St Mary's Catholic Primary School, Isleworth
Calculation Policy

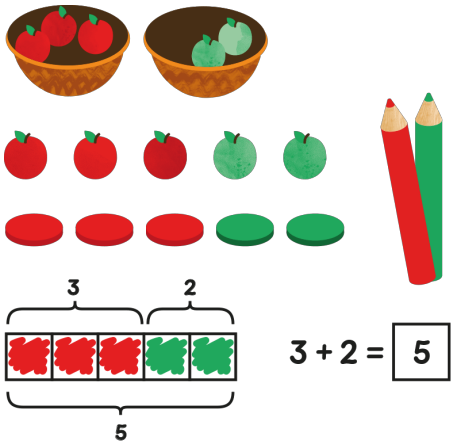
This calculation policy sets out the methods used to help our pupils with calculations and has been devised to meet the requirements of the National Curriculum for the teaching and learning of maths. It is also designed to give pupils a consistent and smooth progression of learning in calculations across the school, taking into account Maths:No Problem! – a Singaporean approach to teaching Maths.

Pupils are taught strategies to develop and strengthen their mental agility on a daily basis. They also need to be able to apply written calculation skills in order to:

- Represent work that has been done practically
- Support, record and explain mental calculation
- Keep track of steps in a longer task
- Work out calculations that are too difficult to do mentally

The Calculation Policy shows methods that pupils will be taught within their respective year group. It is shown in teaching order. Children should be confident in choosing and using a strategy that they know will get them to the correct answer as efficiently as possible; pupils are free to choose their preferred method to solve calculations.

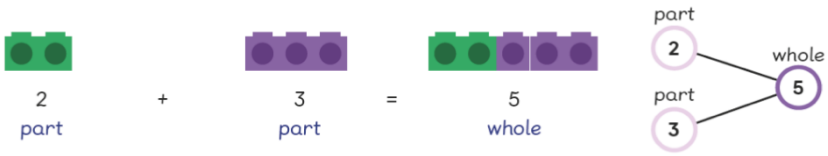
Concrete, Pictorial, Abstract (CPA):
A key principle behind the Singapore Maths textbooks and Maths Mastery is based on the concrete, pictorial and abstract approach. Pupils are first introduced to an idea or skill by acting it out with real objects (a hands-on approach). Pupils then are moved onto the visual stage, where they are encouraged to relate the concrete understanding to pictorial representations. The final abstract stage is a chance for pupils to represent problems by using mathematical notation. Whilst this calculation policy aims to show the CPA approach to the different calculations, it is not always noted further up the year groups. However, it is expected that the CPA approach is used continuously in all new learning and calculations.



Year 1

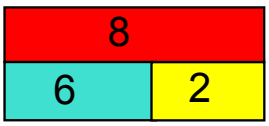
Addition: Add one-digit and two-digit numbers within 20

1. Use objects to count on and add by using **number bonds**. They will learn to use the 'Part-Part-Whole' model as shown here.



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

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



"Putting together" words include:
Altogether
Sum
Total

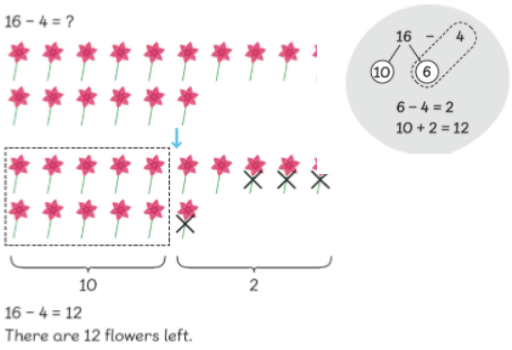
Year 1

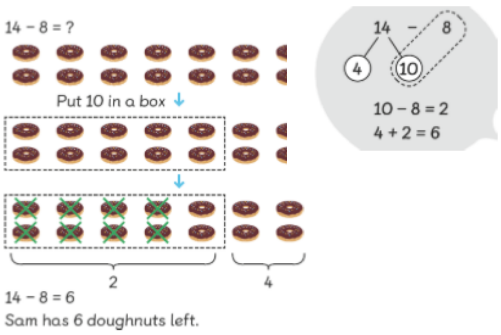
Subtraction: Subtract one-digit and two-digit numbers within 20

