Calculation Policy
2023-2024

Lanercost Church of England Primary School
Care Believe Achieve
Live life in all its fullness - John 10:10

The following Lanercost Church of England Calculation Progression Document has been written to support our teachers with the National Curriculum and to support our implementation of the Maths Mastery approaches to teaching lessons. We also use the White Rose and NCETM resource materials to ensure methods are taught in a progressive manner. This links with our Intent, Implementation and Impact documentation.

Key to the successful implementation of a school calculation policy is the consistent use of representations (models and images that support conceptual understanding of mathematics) and this policy promotes a range of relevant representations across the primary years. Mathematical understanding is developed through the use of representations that are first of all concrete. (eg. Numicon, Dienes apparatus) and then pictorial (array, place value counters) and then to facilitate abstract working. Additional strategies used across the school are:

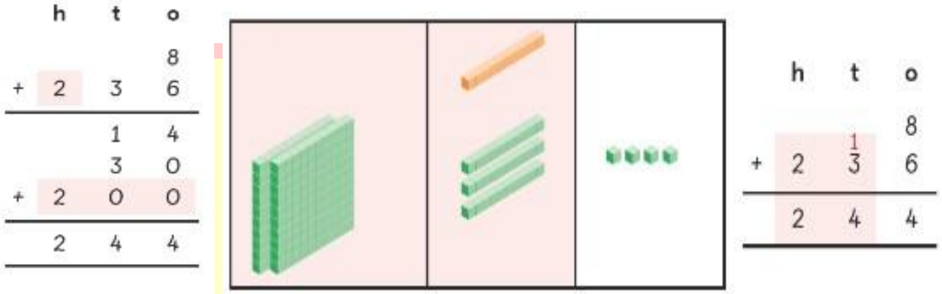
1. Develop children's fluency with basic number facts

Fluent computational skills are dependent on accurate and rapid recall of basic number bonds to 20 and times-table facts. At Lanercost C of E Primary School, we have found that spending a short time every day on these basic facts quickly leads to improved fluency (Rapid Recall, Doodle Maths and Times Table Rockstars). We are clear that this is not meaningless rote learning; rather, this is an important step to developing conceptual understanding through identifying patterns and relationships between the tables (for example, that the products in the 6× table are double the products in the 3× table). This has helped children develop a strong sense of number relationships, an important prerequisite for procedural fluency.

2. Develop children's fluency with mental and written methods

Efficiency in calculation requires having a variety of mental strategies. It is important that children can mentally recall number bonds and are able to partition numbers in order to bridge through ten. Children are taught that it is helpful to make 10 as this makes the calculation easier.

Teaching column methods for calculation provides the opportunity to develop both procedural and conceptual fluency. We ensure that children understand the structure of the mathematics presented in the algorithms, with a particular emphasis on place value. This is developed through the use of base ten apparatus and the use of models and images in the textbooks to support the development of fluency and understanding. Informal methods of recording calculations are also an important stage to help children develop fluency with formal methods of recording. Informal methods are only used for a short period, to help children understand the internal logic of formal methods of recording calculations. They are stepping stones to formal written methods. For example,



3. Don't count, calculate

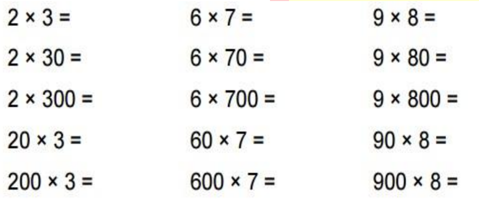
Children benefit from being helped at an early stage to start calculating, rather than relying on 'counting on' as a way of calculating. For example, with a sum such as: 4 + 7 = Rather than starting at 4 and counting on 7, children could use their knowledge and bridge to 10 to deduce that because 4 + 6 = 10, so 4 + 7 must equal 11.

4. Look for patterns and make connections

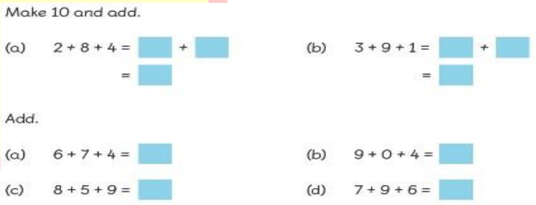
Children are given opportunities in the lessons to look for patterns and make connections. The question "What's the same, what's different?" is used frequently to make comparisons.

5. Use of intelligent Practice

The practice children engage in provides the opportunity to develop both procedural and conceptual fluency. Children are required to reason and make connections between calculations. Calculations are chosen carefully to develop children's connections and strategies. Carefully selected calculations provide opportunities for making these connections. For example,



2 × 3 =	6 × 7 =	9 × 8 =
2 × 30 =	6 × 70 =	9 × 80 =
2 × 300 =	6 × 700 =	9 × 800 =
20 × 3 =	60 × 7 =	90 × 8 =
200 × 3 =	600 × 7 =	900 × 8 =



Make 10 and add.

(a) 2 + 8 + 4 = ▢ + ▢ = ▢

(b) 3 + 9 + 1 = ▢ + ▢ = ▢

Add.

(a) 6 + 7 + 4 = ▢

(b) 9 + 0 + 4 = ▢

(c) 8 + 5 + 9 = ▢

(d) 7 + 9 + 6 = ▢

6. Move between the concrete and the abstract

Children's conceptual understanding and fluency is strengthened if they experience concrete, visual and abstract representations of a concept during a lesson. Moving between the concrete and the abstract helps children to connect abstract symbols with familiar contexts, thus providing the opportunity to make sense of, and develop fluency in the use of, abstract symbols. Maths lessons at Lanercost C of E Primary School, move between the concrete, visual and abstract.

7. Contextualise the maths

The children are posed with contextualised problems. This supports the children's understanding of the abstract calculation.

