Riversdale Primary School
Calculation Policy

This policy has been largely adapted from the White Rose Maths Hub Calculation Policy with further material added. It is a working document and will be revised, as necessary. Many variations have been included to provide teachers with a range of tools to support pupils in their grasp of number and calculation. The Mathematical vocabulary that is specified in this document allows staff to maintain consistency in terminology throughout the school.

The document will demonstrate the way we teach each concept. It is organised into year group order to ensure progression of skills for each operation. It also includes an overview of mental strategies for each year group.

*At Riversdale, mathematical understanding is developed through the use of representations that are first: **concrete**, (e.g. base ten, apparatus), second: **pictorial** (e.g. array, place value counters) both working to then facilitate **abstract** working (e.g. columnar addition, long multiplication).*

To ensure deep conceptual understanding, struggling learners are supported by reverting to concrete and/or pictorial resources and representations to solidify understanding or revisit the previous year's strategy.

This policy is designed to help teachers and staff members at our school to ensure that calculation is taught consistently across the school and to aid them in helping children who may need extra support or further challenge.

This policy is also designed to help parents, carers and other family members support children by providing an explanation of the methods used in our school.

EYFS

In EYFS, pupils should be developing their concept of the number system through the use of concrete materials and pictorial representations. They should experience practical calculation opportunities using a wide variety of equipment, e.g. small world play, role play, counters, cubes etc. They can then develop ways of recording calculations using pictures, etc.

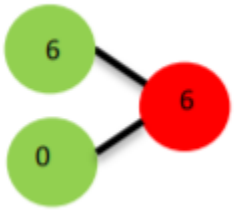
Addition: Add two single digit numbers, counting on to find the answer.

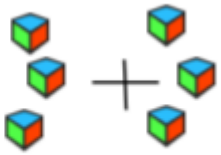
Pupils must be provided with opportunities to develop their skills, so that they are able to count reliably, including one to one correspondence and counting on from a given number. Pupils should be given the opportunity to count out sets of objects and then combine them to make a total

e.g. 6 + 2 = 8

First count out a group of 6. Then count out a group of 2. Finally combine them to find a total.

Pupils should recognise different ways of making numbers. E.g. 6 can be made as



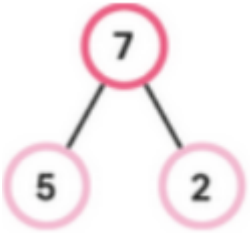


Subtraction: Using quantities and objects, subtract two single-digit numbers and count back to find the answer.

Pupils should count out a group of objects, move some away and recount the total.

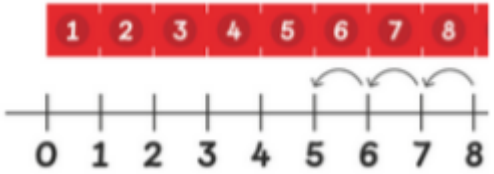
8 – 3 = 5

After pupils have recognised different ways of making numbers, they should use this number bond knowledge to help with subtraction facts.



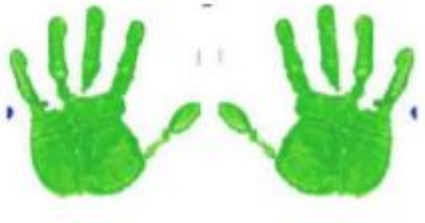
Children should use concrete materials to start counting back in order to solve subtraction problems.

8 – 3 =

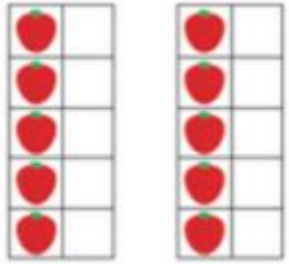


Multiplication: Solve problems, including doubling

Children will experience equal groups of objects. They should work on practical problem solving activities.



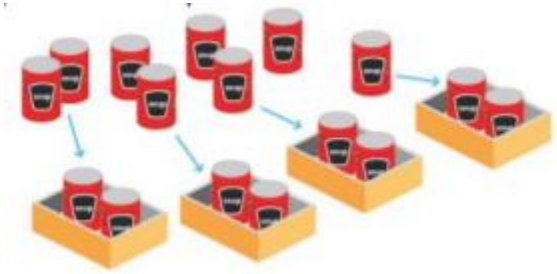
Use a range of concrete materials to show a number and then repeat the number to show doubling. Then move onto pictorial representations.

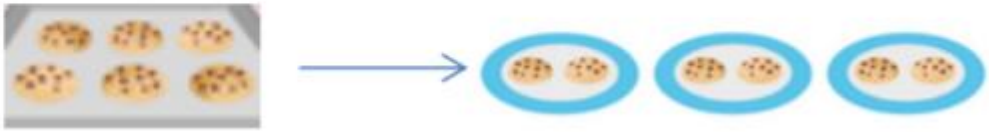


Division: Solve problems, including halving and sharing

Pupils should have many practical experiences of sharing objects e.g. sharing between 2 people, or finding ½ of a group of objects.

Use a range of concrete materials to show a number and then share them equally. Then move onto pictorial representations

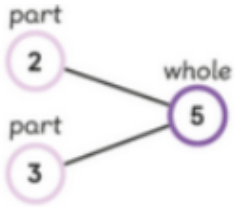




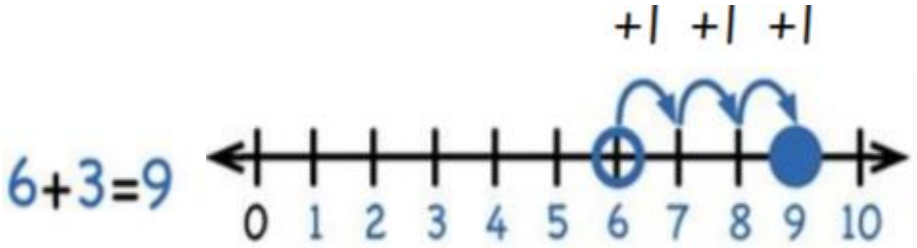
Year 1

Addition: Add one-digit and two-digit numbers to 20, including zero

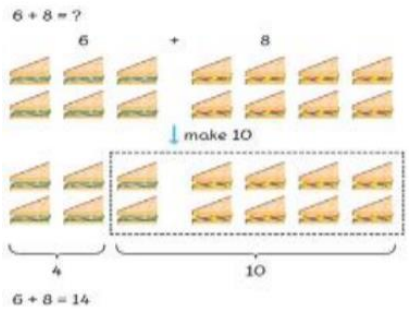
Use objects to count on and add by using number bonds.