1. Use **objects** to count back. Progress this to using **number lines** and **hundred squares**.

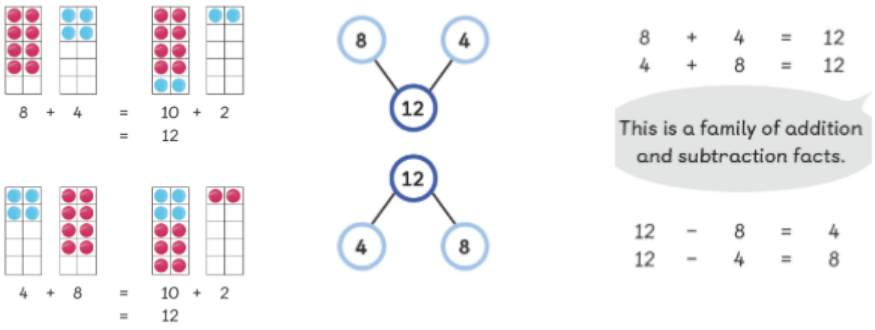
"Removing" words include:
Take away
Remove
Reduce
Left

2. Use knowledge of place value to **partition** 2 digit numbers in order to subtract ones from the number. Language to be used will include "**How much more?"** and "**What is the difference between?**"





3. Introduction to **commutativity** and **fact families**.



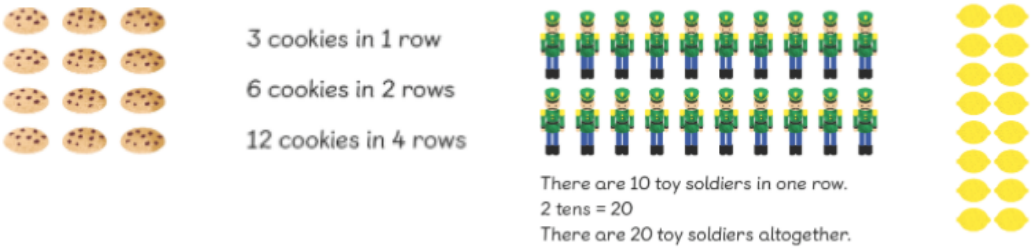
4. To start recalling subtraction facts up to and within 10 and 20, and should be able to subtract zero.

Year 1

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

1. 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.**

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



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

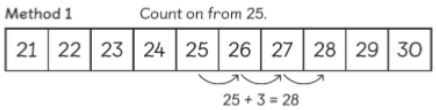
1. Children practise grouping concrete objects equally in order to count the amount in each group. Use a range of **concrete materials** first before **pictorial representations**.

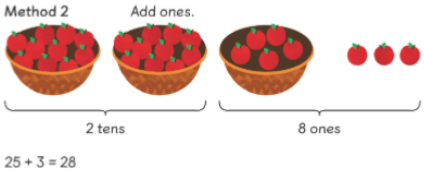
Key words for Division:
Sharing equally
How many groups?
Each

Year 2

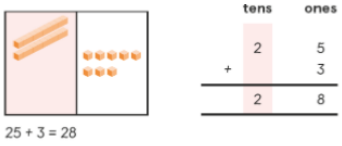
Addition: Add with 2 digit numbers.

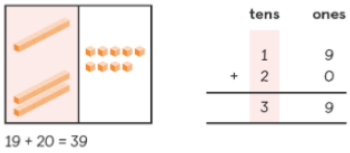
1. Before moving on to a written method, children should **add using a range of resources and methods**.

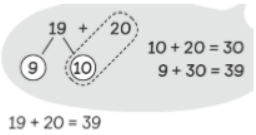




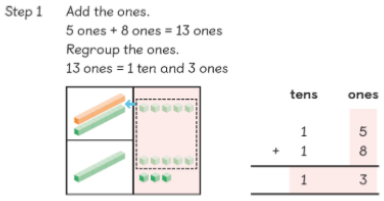
2. Use a range of resources to add and **associate to written method** (column method).

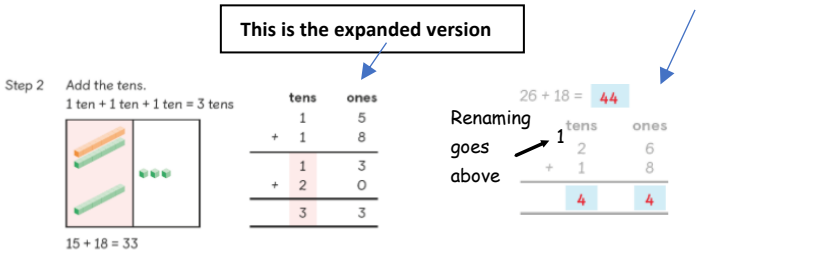




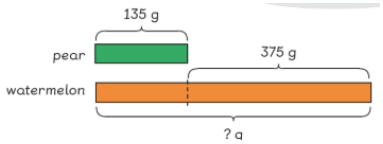


3. When renaming, show the **expanded version**, but link straight to the **compact version**.





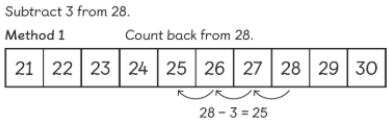
4. Children should use **bars as a visual model** to solve addition calculations and be exposed to word problems.