8. Use of questioning to develop reasoning

Teachers have a strong and consistent focus on questioning that encourages and develops their mathematical reasoning. For example, there is always an emphasis on the 'How do you know?' as opposed to 'What is the answer?' Children know that they need to explain how they worked out a calculation or solved a problem and justify their reasoning.

9. Use of precise mathematical vocabulary

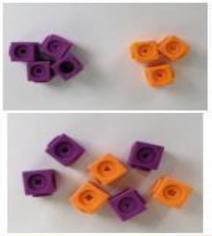
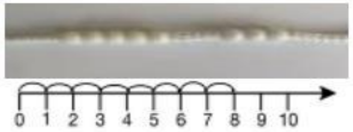
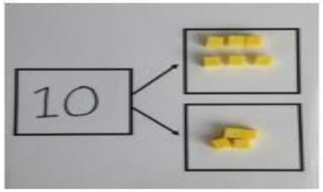
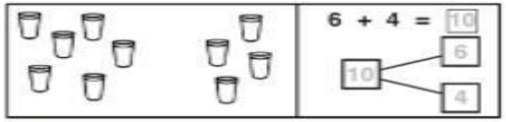
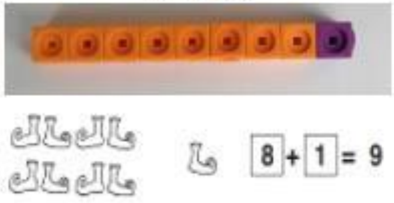
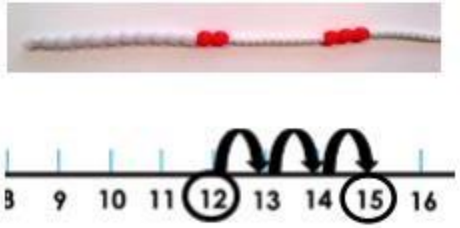
The quality of children's mathematical reasoning and conceptual understanding is significantly enhanced if they are consistently expected to use correct mathematical terminology (e.g. saying 'digit' rather than 'number'). By all using precise vocabulary, everyone is clear which part of the calculation we are talking about e.g., divisor, dividend, quotient. High expectations of the mathematical language used are essential, with staff only accepting what is correct. Consistency across the school is key. All staff are aware of the correct terminology, as this is located on the Maths Vocabulary Progression document. The precise mathematical vocabulary for a unit is displayed on yellow card (in accordance with every other subject) on the maths working wall in the classroom.

Examples of precise Vocabulary	
Ones	Factor product
is equal to (is the same as)	Whole part whole
Exchange exchanging regrouping	Dividend divisor quotient

calculation equation	Known unknown
bar model	

10. Identifying misconceptions

Difficult points need to be identified and anticipated when lessons are being designed and these need to be an explicit part of the teaching, rather than the teacher just responding to children's difficulties if they happen to arise in the lesson. The teacher should be actively seeking to uncover possible difficulties because if one child has a difficulty it is likely that others will have a similar difficulty. Difficult points also give an opportunity to reinforce that we learn most by working on and through ideas with which we are not fully secure or confident. Discussion about difficult points can be stimulated by asking children to share thoughts about their own examples when these show errors arising from insufficient understanding. For example: A visualiser is a valuable resource since it allows the teacher quickly to share a child's thinking with the whole class.

Addition - Strategy and Guidance	Concrete/Pictorial/Abstract
EYFS <u>Count all 1:1 correspondence</u> Joining two groups and then recounting all objects using 1:1 correspondence	3 + 4 = 7   5 + 3 = 8
EYFS/Year 1 <u>Combining two parts to make a whole - Part whole model</u> Teach both addition and subtraction alongside each other as pupils will use the model to see the inverse relationships between them. This model begins to develop the understanding of commutativity of addition, as pupils will become aware that the parts will make the whole in any order.	  10 = 6 + 4 10 − 6 = 4 10 − 4 = 6 10 = 4 + 6
EYFS/Year 1 <u>Counting on with number lines</u> As a strategy, this should be limited to adding small quantities only (1,2 or 3) with pupils understanding that counting on from the greater number is more efficient.	8 + 1 = 9  15 = 12 + 3 

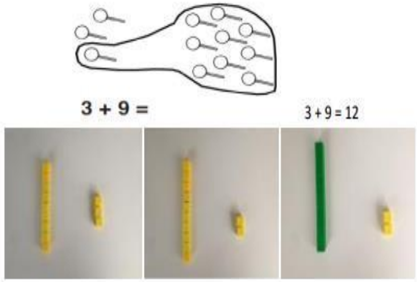
<table>
<tr>
<td>

EYFS/Year 1

<u>Regrouping ten ones to make ten.</u>

This is an essential skill that will support column addition later on.

</td>
<td>



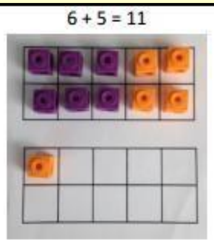
</td>
</tr>
<tr>
<td>

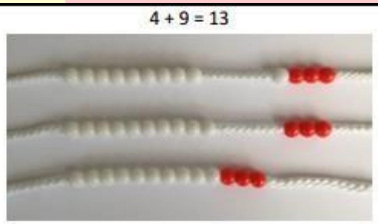
EYFS/Year 1

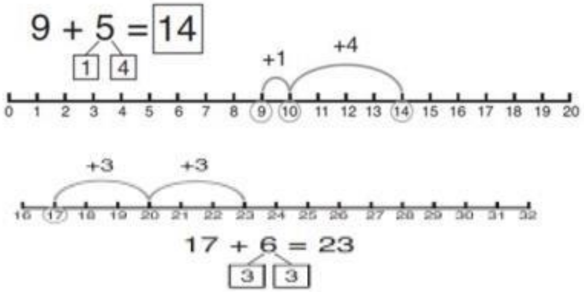
<u>'Make ten' strategy</u>

Pupils should be encouraged to start at the greater number and partition the smaller number to make ten. The ten frames are good for modelling and exploring this.

