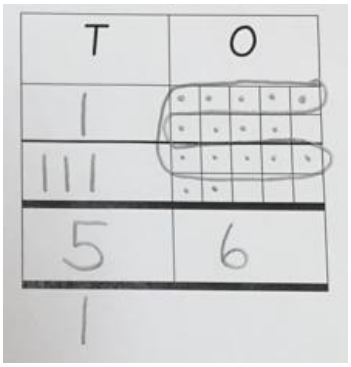


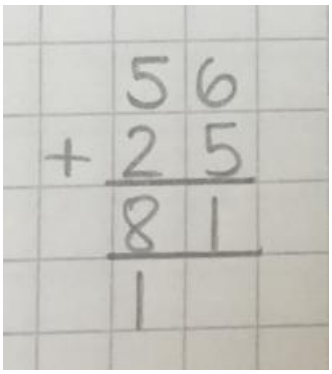


Column with exchanges (mainly 2 digit numbers)

concrete representation pictorial representation abstract representation





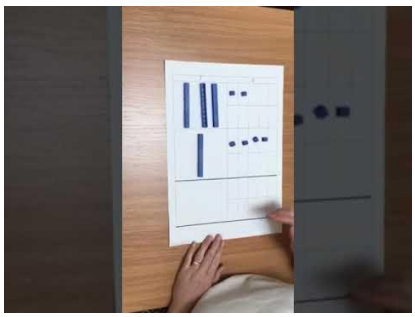


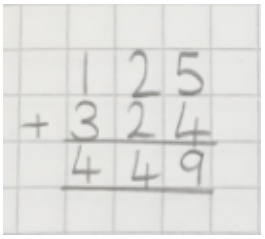
Year 3

In year 3, children move to the formal written method with 3 digits including exchanges

Column with no exchanges (mainly 3 digit numbers)

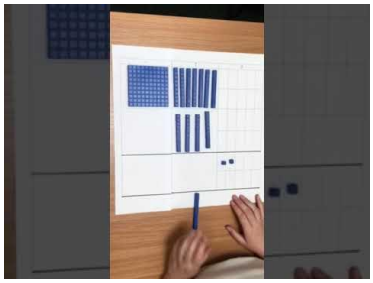
concrete representation pictorial representation abstract representation



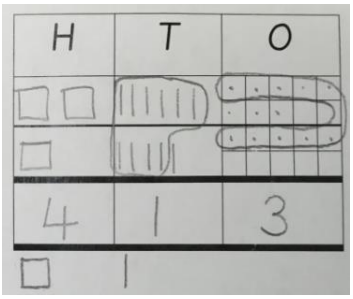


Column with exchanges (mainly 3 digit numbers)

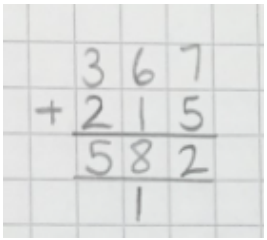
concrete representation



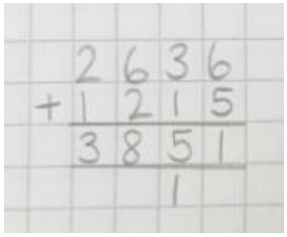
pictorial representation



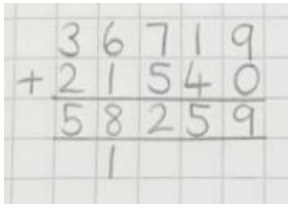
abstract representation



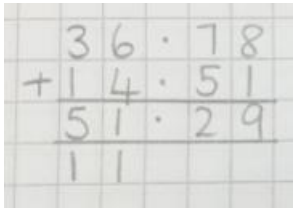
Year 4 – Use the formal written method with 4 digits including exchanges



Year 5 – Use the formal written method with more than 4 digits including exchanges and decimal numbers



Year 6 – Use the formal written method with more than 4 digits including exchanges and decimal numbers