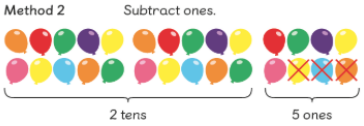


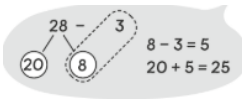
Year 2

Subtraction: Subtract with 2 digit numbers.

1. Before moving on to a written method, children should **subtract using a range of resources and methods**.

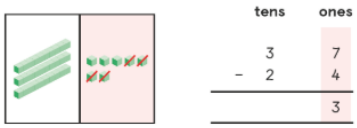


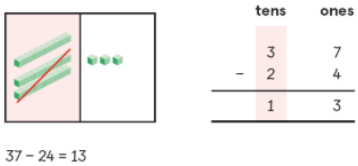




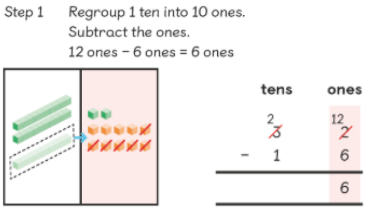
2. Use knowledge of subtraction to **take away groups of 10**.
   4 – 1 = 3 therefore 40 – 10 = 30.

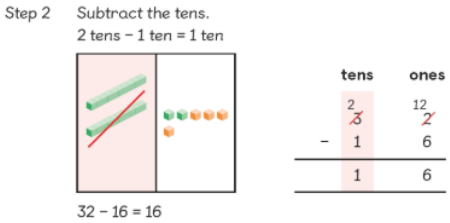
3. Use a range of resources to subtract and **associate to a written method** (column method).



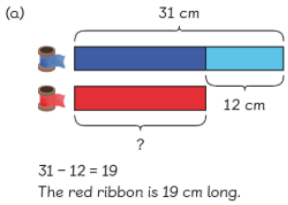


4. When renaming, you **subtract the ones first** and then cross out the number you need to rename and write the new number **on top**.





5. Children should use **bars as a visual model** to solve subtraction calculations.



Year 2

Multiplication: Solve multiplication problems within the 2, 5 and 10 times tables.

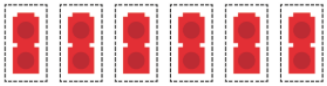
1. **Consolidate** year 1 repeated addition and associate to multiplication.

How many cupcakes are there altogether?

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

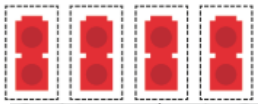
There are 12 cupcakes altogether.

2. 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

3. 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.

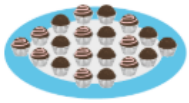
4. Move onto **abstract** route with problems.

2 × 3 = 6

Division: Solve division problems within the 2, 5 and 10 times tables.

1. **Consolidate** Year 1 work by grouping equally. Use a range of resources to show division.

2. Work on each times table in order (2, 5 then 10). Use idea of **grouping** before showing division and **link to abstract calculation** with the ÷ sign.



20 ÷ 2 = 10

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

10 ÷ 2 = 5

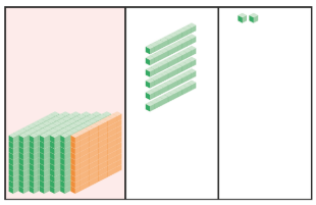
5 × 2 = 10 —— 10 ÷ 2 = 5
2 × 5 = 10 —— 10 ÷ 5 = 2

4. Work through CPA (Concrete, Pictorial, Abstract) approach.

Year 3

Addition: Add numbers with 3 digits.

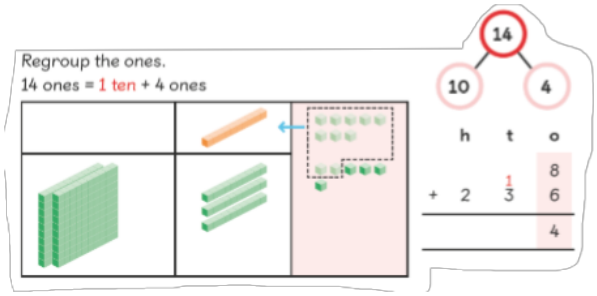
1. Introduce the **expanded** version of the column method first using **concrete materials**.