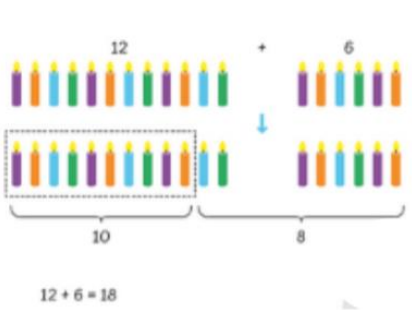


Use numbered number lines to add, by counting on in ones. Encourage children to start with the larger number and count on

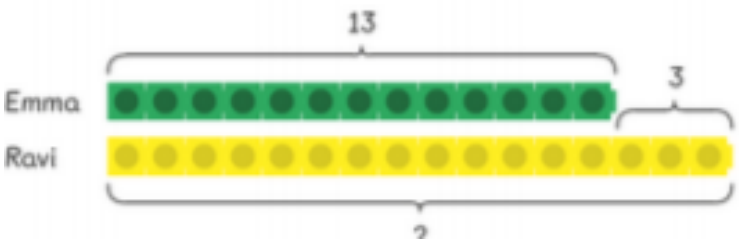


Add by using number bond knowledge in order to make 10 / add the ones.



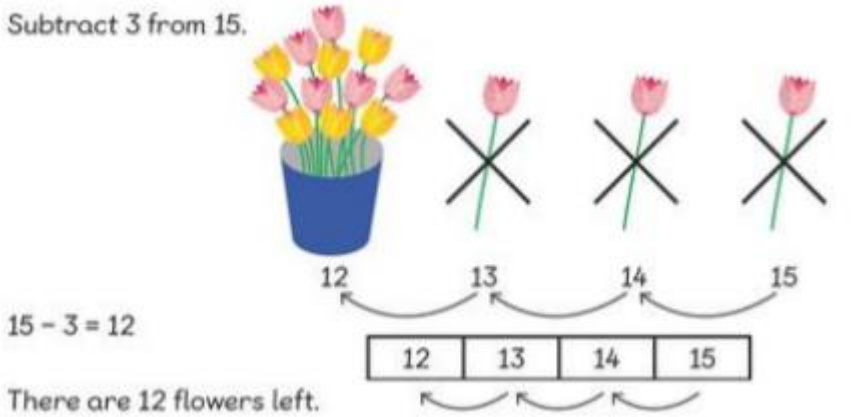


Introduce to the bar method. Use visual bars to show the calculation.

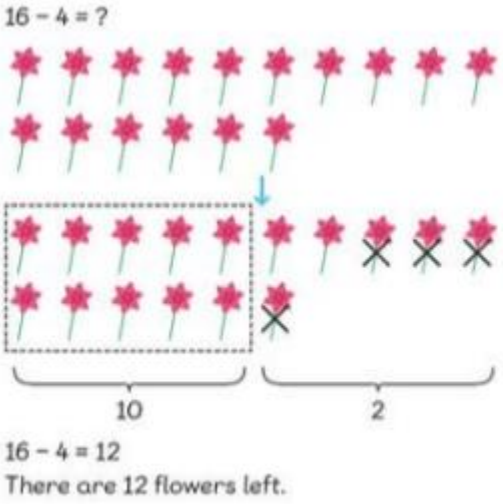


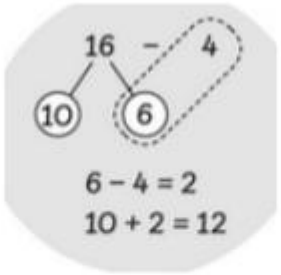
Subtraction: Subtract one-digit and two-digit numbers to 20, including zero

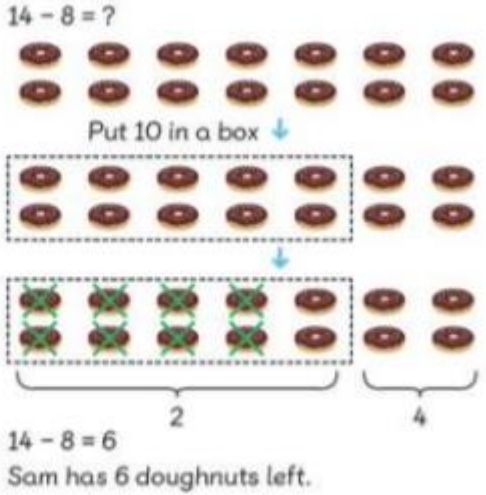
Building on from the EYFS methods, children consolidate understanding of subtraction practically. Use physical objects to count back, which is then reinforced on different number squares and number lines.

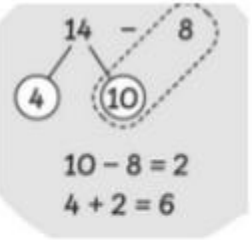


Pupils use knowledge of place value to partition 2 digit numbers in order to subtract ones from the number. They will be exposed to language such as "How much more" and "What is the difference between".