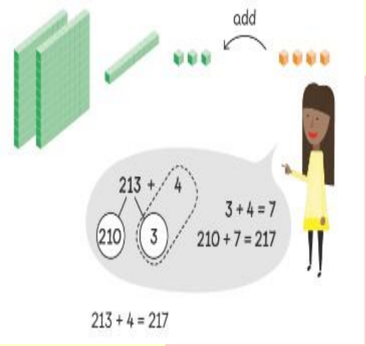
</td>
<td>

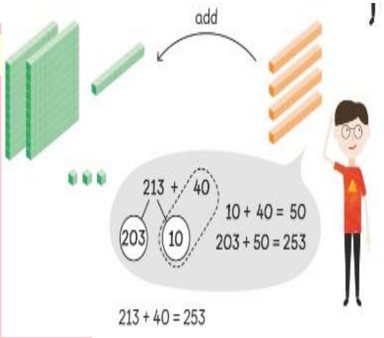


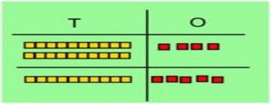


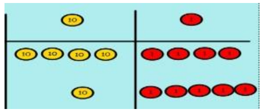


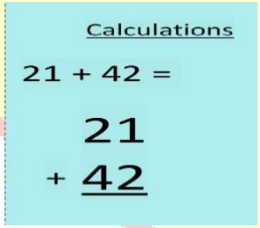
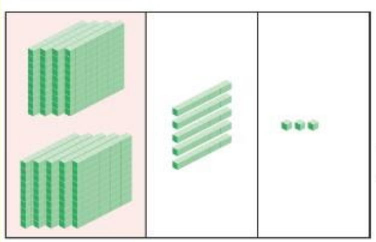
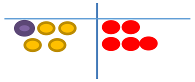
</td>
</tr>
</table>

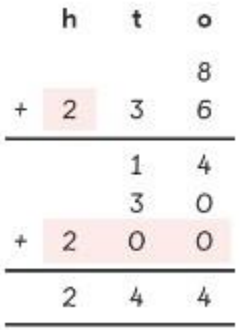
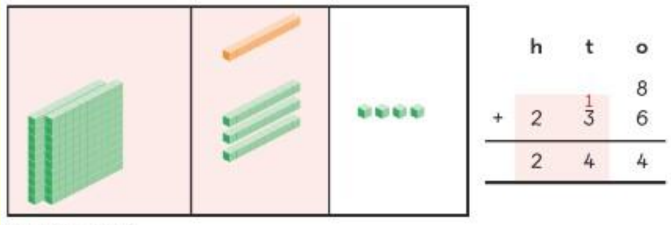
<table>
<tr>
<td>Year 2
<u>Partitioning T and O to add, moving to formal column method (no regrouping)</u></td>
<td>


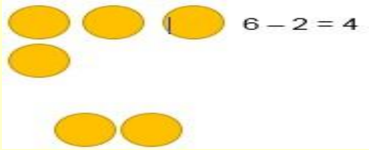
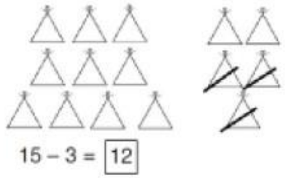
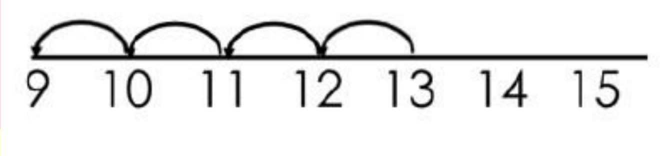
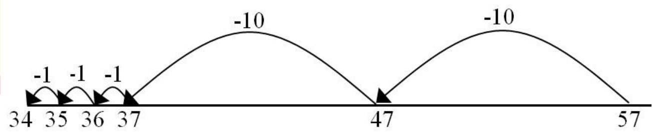


</td>
</tr>
<tr>
<td>Year 2
<u>Column method no regrouping</u>
Year 3 (up to 3 digits)
Year 4 (up to 4 digits)
Year 5 (decimals)</td>
<td>
24 + 15=
Add together the ones first then add the tens. Use the Base 10 blocks first before moving onto place value counters.


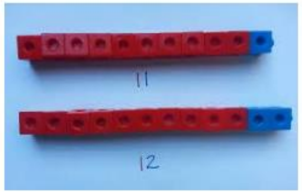
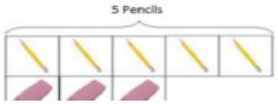
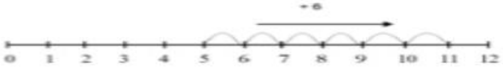
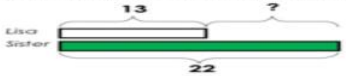
After practically using the base 10 blocks and place value counters, children can draw the counters to help them to solve additions.