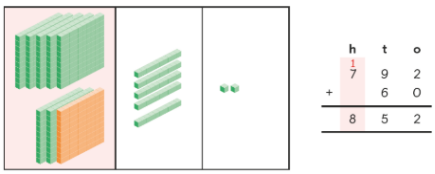


	h	t	o
	6	9	2
+		7	0
			2
	1	6	0
+	6	0	0
	7	6	2

Add the ones first in preparation for the **compact** version.

2. Introduce addition with renaming using the **compact** version with concrete materials first. Show how to rename, with partitioning.

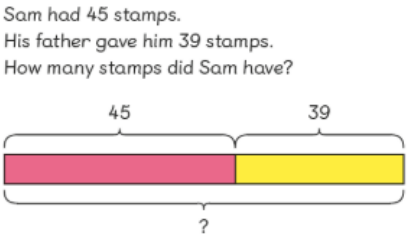




	h	t	o
	1 7	9	2
+		6	0
	8	5	2

- 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.

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

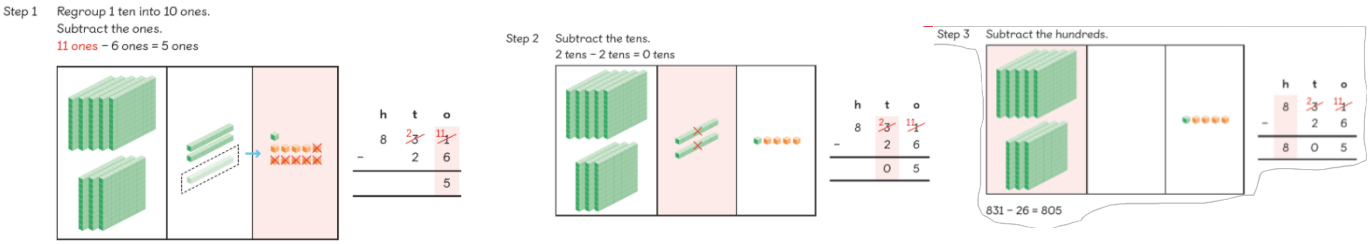


Year 3

Subtraction: Subtract numbers with 3 digits.

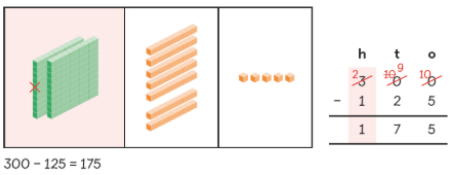
1. Children should use mental strategies to subtract 1 digit numbers and multiples of 10 from 3 digit numbers.

2. Introduce subtraction with renaming using the compact version with concrete materials first. Show how to rename, with partitioning.

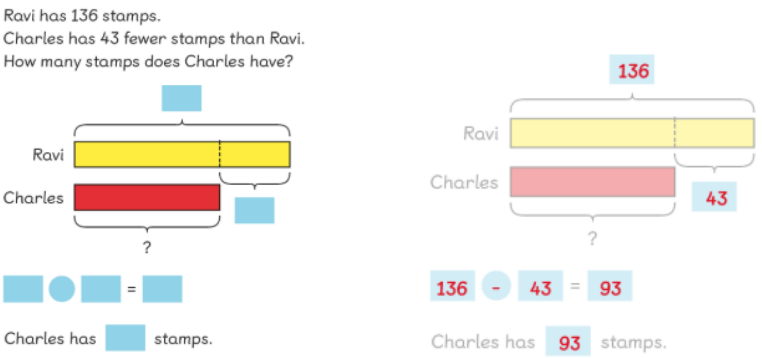


- Subtract the ones first.
- Cross out a number which needs renaming and write the new number directly on top.
- The – symbol is positioned to the left, away from the digits.

3. Carry on using **multi-step** renaming in single calculations.



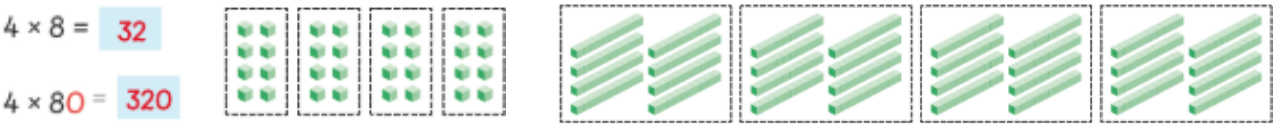
4. Continue to use bars as a visual method to solve subtraction calculations and exposed to word problems.