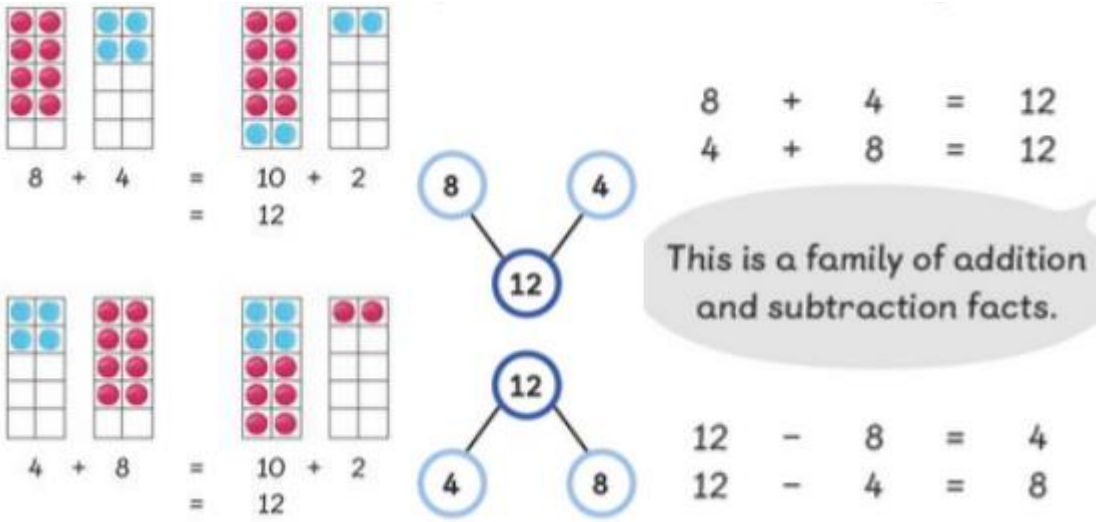








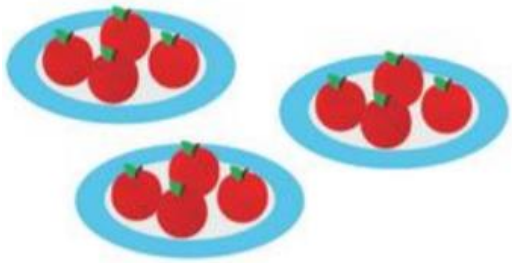
Pupils will be exposed to the idea of commutativity to understand the idea of fact families.

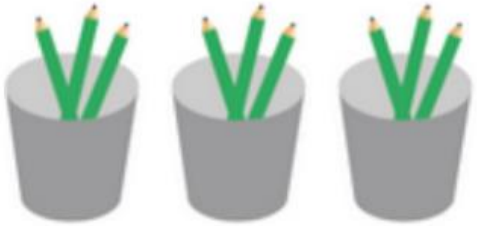


Children should start recalling subtraction facts up to and within 10 and 20, and should be able to subtract zero.

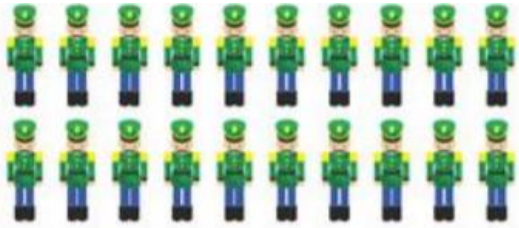
Multiplication: Solve one-step problems involving multiplication by calculating the answer using concrete objects, pictorial representations and arrays

Children should practise making equal groups first and add them to associate repeated addition with multiplication. Use a range of concrete materials before pictorial representations.





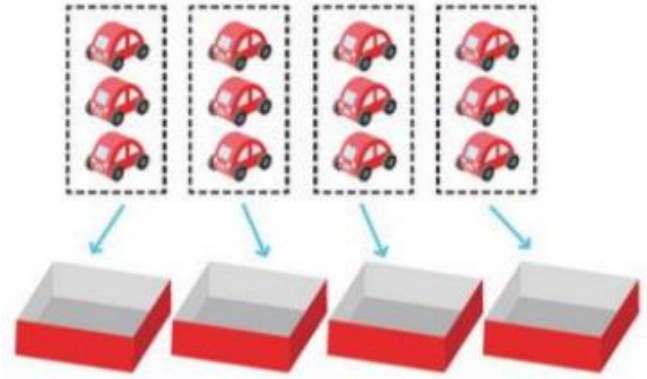
Associate grouping to equal rows so children learn to count up in the same number.



There are 10 toy soldiers in one row.
2 tens = 20
There are 20 toy soldiers altogether.

Division: Solve one-step problems involving division by calculating the answer using concrete objects, pictorial representations and arrays

Building on multiplication knowledge and EYFS division strategies, children practise grouping concrete objects equally in order to count the amount in teach group. Use a range of concrete materials before pictorial representations.

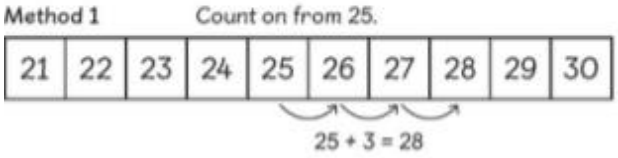


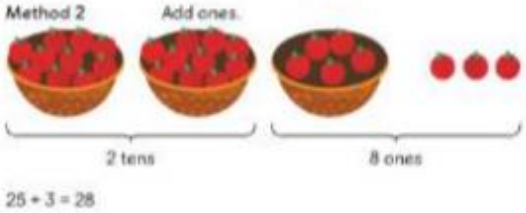
Build on practical materials by sharing and moving objects.

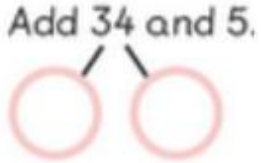
Year 2

Addition: Add with 2-digit numbers

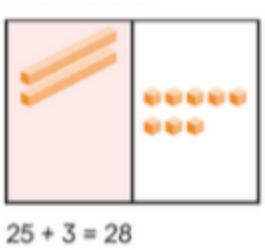
Before moving onto the written method, children should add using a range of resources and methods.



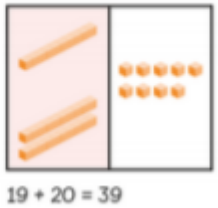




Use a range of resources to add and associate to a written method (column method)

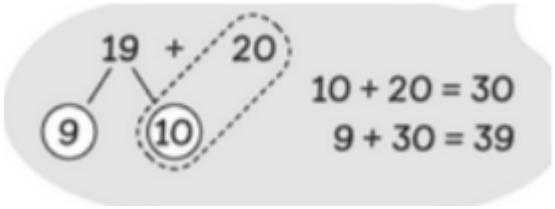


	tens	ones
	2	5
+		3
	2	8



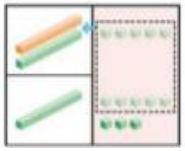
	tens	ones
	1	9
+	2	0
	3	9

Use knowledge of number bonds to add numbers



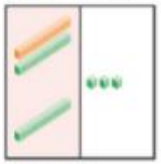
When renaming, show the expanded method, but link straight to the compact method.