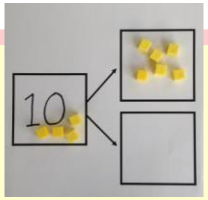
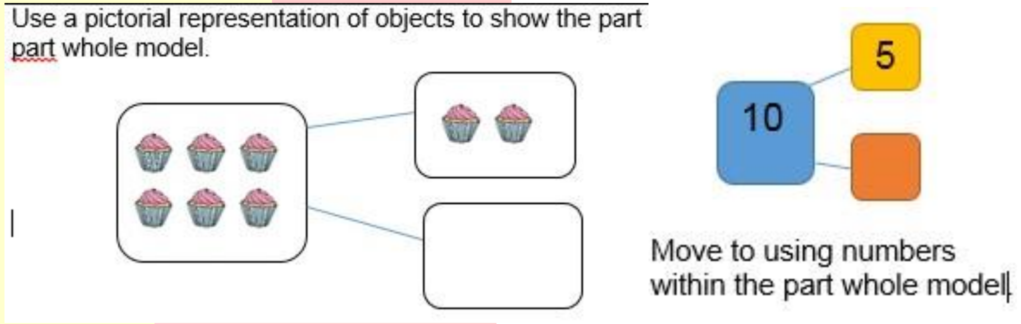
</td>
</tr>
<tr>
<td></td>
<td>
<u>Examples,</u>

<u>Calculations</u>
21 + 42 =
21
+ 42

432 + 521 = 953
<table>
<tr><td></td><td>h</td><td>t</td><td>o</td></tr>
<tr><td></td><td>4</td><td>3</td><td>2</td></tr>
<tr><td>+</td><td>5</td><td>2</td><td>1</td></tr>
<tr><td></td><td>9</td><td>5</td><td>3</td></tr>
</table>

</td>
</tr>
</table>

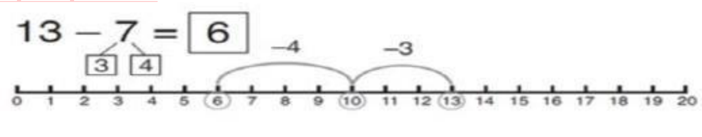
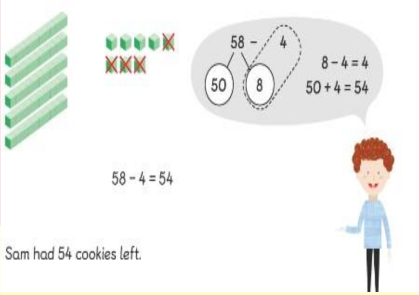
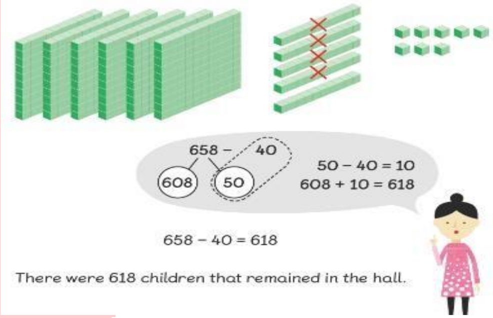
Expanded column method ***Year 3 (up to 3 digits)*** ***Year 4 (up to 4 digits)*** ***Year 5 (decimals)*** This is a bridging process before pupils reach the full algorithm for column method. This can be used for struggling learners who are not yet ready to move to the complete column method.	
Column method with regrouping ***Year 3 (up to 3 digits)*** ***Year 4 (up to 4 digits)*** ***Year 5 (decimals)*** This is the standard column method. Show both this and the expanded methods together so pupils can see the link between the two and feel more comfortable using the column method. It is important to go through different methods so that pupils get an understanding of the question and numbers, rather than to just follow a procedure.	Make both numbers with the Base 10. Add up the units and exchange 10 ones for one 10. Add up the rest of the columns. As children move on to decimals, money and decimal place value counters can be used to support learning.  8 + 236 = 244

Subtraction - Strategy and Guidance	Concrete/Pictorial/Abstract
EYFS/Year 1 Count all 1:1 correspondence- Taking away ones	Use physical objects, counters, cubes etc to show how objects can be taken away.  Cross out drawn objects to show what has been taken away. 
EYFS/Year 1 Counting back Pupils may start off by counting back but they should be quickly encouraged to rely on number bonds knowledge as time goes on, rather than using counting back as their main strategy.	**Concrete:** Make the larger number in your subtraction. Move the beads along your bead string as you count backwards in ones.  13 – 4 Use counters and move them away from the group as you take them away counting backwards as you go.   **Pictorial:** Count back on a number line or number track Start at the bigger number and count back the smaller number showing the jumps on the number line.  This can progress all the way to counting back using two 2 digit numbers.

	Abstract: Put 13 in your head, count back 4. What number are you at? Use your fingers to help.
EYFS/Year 1 <u>Finding the difference (counting on)</u>	**Concrete/Pictorial:** Compare amounts and objects to find the difference.

	 Use cubes to build towers or make bars to find the difference Use basic bar models with items to find the difference   Count on to find the difference. **Comparison Bar Models** Draw bars to find the difference between 2 numbers. Lisa is 13 years old. Her sister is 22 years old. Find the difference in age between them.  **Abstract:** Hannah has 23 sandwiches, Helen has 15 sandwiches. Find the difference between the number of sandwiches.

EYFS/Year 1 Part whole model Teach both addition and subtraction alongside each other, as the pupils will use this model to identify the link between them.	 Link to addition- use the part whole model to help explain the inverse between addition and subtraction. If 10 is the whole and 6 is one of the parts. What is the other part? 10 - 6 =  Use a pictorial representation of objects to show the part part whole model. Move to using numbers within the part whole model
EYFS/Year 1 'Make ten' strategy	**Concrete:** 14 – 5 =  Make 14 on the ten frame. Take away the 4 first to make 10 and then takeaway 1 more so you have taken away 5. You are left with the answer of 9.