Year 3

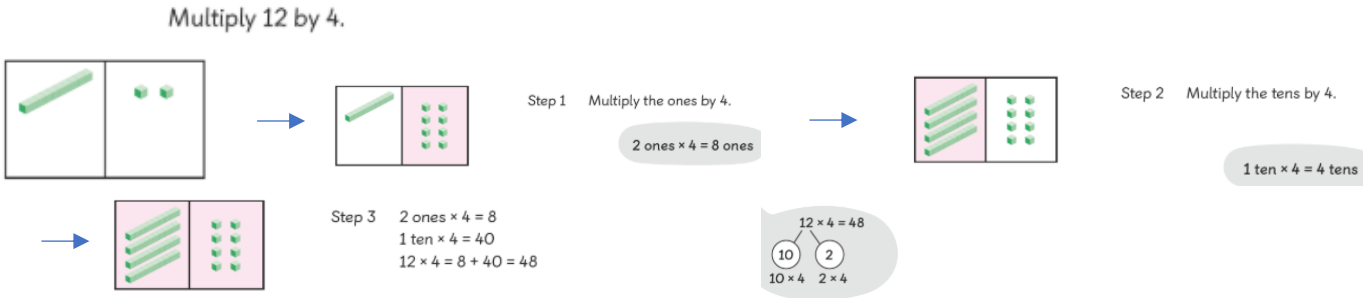
Multiplication: Multiply 2 digits by a single digit number.

1. Introduce by applying already known knowledge to multiples of 10. Use a range of **concrete materials** to show.

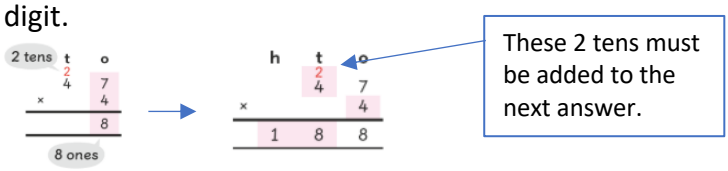


2. **Consolidate repeated addition** before moving onto multiplication of 2 digit numbers.
   - Multiply the ones digit by the single-digit number.
   - Multiply the tens digit by the single-digit number.

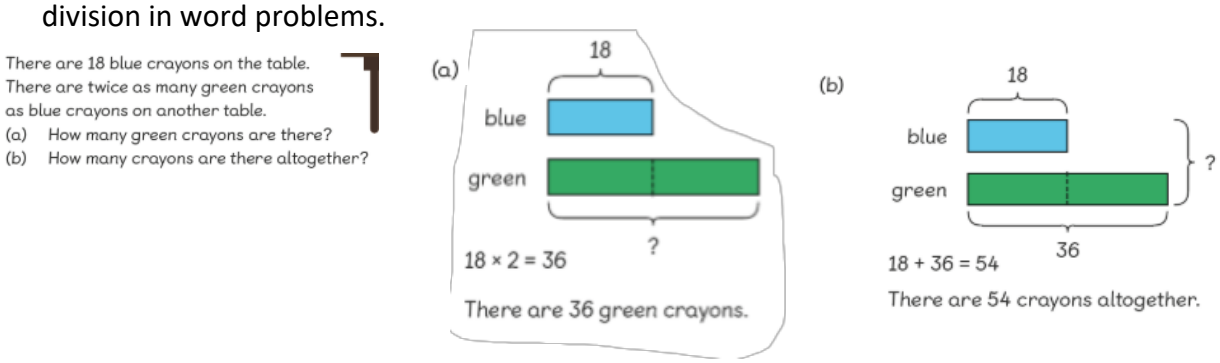
3. Show **partition** to show how this looks, using concrete materials as a supporting mechanism. Show column method alongside.



4. Show **expanded version** for conceptual understanding, but move straight onto the **compact version** using same techniques and break-downs.
   When regrouping, always start with the larger value and write on top of the next digit.