Step 1 Add the ones.
5 ones + 8 ones = 13 ones
Regroup the ones.
13 ones = 1 ten and 3 ones



	tens	ones
	1	5
+	1	8
	1	3

Step 2 Add the tens.
1 ten + 1 ten + 1 ten = 3 tens



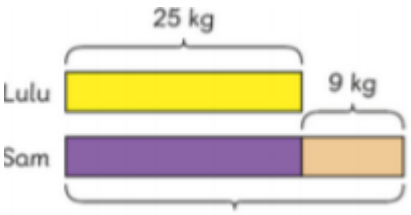
15 + 18 = 33

	tens	ones
	1	5
+	1	8
	1	3
+	2	0
	3	3

26 + 18 = ☐

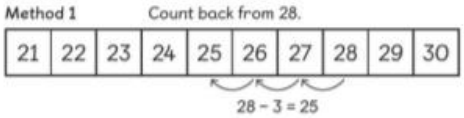
	tens	ones
	2	6
+	1	8
	☐	☐

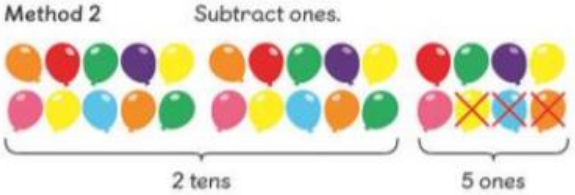
Children should use bars as a visual model to solve addition calculations and exposed to word problems.



Subtract: Subtract with 2-digit numbers

Before moving onto the written method, children should add using a range of resources and methods, including using knowledge of number bonds to subtract numbers.

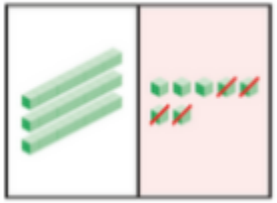




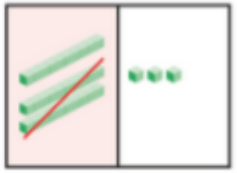
Use knowledge of subtraction to take away groups of 10.

4 – 1 = 30 therefore 40 – 10 = 30

Use a range of resources to add and associate to a written method (column method)

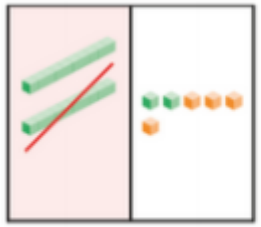


	tens	ones
	3	7
–	2	4
		3



	tens	ones
	3	7
–	2	4
	1	3

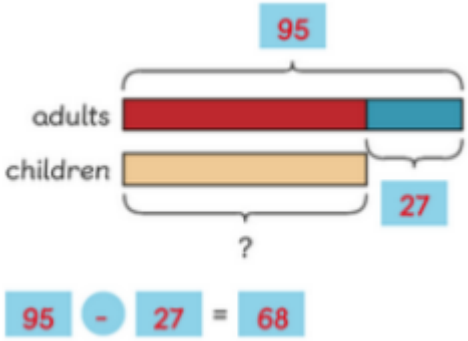
When renaming, you subtract the ones first, and then cross out the number you need to rename and write new number on top.



	tens	ones
	~~3~~ 2	~~2~~ 12
–	1	6
	1	6

Use knowledge of number bonds to subtract.

Children should use bars as a visual model to solve subtraction calculations and exposed to word problems.

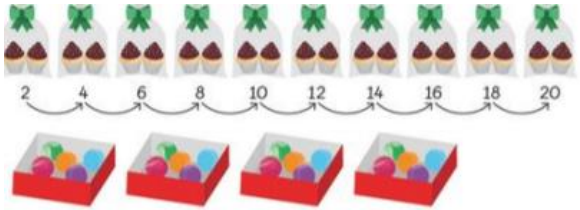


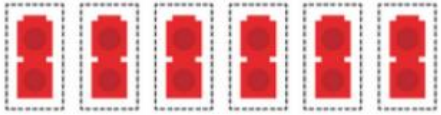
Multiplication: Calculate mathematical statements and solve problems for multiplication within the multiplication tables (2, 5 & 10)

Begin with consolidating Year I repeated addition and associate to multiplication.

3 + 3 + 3 + 3 = 12
4 threes = 12
4 groups of 3 = 12
4 × 3 = 12

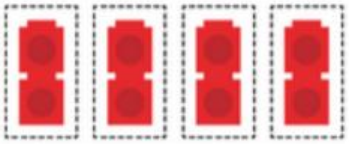
Before moving onto the written method, children should add using a range of resources and methods



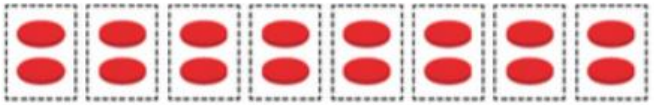


1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Children will associate the law of commutativity to multiplication using arrays and practical resources to show.



2 × 4 is equal to 4 × 2



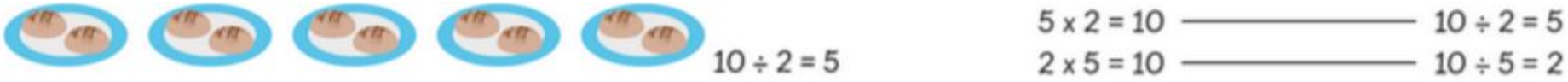
2 × 8 is equal to 8 × 2

Move onto abstract route with problems.

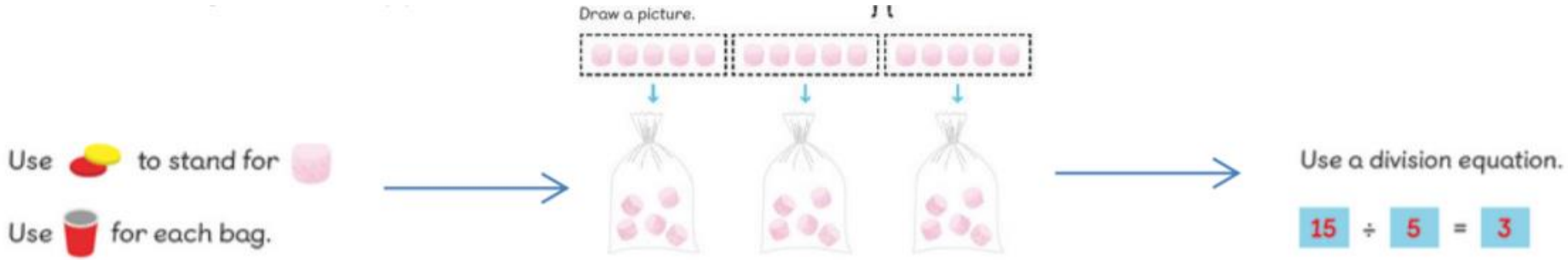
Division: Calculate mathematical statements and solve problems for division within the multiplication tables (2, 5 & 10)

Build on Year 1 by consolidating grouping equally. Use a range of resources to show division. Work on each times table in order (2, 5 then 10). Use idea of grouping before show division and link to the abstract calculation with the ÷ sign.