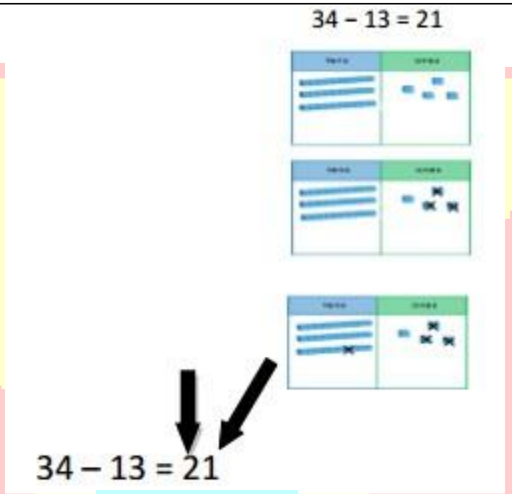
	Pictorial: Start at 13. Take away 3 to reach 10. Then take away the remaining 4 so you have taken away 7 altogether. You have reached your answer.  **Abstract:** 16 – 8= How many do we take off to reach the next 10? How many do we have left to take off?
Year 2 Partitioning T and O to subtract It is important to look at different ways to partition numbers.	Examples  

Year 2

Column method no exchanging

Use Base 10 to support their understanding.

Misconception: Pupils don't recognise that they are subtracting ones from ones, tens from tens, hundreds from hundreds and inappropriately subtract digits in the wrong columns.



$$\begin{array}{r} 34 \\ -\ 13 \\ \hline 21 \end{array}$$

Concrete: Use Base 10 to make the bigger number then take the smaller number away.
Show how you partition numbers to subtract.
For example, 34 = 30 + 4
13 = 10 + 3

Pictorial: Children may wish to draw the Base 10 or place value counters alongside the written calculation to help to show working.

Abstract: This will lead to a clear written column subtraction.

Column method with exchanging

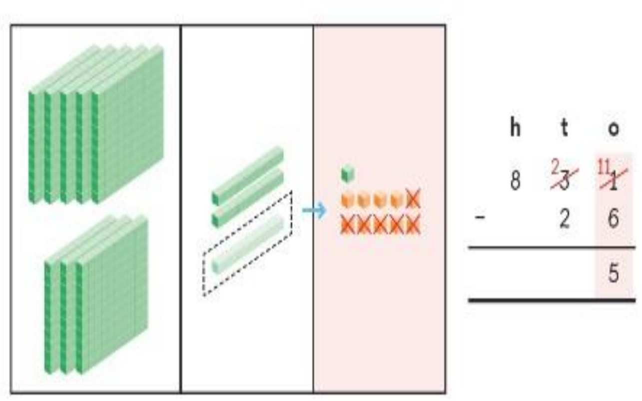
Year 3 (up to 3 digits)

Year 4 (up to 4 digits)

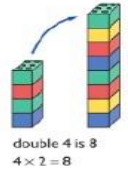
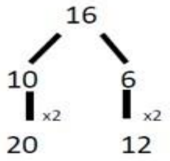
Year 5 (decimals)

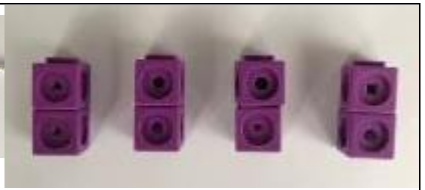
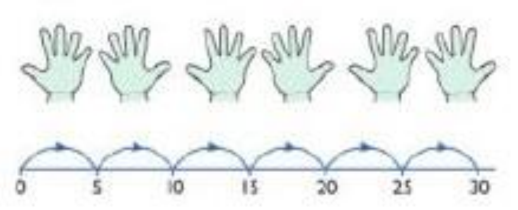
This example shows how pupils should work practically when being introduced to this method. Allow pupils time to explore the written method, showing that they removed a ten and created more ones. It is important here that pupils understand why they are crossing out the tens column and ones column and changing the numbers.

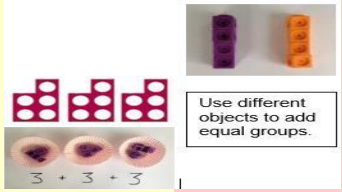
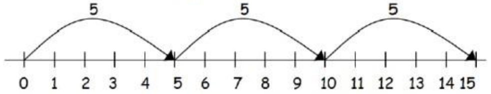
Use Base 10 to start with before moving on to place value counters. Start with one exchange before moving onto subtractions with two exchanges.



Misconception: Pupils don't recognise that they can exchange tens for ones as the tens sticks are stuck together.	

Multiplication - Strategy and Guidance	Concrete/Pictorial/Abstract
EYFS/Year 1 Doubling	**Concrete:** Use practical activities to show how to double a number.  **Pictorial:** Double 4 is 8  Draw pictures to show how to double a number. **Abstract:**  Partition a number and then double each part before recombining it back together.

EYFS/Year 1 Counting in multiples	**Concrete:** Count in multiples supported by concrete objects in equal groups.    **Pictorial:** Use a number line or pictures to continue support in counting in multiples. **Abstract:** Count in multiples of a number aloud. Write sequences with multiples of numbers. For example, 2, 4, 6, 8, 10

EYFS/Year 1 Repeated addition	Concrete:  Pictorial:  There are 3 plates. Each plate has 2 star biscuits on. How many biscuits are there? 2 add 2 add 2 equals 6  5 + 5 + 5 = 15

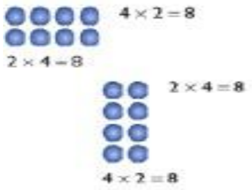
Year 2

<u>Arrays- showing commutative multiplication</u>

Pupils should understand that an array and, later, bar models can represent different equations and that, as multiplication is commutative, the order of the multiplication does not affect the answer.

Concrete: Create arrays using counters / cubes to show multiplication sentences.

Pictorial: Draw arrays in different rotations to find **commutative** multiplication sentences.



Abstract: Use an array to write multiplication sentences and reinforce repeated addition.