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

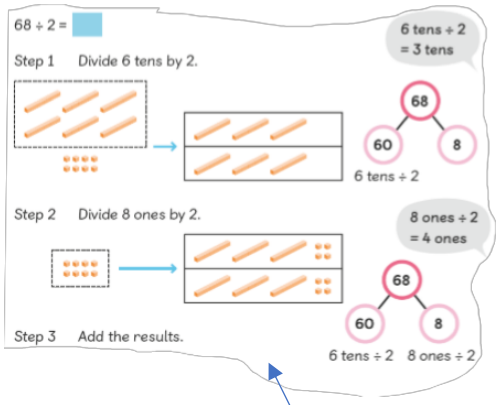


Year 3

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

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

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

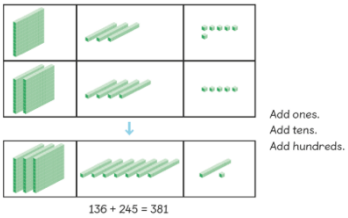


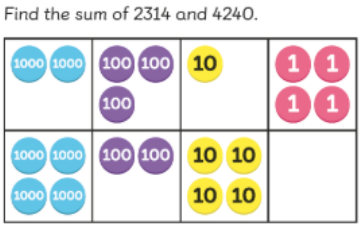
The tens are divided first so children are prepared for the short division method.

Year 4

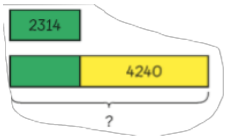
Addition: Add numbers with 4 digits.

1. Reinforce column method by using **concrete materials** first.

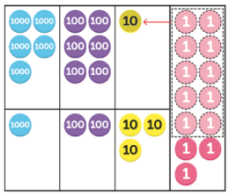


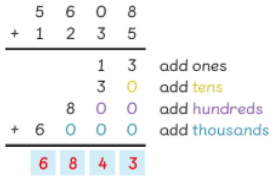


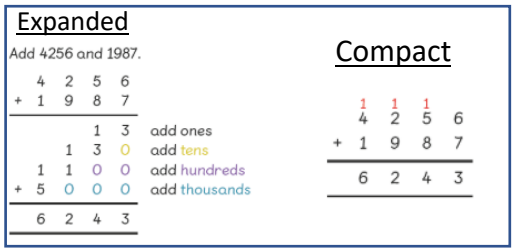
2. Move onto **pictorial**, using **bar modelling**.



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

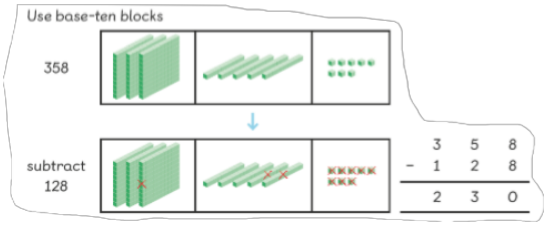


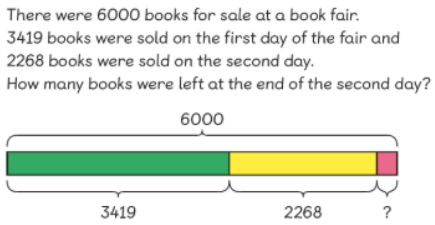




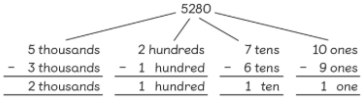
Subtraction: Subtract numbers with 4 digits.

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



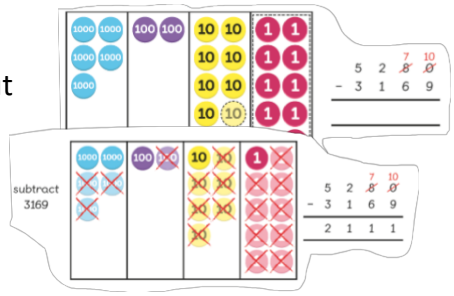


2. Move onto **pictorial**, using **bar modelling**.



3. Show **expanded version** to make link of place value. Move straight onto **compact version**.

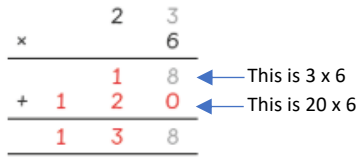
4. When **renaming**, the number is crossed out and **rewritten directly above**. Use **concrete materials** to show renaming.

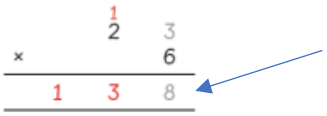


Year 4

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

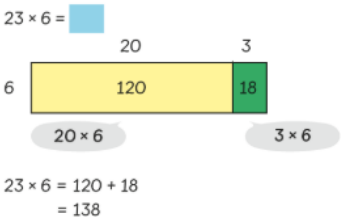
1. Continue to develop knowledge and understanding of multiplying by a single digit, using short multiplication.
2. Show **expanded** version but move straight onto **compact version**, as in year 3, to show why and how to regroup.