Associate to the law of commutativity to show link between multiplication and division.



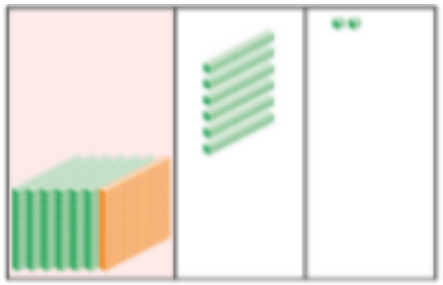
Work through CPA approach.



Year 3

Addition: Add numbers with 3 digits

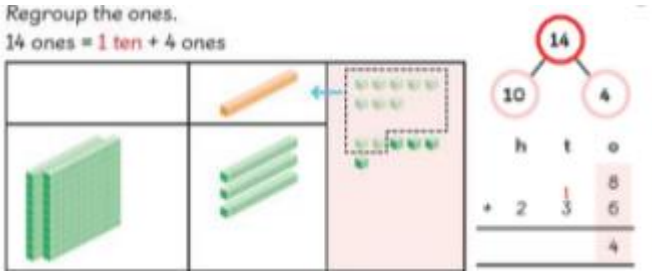
Introduce the expanded column method first using manipulatives first.



	h	t	o
	6	9	2
+		7	0
			2
	1	6	0
+	6	0	0
	7	6	2

Add the ones first in preparation for the compact method.

Introduce addition with renaming using the compact method with manipulatives first. Show how to rename, with partitioning.

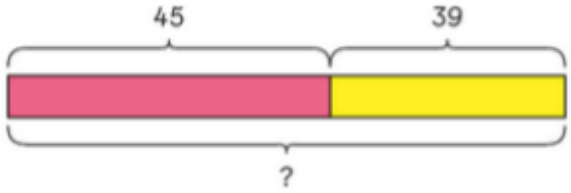


	h	t	o
		1	8
+	2	3	6
			4

- *Add the ones first.*
- *Carry the numbers directly above the next number, ensuring that the carried number is recorded first.*
- *The + symbol is positioned to the left, away from the digits*

	h	t	o
	1 7	9	2
+		6	0
	8	5	2

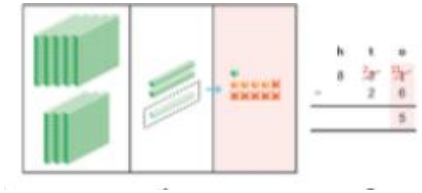
Continue to use bars as a visual model to solve addition calculations and exposed to word problems.

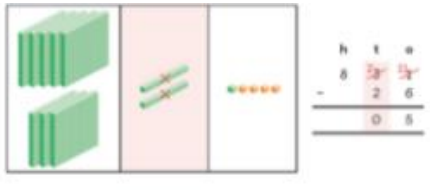


Subtraction: Subtract numbers with 3 digits

Children should use mental strategies to subtract 1 digit numbers and multiples of 10 from 3 digit numbers.

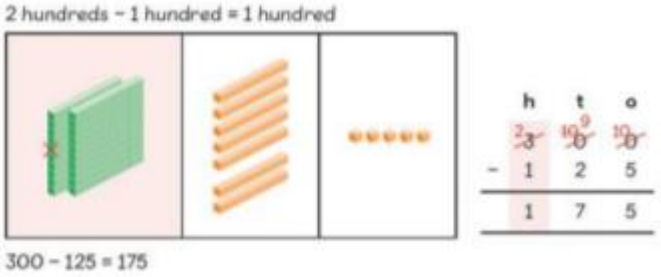
Introduce subtraction with renaming using the compact method with manipulatives first. Show how to rename, with partitioning.



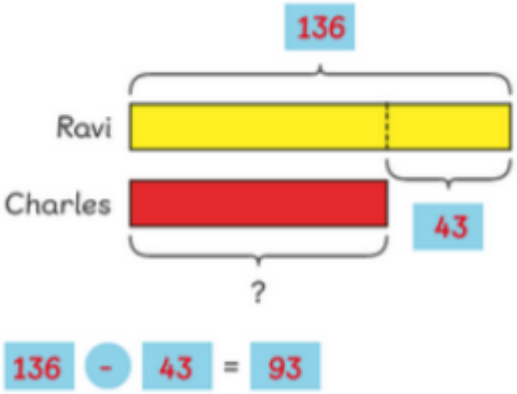


- *Subtract the ones first.*
- *Cross out a number which needs renaming and write the new number directly on top.*
- *The - symbol is positioned to the left, away from the digits*

Carry on, introducing multi-step renaming in single calculations.



Continue to use bars as a visual model to solve subtraction calculations and exposed to word problems.



136 - 43 = 93

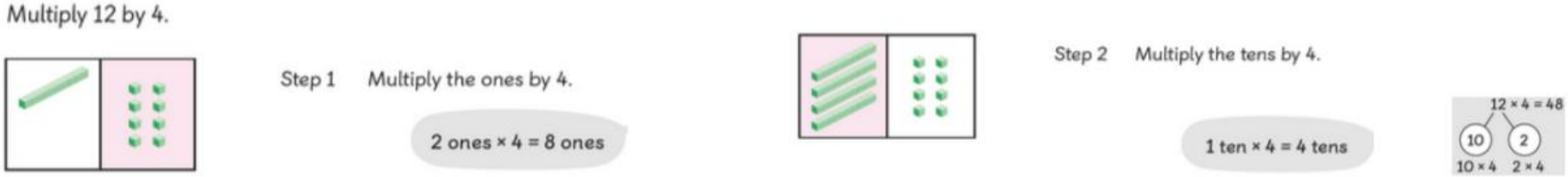
Multiplication: Multiply 2-digits by a single digit number

Introduce by applying already known knowledge to multiples of 10. Use a range of manipulatives to show:

Consolidate repeated addition before moving onto multiplication of 2 digit numbers.