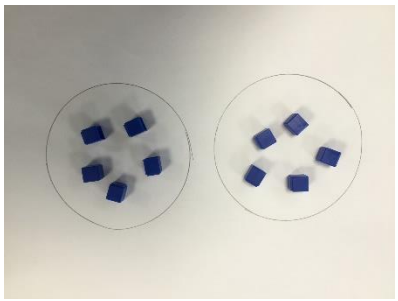


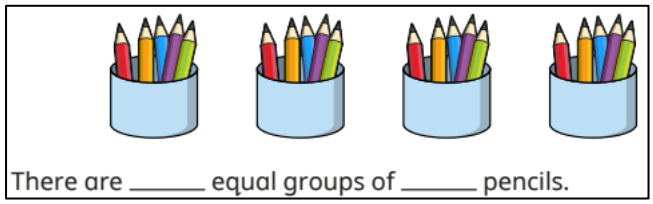
Multiplication

Year 1

In year 1 the children are introduced to the concept of multiplication by learning about equal groups by using concrete objects and pictorial representations. Children in year 1 have a big focus on groups of 2, 5 and 10. Children are not introduced to the multiplication symbol but display calculations as repeated additions.

Children draw out the correct number of groups and then add counters, cubes or any other concrete resource.

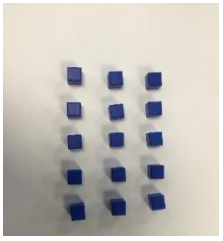


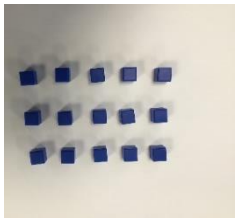


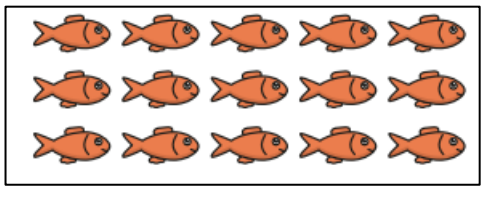
5 + 5 + 5 + 5 = 20

Children then move onto making arrays, arranging objects into columns and rows. Children need to be encouraged to read the array both ways to show commutative law (rows and columns or columns and rows).

Children can use the language to show their understanding of arrays, and they can record as a repeated addition.







There are 3 rows of 5.

There are 15 fish.

5 + 5 + 5 = 15

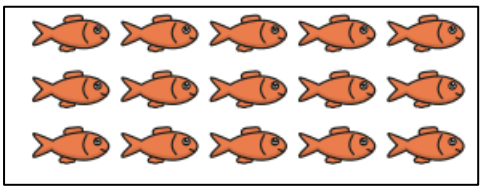
There are 5 columns of 3.

There are 15 fish.

3 + 3 + 3 + 3 + 3 = 15

Year 2

In year 2, children make the connection between repeated addition and multiplication. Children continue to recognise equal and unequal groups and use repeated addition before moving on to look at the multiplication symbol to represent lots of and groups of. They should be encouraged to identify the 2 multiplication sentences that can be seen in an array. By the end of year 2, children are expected to recall and use the multiplication facts for the 2, 5 and 10 times tables.



There are 3 rows of 5.

There are 15 fish.

5 + 5 + 5 = 15

3 x 5 = 15

There are 5 columns of 3.

There are 15 fish.

3 + 3 + 3 + 3 + 3 = 15

5 x 3 = 15

Year 3

In year 3, children recap their learning from KS1. They revisit repeated addition sentences, arrays and simple multiplication sentences using the symbol but focus on the times tables that have been taught at that point in time. By the end of year 3, children are expected to recall and use the multiplication facts for the 3, 6, 4 and 8 times tables as well as the 2, 5 and 10 times tables from Year 2.

A crucial part of the learning around multiplication in year 3 is the understanding of multiples of 10. Children reinforce their earlier work on place value and use a range of representations, such as ten frames, Gattegno charts and place value charts. They must place the digits on a place value chart and move the digits the correct number of places, filling in the empty columns with a zero as a place holder. It is important that they do not develop the misconception that they just add a zero to multiply by 10, as this will cause confusion when multiplying decimals in later learning. They recognise that multiples of 10 end in a zero and use this fact to solve basic multiplication problems beyond the 10 times-table.