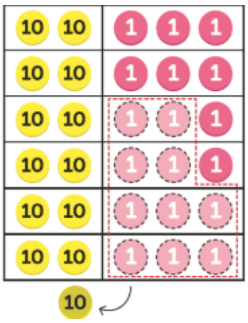




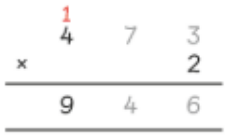
Product:
This is the result when you multiply numbers.

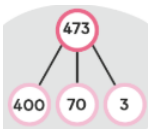
3. Use different **CPA** approaches to show the same calculation.





4. 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.



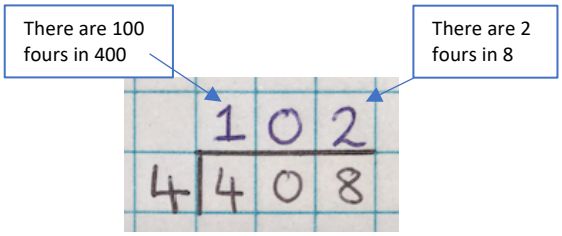


400 × 2 = 800
70 × 2 = 140
3 × 2 = 6
473 × 2 = 946

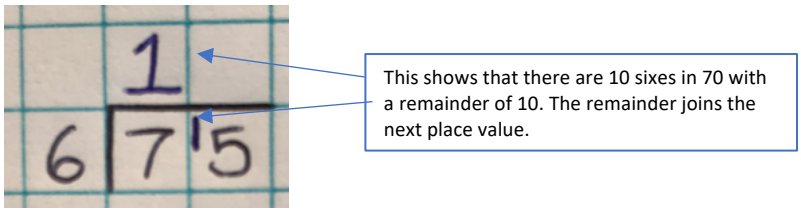
Year 4

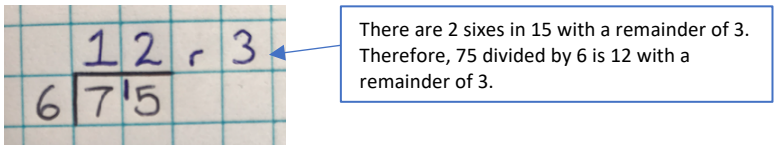
Division: Divide 3 digits by a single digit number.

1. Continue to develop knowledge and understanding of dividing by two-digits, using chunking and **short division**. Move onto 3-digit using same approach.

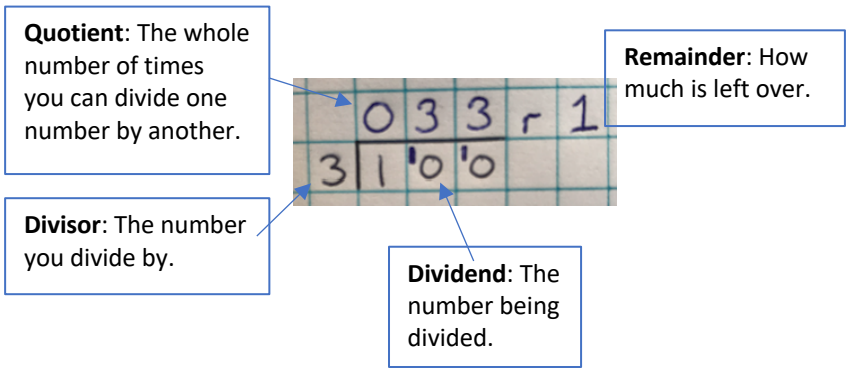


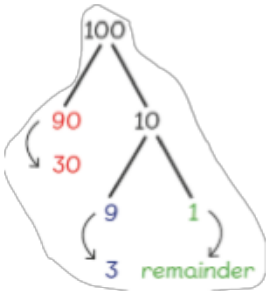
2. If there is a **remainder**, this should be noted after the answer.





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



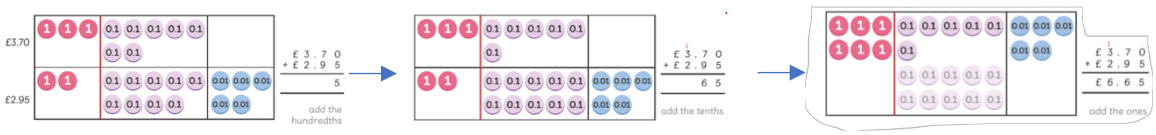


Years 5 and 6

Addition: Add numbers with more than 4 digits.