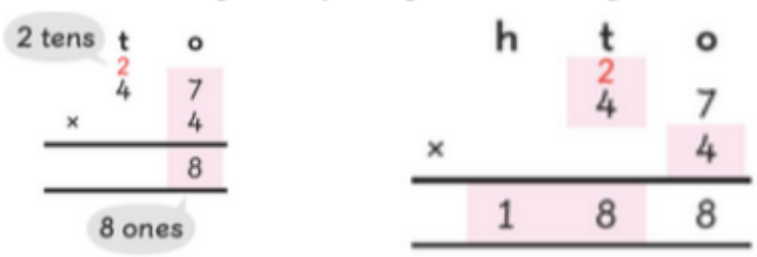
- *Multiply the ones digit by the single-digit number*
- *Multiply the tens digit by the single-digit number*

Show partition to show how this looks, using manipulatives as a supporting mechanism. Show column method alongside.

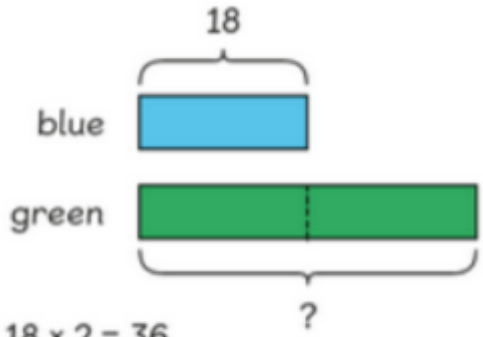


Show expanded method for conceptual understanding, but move straight onto the compact method using same techniques and break-downs.

When regrouping, always start with the larger value and write on top of the next digit.



Continue to use CPA approach and visual bars when solving multiplication and division in word problems.

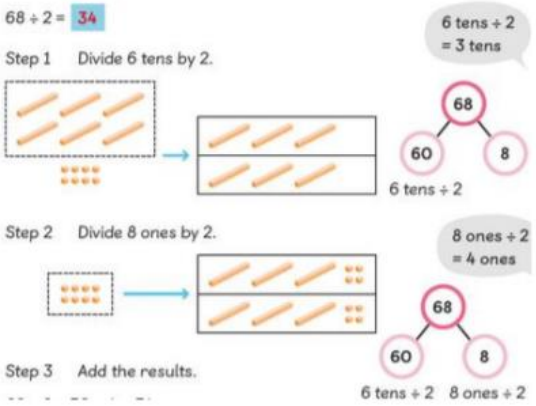


18 × 2 = 36

There are 36 green crayons.

Division: Divide 2-digit numbers by a single digit (where there is no remainder in the final answer)

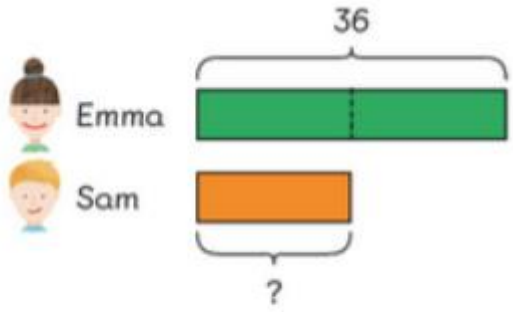
Introduce division by using manipulatives to divide (working on times table in order – 2, 5, 10, 3, 4, 8). Show partitioning to link in division.



Show 'chunking' method of division, using known division facts to take away chunks. Also show 'short division' method and link 2 methods together.

```
      1  2
   ┌─────
8  │ 9  6
   - 8  0
   ──────
      1  6
   - 1  6
   ──────
         0
   ──────
```

Continue to use CPA approach and visual bars when solving multiplication and division in word problems.



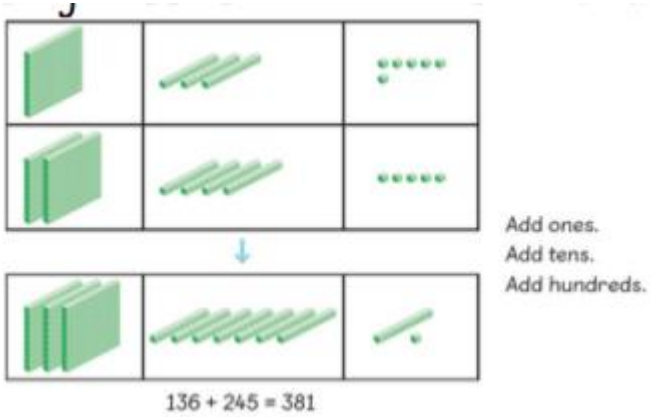
$36 \div 2 = 18$

Sam has 18 beads.

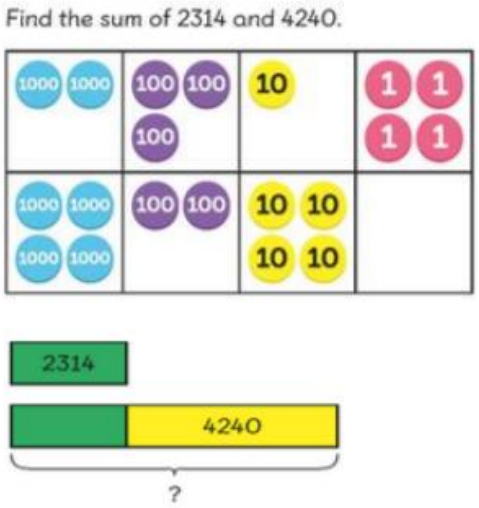
Year 4

Addition: Add numbers with 4 digits

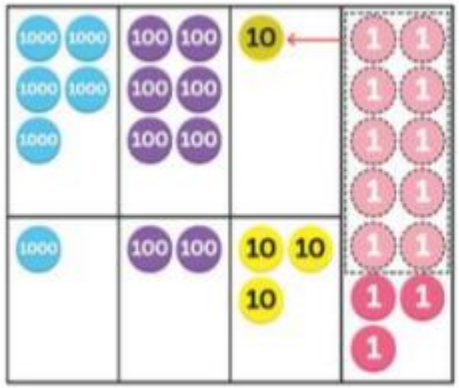
Reinforce column method by using concrete materials first



Move onto pictorial, using bar modelling.