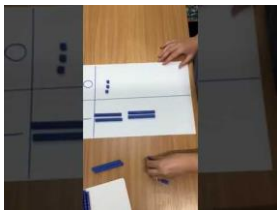
100	200	300	400	500	600	700	800	900
10	20	30	40	50	60	70	80	90
1	2	3	4	5	6	7	8	9

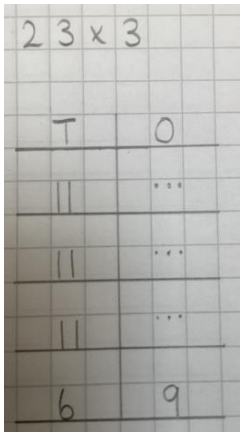
Hundreds	Tens	Ones

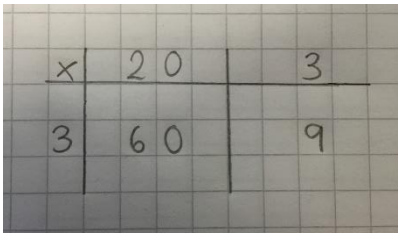
Children then move on to explore multiplying 2-digit numbers by 1-digit numbers. They work with the table facts that they know. They begin by having no exchanges, then move onto exchanges. Children complete the calculations using concrete materials and then represent these pictorially. Before children move on to the abstract form of the short multiplication method, they complete the calculation using partitioning using the grid method.

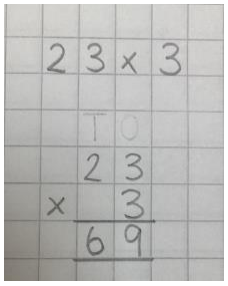
Multiply 2 digit by 1 digit (no exchange)

23 x 3 = 69 pictorial The grid method short multiplication



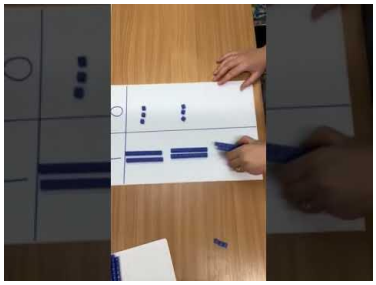


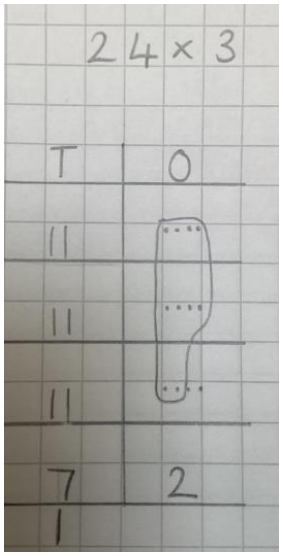


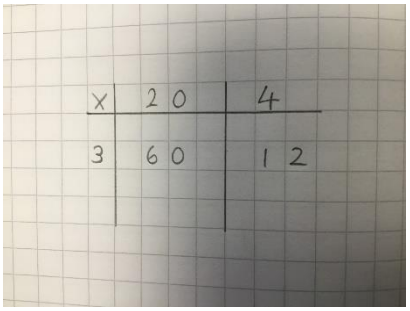


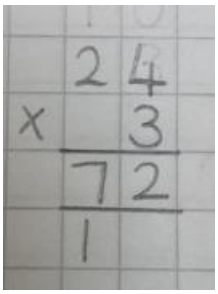
Multiply 2 digit by 1 digit (with an exchange)

24 x 3 = 72









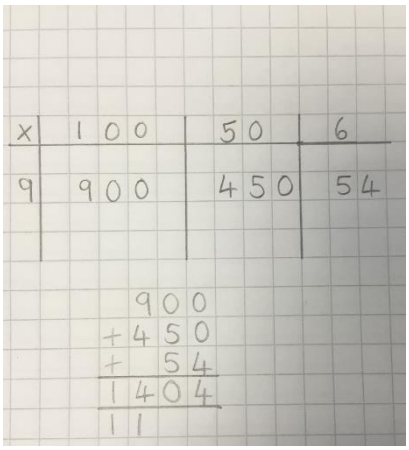
Year 4

By the end of year 4, children are expected to recall and use the multiplication facts up to 12 x 12. Children learn about multiplying numbers by 10 and 100. They must place the digits on a place value chart and move the digits the correct number of places, filling in the empty columns with a zero as a place holder. It is important that they do not develop the misconception that they just add a zero to multiply by 10, as this will cause confusion when multiplying decimals in later learning.

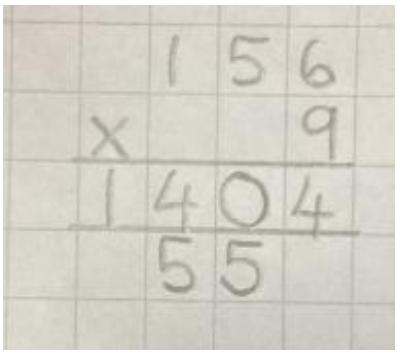
Hundreds	Tens	Ones

Children calculate 2 digit times by a 1 digit number by recapping their learning from year 3. They then calculate 3-digit numbers times by a 1 digit number. The step using place value charts and base 10 materials can be used if needed and then children use partitioning using the grid method before using the formal written short method.