1. Carry on using previous methods taught in previous years to add, using the same terminology. Continue up to place value being taught.

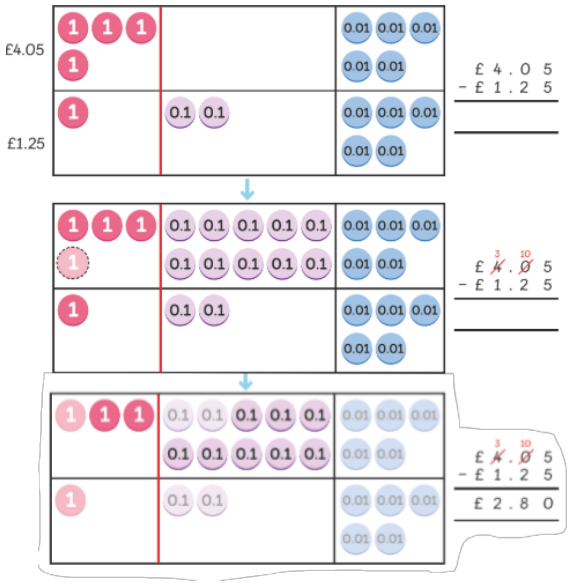
2. When **adding decimals**, use place value counters to show addition and use when **renaming**.



Subtraction: Subtract numbers with more than 4 digits.

1. Carry on using previous methods taught in previous years to subtract, using the same terminology. Continue up to place value being taught.

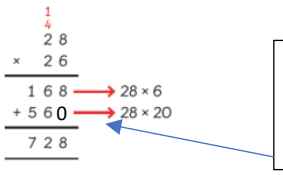
2. When subtracting decimals, use place value counters to show subtraction and use when renaming.



Years 5 and 6

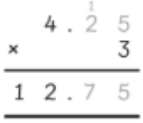
Multiplication: Multiply numbers up to/more than 4 digits (with decimals in Year 6)

1. 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 multiplied by 1 digit before slowly adding further digits.



Children often forget to place the '0' in this place value. It is there to remind us we are multiplying by the tens. In this example, it is 2 tens.

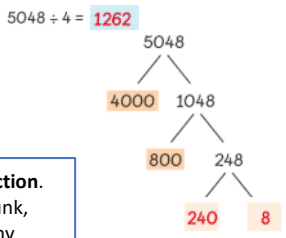
2. When multiplying decimals, use same method but ensure **decimal point is in** with all values carefully written, in line, on either side.



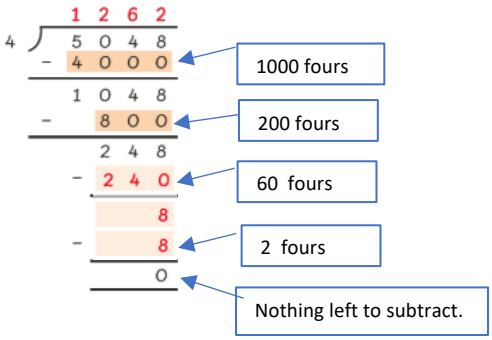
Division: Divide at least 4 digits by single-digit numbers (and 2 digit numbers in Year 6).

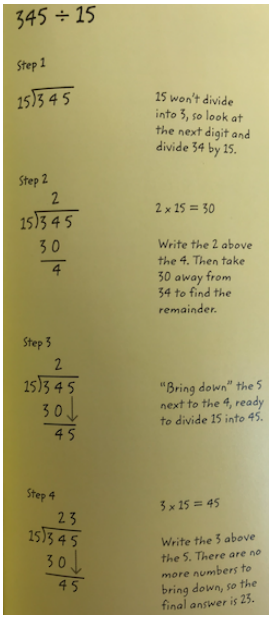
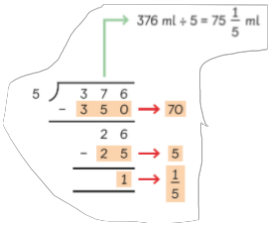
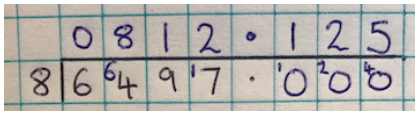
1. Carry on using previous methods taught in previous years to divide, using the same terminology. Continue up to place value being taught. Start with 4 digits divided by 1 digit before slowly adding further digits.

2. Show **chunking** and **long division** method. When chunking, show partitioning as place value.



Division is **repeated subtraction**. Each time we subtract a chunk, we note at the top how many chunks were subtracted. We note underneath how much is left.





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