Show expanded method to make link of place value. Move straight onto compact method. When renaming, the number is carried directly above the number. Use concrete materials to show renaming.

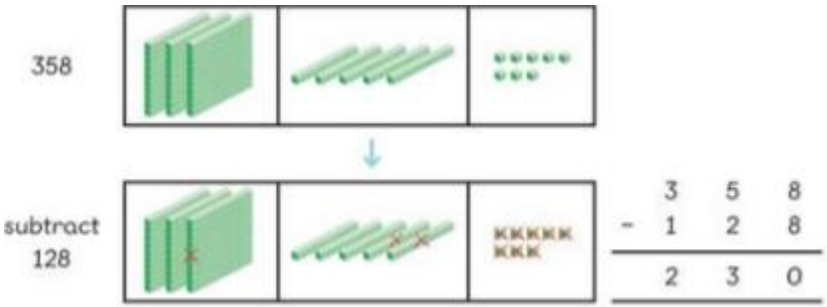


	4	2	5	6	
+	1	9	8	7	
			1	3	add ones
		1	3	0	add tens
	1	1	0	0	add hundreds
+	5	0	0	0	add thousands
	6	2	4	3	

	1	1	1	
	4	2	5	6
+	1	9	8	7
	6	2	4	3

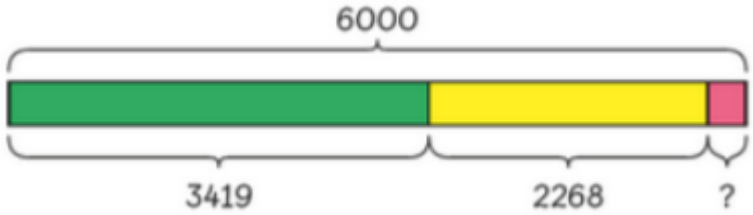
Subtraction: Subtract numbers with 4 digits

Reinforce column method by using concrete materials first, including for renaming

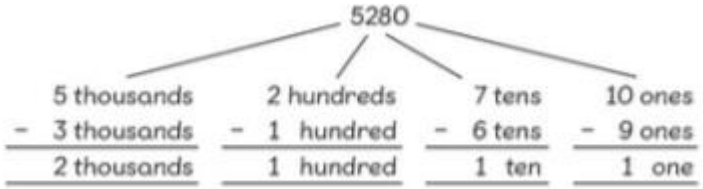


	3	5	8
−	1	2	8
	2	3	0

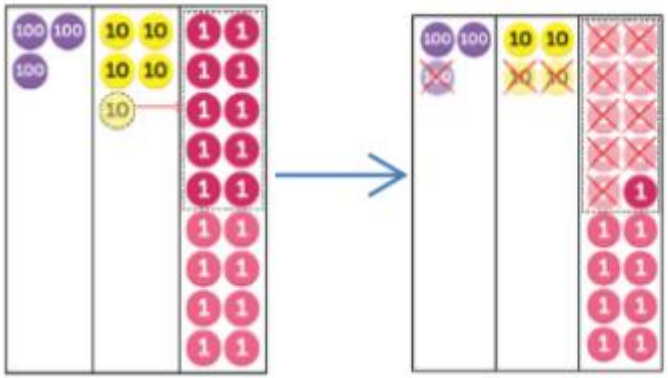
Move onto pictorial, using bar modelling.



Show expanded method to make link of place value. Move straight onto compact method.



When renaming, the number is crossed out and rewritten directly above. Use concrete materials to show renaming.

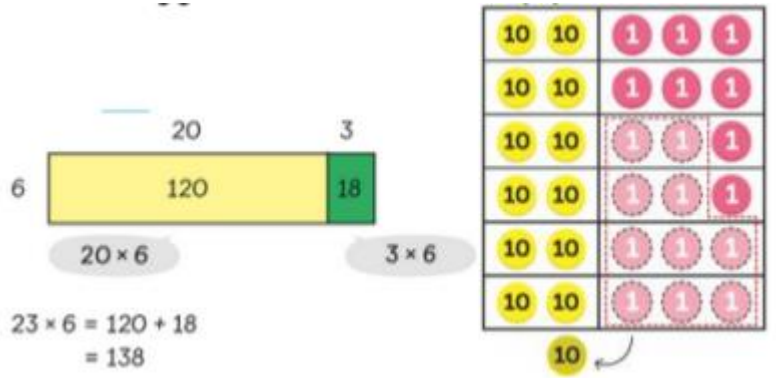


$$\begin{array}{r} \overset{}{3}\ \overset{4}{\cancel{5}}\ \overset{18}{\cancel{8}} \\ -\ 1\ 2\ 9 \\ \hline 2\ 2\ 9 \end{array}$$

Multiplication: Multiply 2 and 3-digit numbers by a single digit, using all multiplication tables up to 12x12

Pupils should continue to develop their knowledge and understanding of multiplying by a single digit, using short multiplication (the formal written method of compact multiplication). Show expanded method but move straight onto compact method, as in Year 3, to show why and how to regroup.

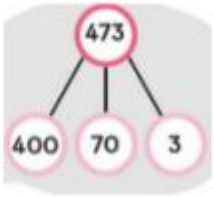
Use different CPA approaches to show the same calculation.



Pupils must be secure in multiplying a 2-digit number by a single digit, before moving onto 3-digit numbers. Repeat using same process as 2-digit numbers.

	1		
	4	7	3
×			2
	9	4	6

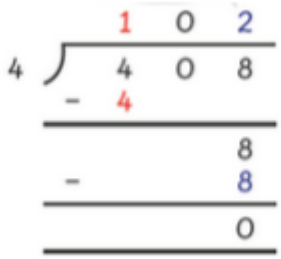
		4	7	3
	×			2
				6
		1	4	0
+		8	0	0
		9	4	6



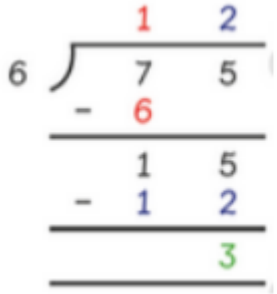
400 × 2 = 800
70 × 2 = 140
3 × 2 = 6
473 × 2 = 946

Division: Divide up to 3-digit numbers by a single digit

Pupils should continue to develop their knowledge and understanding of dividing by two-digits, using chunking and short division. Move onto 3-digit using same approach.