5 + 5 + 5 = 15

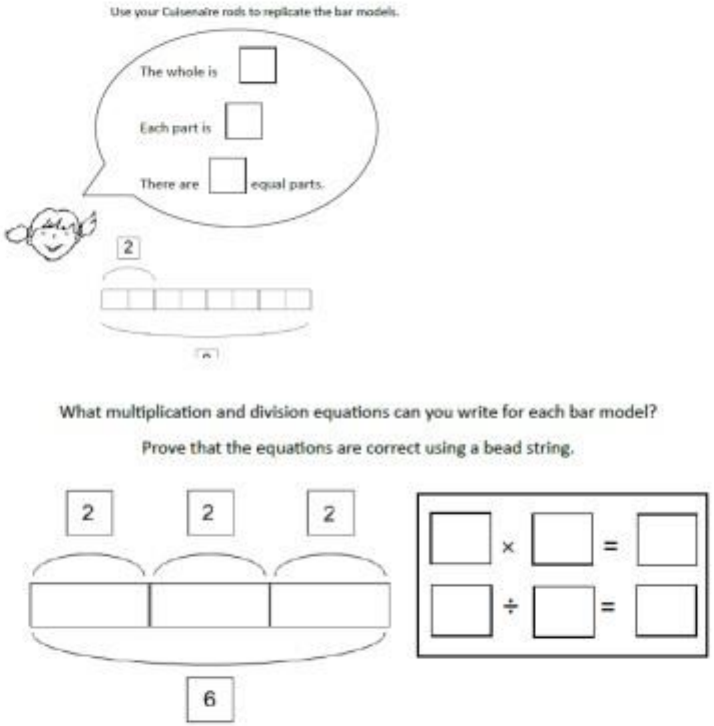
3 + 3 + 3 + 3 + 3 = 15

3 x 5 = 15

5 x 3 = 15

Part whole model

Use of part-part whole model to establish the inverse relationship between multiplication and division This link should be made explicit from early on, using the language of the part-part-whole model, so that pupils develop an early understanding of the relationship between multiplication and division. Bar models (with Cuisenaire rods) should be used to identify the whole, the size of the parts and the number of parts.


Use your Cuisenaire rods to replicate the bar models.

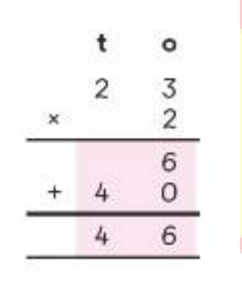
What multiplication and division equations can you write for each bar model?

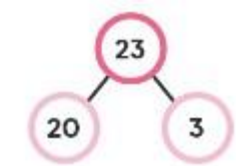
Prove that the equations are correct using a bead string.

Year 3

Expanded Column Multiplication

Show this method alongside the partitioning model and the Base 10.



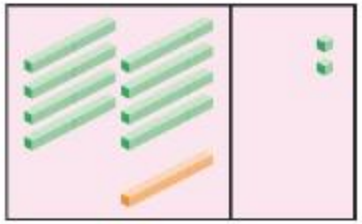
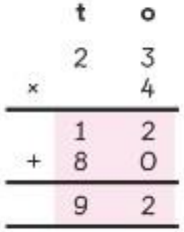
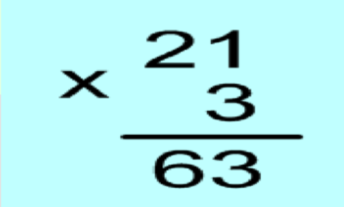
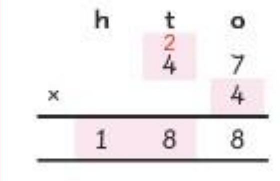
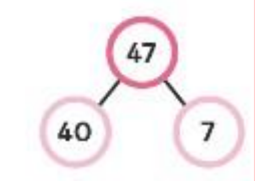
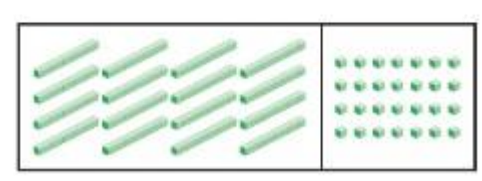


Step 1 Multiply the ones by 2.
3 ones × 2 = 6 ones

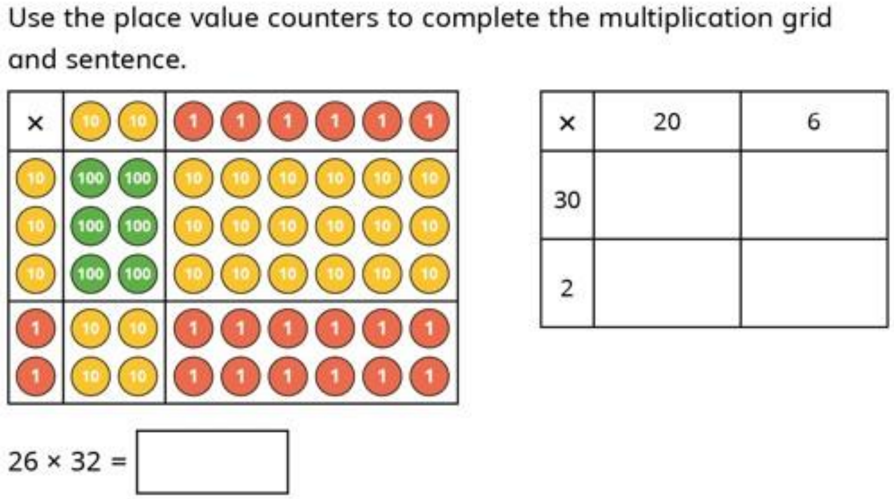
Step 2 Multiply the tens by 2.
2 tens × 2 = 4 tens

Step 3 Add the products.
6 + 40 = 46

23 × 2 = 46

Year 3 <u>Expanded Column Method with regrouping.</u>	
Year 3/4 <u>Efficient Column method no regrouping</u>	 Base 10 or place value counters can be used alongside this too.
Year 3/4 <u>Efficient Column method with regrouping</u> It is important that the children are able to see all the representations so they can fully understand the concept and not just a procedure. The children need to be using the vocab of how many tens make one hundred, how many ones in a ten etc.	   7 ones x 4 = 28 ones 28 ones = 2 tens and 8 ones 4 tens x 4 = 16 tens 16 tens = 1 hundred and 6 tens
Year 5 <u>Area model</u>	<u>Concrete:</u> To explore as Base 10 on an area grid. To model how the calculations are carried out, i.e. which column and row are multiplied. <u>Pictorial:</u>

Children can relate partitioning and place value when multiplying. Especially important when moving to TOxTO calculations.