The grid method



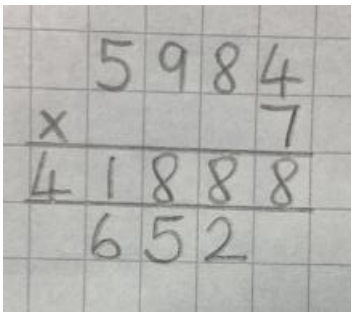
Short multiplication



Year 5

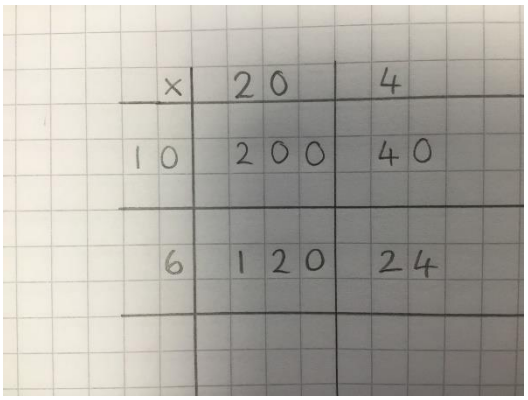
In year 5, children revisit multiplying whole numbers by 10 and 100 (introduced in Year 4) and move on to multiplying whole numbers by 1,000. Concrete manipulatives such as place value charts and counters and Gattegno charts can be used to support understanding, using children's knowledge of the relationship between digits in given rows/columns.

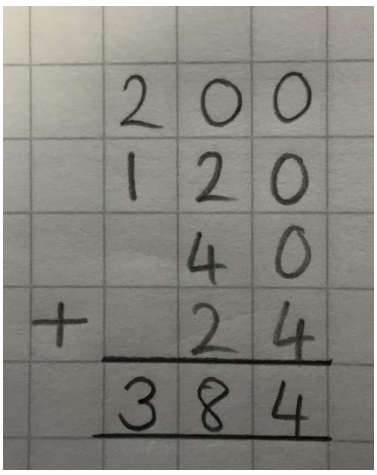
In Year 4, children used the formal written method to multiply numbers with up to three digits by a 1-digit number. In Year 5, children continue to use the formal written method for short multiplication for multiplying 4-digit numbers by a 1-digit number.

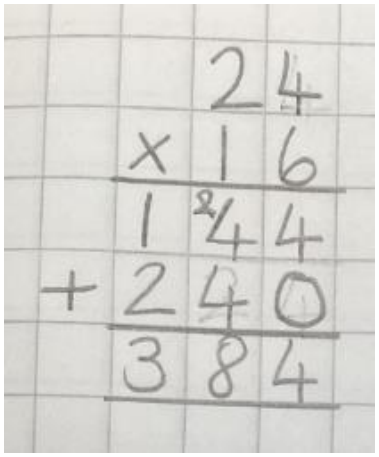


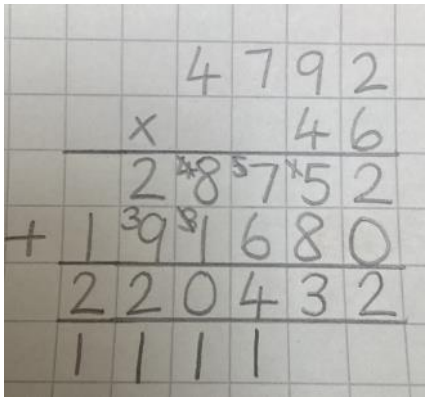
Children then move onto multiplying numbers with up to 4 digits by a 2-digit number. They begin by revisiting a 2 digit multiplied by a 2 digit number using the grid method. Children then complete a long multiplication for a 2 digit multiplied by a 2 digit number.

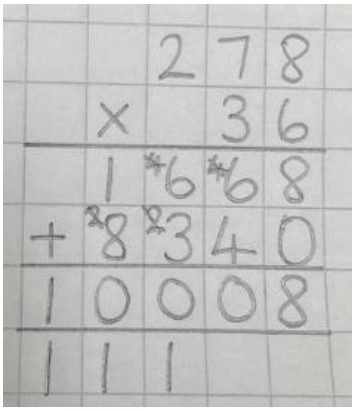
They then move onto multiplying 3 and 4 digit numbers by a 2 digit number using long multiplication.