If there is a remainder, this should be noted after the quotient.

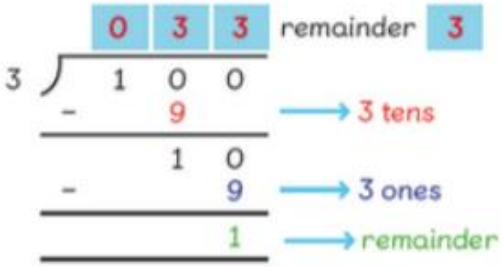


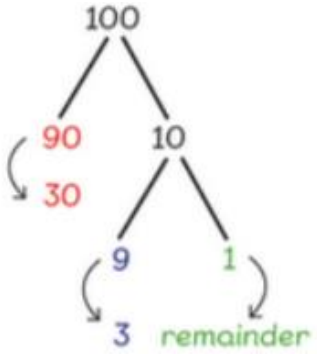
75 ÷ 6 = 12 remainder 3

quotient

Move onto 3-digit numbers divided by a single digit number after children are secure with 2-digit numbers. Use same concept; show chunking and short division, with CPA approach.

100 ÷ 3 = 33 remainder 1

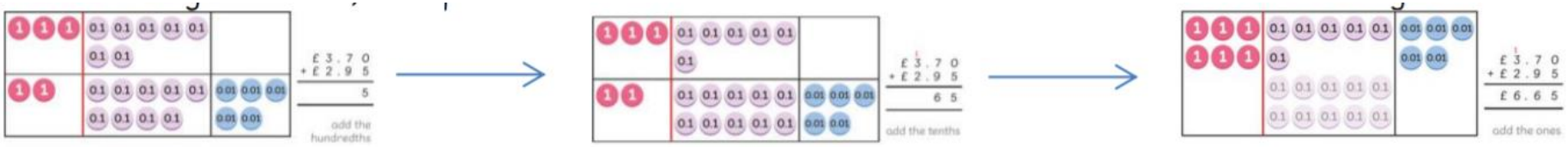




Years 5 - 6

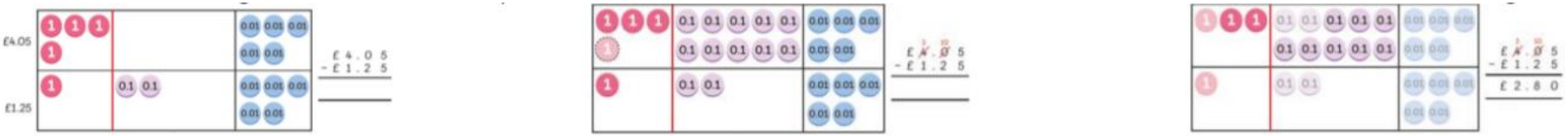
Addition: Add numbers with more than 4 digits

Carry on using previous methods taught in previous years to add, using the same terminology. Continue up to place value being taught. When adding decimals, use place value counters to show addition and use when renaming.



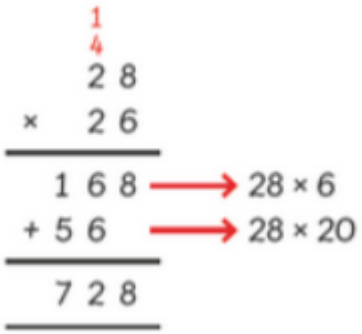
Subtraction: Subtract numbers with more than 4 digits

Carry on using previous methods taught in previous years to subtract, using the same terminology. Continue up to place value being taught. When subtracting decimals, use place value counters to show subtraction and use when renaming

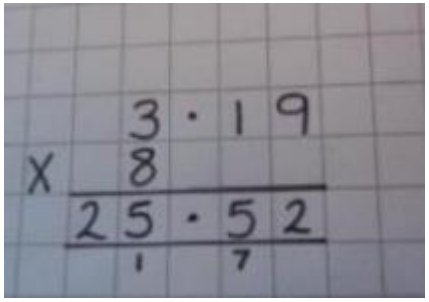


Multiplication: Multiply numbers up to / more than 4 digits (with decimals in Yr6)

Carry on using previous methods taught in previous years to multiply, using the same terminology. Continue up to place value being taught. Start with 4 digits multiply by 1 digit before slowly adding further digit.



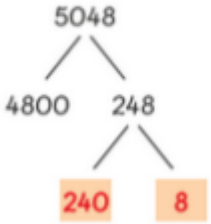
When multiplying decimals, use same method but ensure decimal point is in with all values carefully written, in line, on either side.

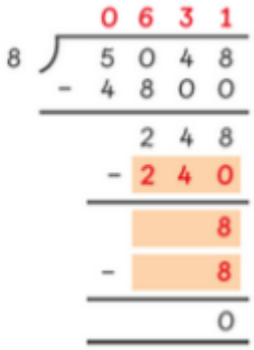


Division: Divide at least 4 digits by single-digit numbers (and 2-digit numbers in Yr 6)

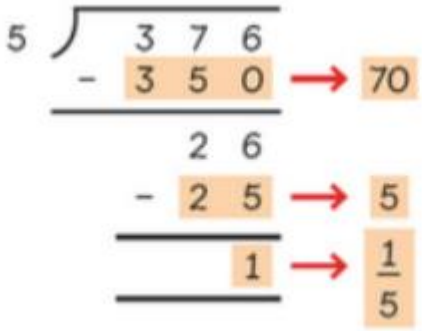
Carry on using previous methods taught in previous years to divide, using the same terminology. Continue up to place value being taught. Start with 4 digits divide by 1 digit before slowly adding further digit. Show chunking and short division method. When chunking, show partitioning as place value.

5048 ÷ 8 = 631





With remainders, continue with same method but replace new value with a crossing out. Put remainders as r____ and fraction. In year 6, show to continue with 0s after the decimal point.



$376 \text{ ml} \div 5 = 75\frac{1}{5} \text{ ml}$