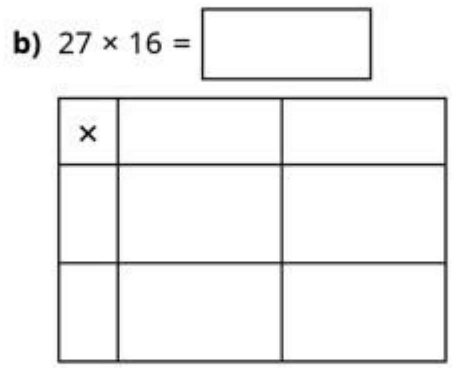
Use the place value counters to complete the multiplication grid and sentence.

×	10 10	1 1 1 1 1 1
10 10 10	100 100 100 100 100 100	10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10
1 1	10 10 10 10	1 1 1 1 1 1 1 1 1 1 1 1

×	20	6
30		
2		

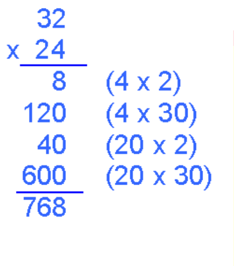
26 × 32 = ☐

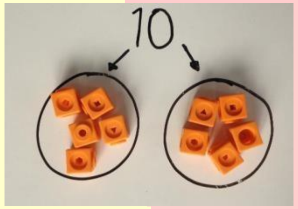
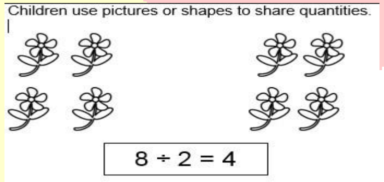
Abstract:

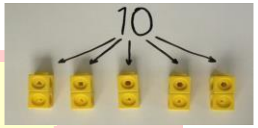


b) 27 × 16 = ☐

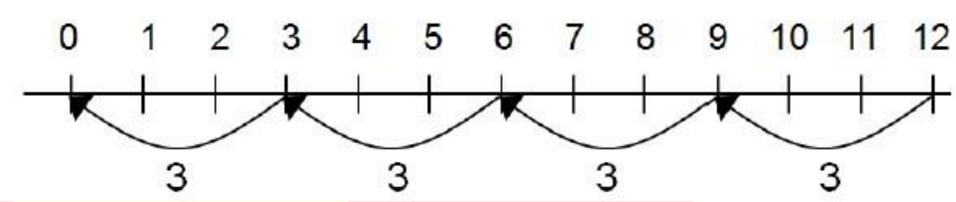
×		

Year 5 Long Multiplication	 32 x 24 8 (4 x 2) 120 (4 x 30) 40 (20 x 2) 600 (20 x 30) 768	Start with long multiplication, reminding the children about lining up their numbers clearly in columns. If it helps, children can write out what they are solving next to their answer.

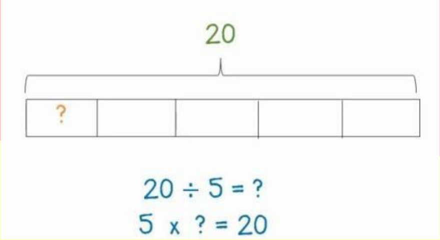
Division - Strategy and Guidance	Concrete/Pictorial/Abstract
EYFS/Year 1 Sharing objects into groups	**Concrete:** I have 10 cubes; can you share them equally in 2 groups?   **Pictorial:**  Children use pictures or shapes to share quantities. 8 ÷ 2 = 4 **Abstract**: Share 9 buns between three people.9 ÷ 3 = 3
EYFS/Year 1 Division as grouping	**Concrete:** Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.



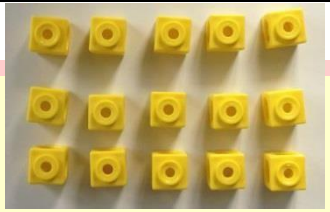
Pictorial: Use a number line to show jumps in groups. The number of jumps equals the number of groups.

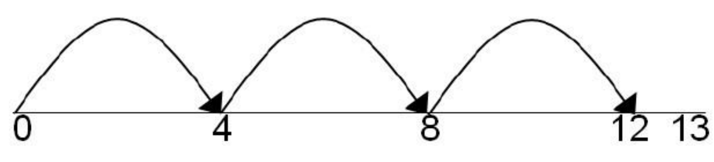
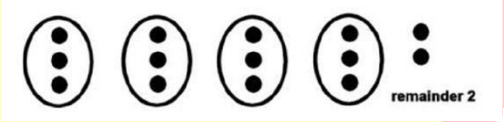


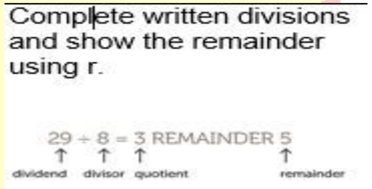
Think of the bar as a whole. Split it into the number of groups you are dividing by and work out how many would be within each group.
Use a number line or pictures to continue support in counting in multiples.