Year 6

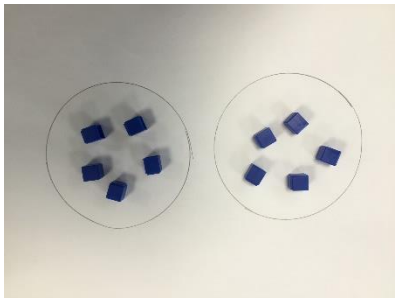
In year 6 children continue to multiply whole numbers up to 4 digits by 2 digit numbers.

Division

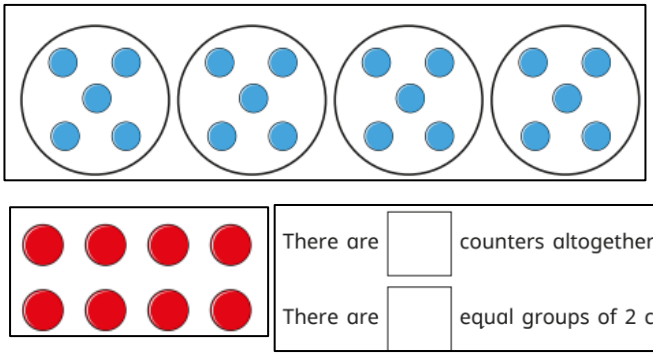
Year 1

In Year 1, children solve one-step problems involving division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher. In Year 1, children will work mainly with concrete objects and some pictorial representations. The language division is not introduced, instead year 1 use the terms grouping and sharing.

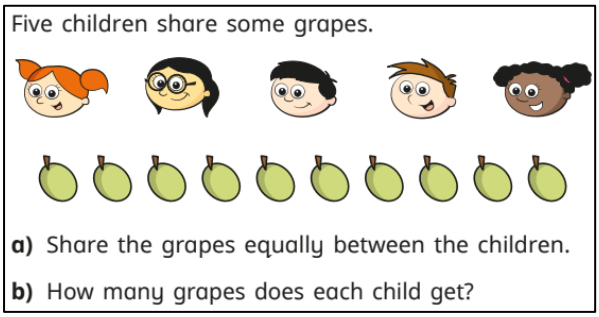
Children draw out the correct number of groups and then share or group the counters, cubes or any other concrete resource.

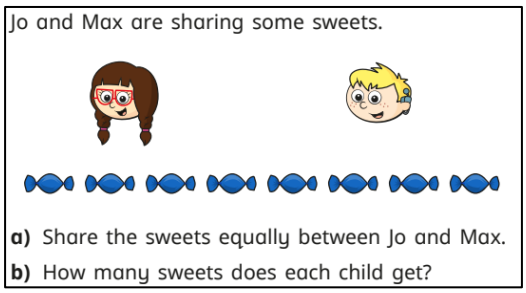


Children look at grouping.



Children look at sharing.





Year 2

At the start of Year 2, children recap their learning from year 1 and recognise equal and unequal groups and they share and group using concrete resources and pictorial representations.

In Year 2, children are first introduced to the symbol for division. Children calculate mathematical statements for division within the 2, 5, 10, 1 and 0 multiplication tables and write them using the division (÷) and equals (=) signs. Division is taught alongside multiplication so that children can make close links between multiplication and division. Children solve division calculations using numbers no bigger than 12x.

Children divide by practically sharing/grouping. Alongside this, children learn that skip counting in groups is a mental method of solving division calculations.

So if the children were working out 30 divided by 5. They would start by practically sharing 30 counters into 5 groups. Then they would group the 30 counters into groups of 5. This will enable a discussion around fact families.

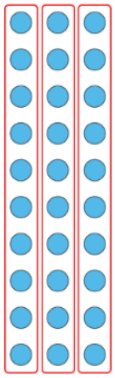
Children will be taught that when we divide by 2, this means the same as half.

Children also learn that division is not commutative.

Children will use arrays practically and pictorially to demonstrate their understanding of division and the links to the known multiplication facts. Children will also use bar models to pictorially represent division.

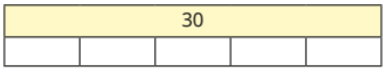
Children solve problems involving division using the methods above.

Ensure that children's times tables knowledge does not impact on their knowledge of division. Children that are not yet fluent with their times tables needs to be given a times tables square so they can access the lessons on division.

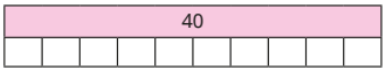


$3 \times 10 = 30$
$10 \times 3 = 30$
$30 \div 10 = 3$

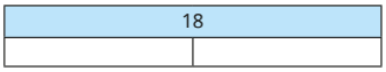
a) $30 \div 5$



b) $40 \div 10$



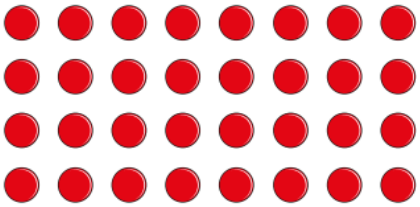
c) $18 \div 2$



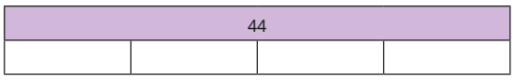
Year 3

Children begin by recapping their Y2 learning using sharing and grouping and move on to using their new multiplication knowledge of 3, 4, 8, 6 to solve division calculations.

Children need to have discussions around fact families, making the link between multiplication and division. Children use bar models and arrays to represent these calculations.

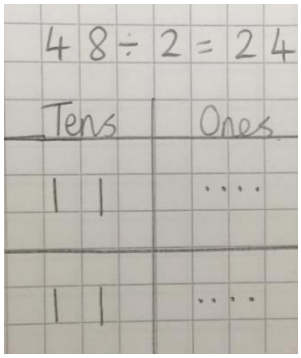


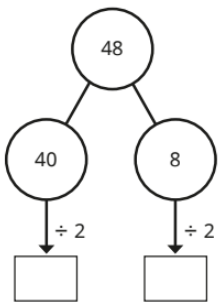
$32 \div 4 =$ ☐



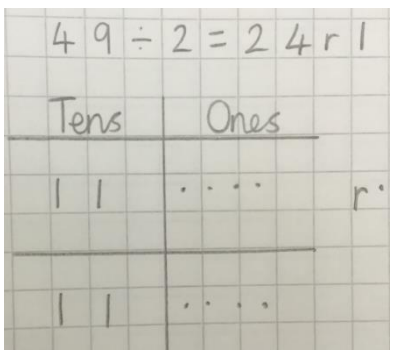
$44 \div$ ☐ $=$ ☐

Children divide using the tens and ones grid and then use the part-whole model. Children are then introduced to calculations that have remainders.



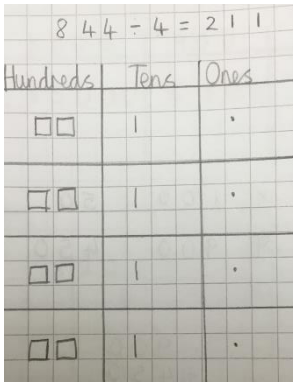


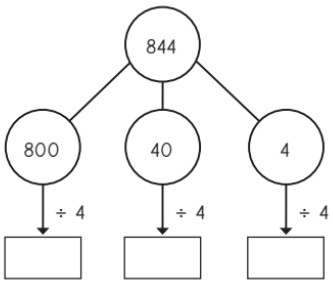
$48 \div 2 =$ ☐



Year 4

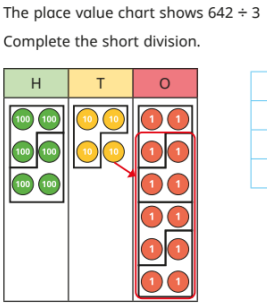
In Year 4, children use place value, known and derived facts to multiply and divide mentally using the multiplication facts for all the times tables. They use the partitioning grid practically and part-whole diagrams like in year 3. They then move on to dividing 3 digits by a 1-digit number. They will also have calculations which result in a remainder.

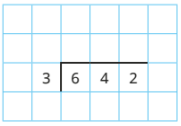


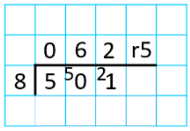


Year 5

In year 5, children revisit the work from year 3 and 4 on partitioning practically and pictorially and make links to the formal written method. They 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.







Year 6

In year 6, divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context. The children write out the multiples of the divisor to help them.