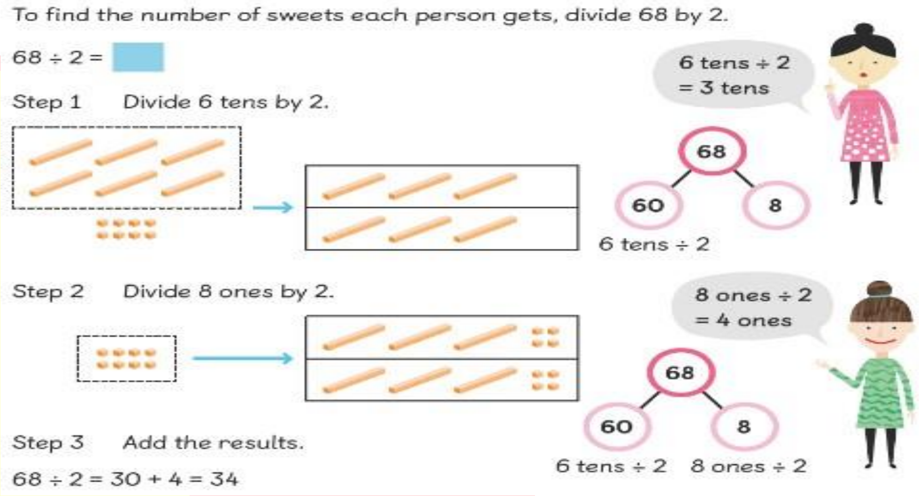


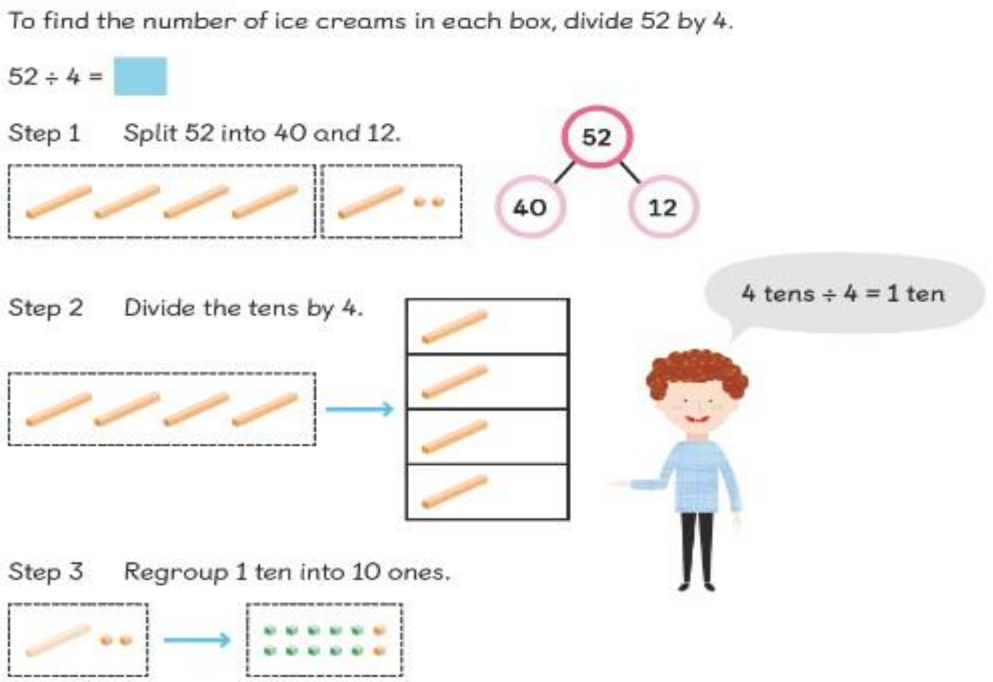
Abstract: 28 ÷ 7 = 4 Divide 28 into 7 groups. How many are in each group?

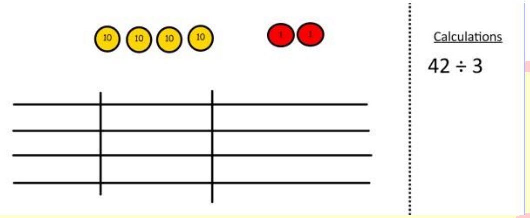
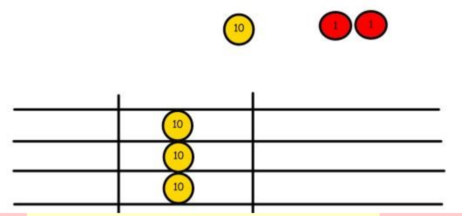
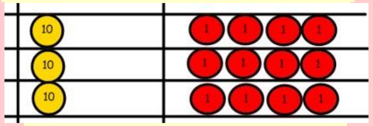
Year 2 Division within arrays	 Concrete: Link division to multiplication by creating an array and thinking about the number sentences that can be created. Eg 15 ÷ 3 = 5 5 x 3 = 15 15 ÷ 5 = 3 3 x 5 = 15
	Pictorial: Draw an array and use lines to split the array into groups to make multiplication and division sentences. Abstract: Find the inverse of multiplication and division sentences by creating four linking number sentences. 7 x 4 = 28 4 x 7 = 28 28 ÷ 7 = 4 28 ÷ 4 = 7

Year 3 Division with remainders	**Concrete:** 14 ÷ 3 = Divide objects between groups and see how much is left over. To use place value counters to do this physically until they fully understand that anything that cannot be grouped is a remainder.  **Pictorial:** Jump forward in equal jumps on a number line then see how many more you need to jump to find a remainder.  Draw dots and group them to divide an amount and clearly show a remainder. 

	Abstract:  Complete written divisions and show the remainder using r. 29 ÷ 8 = 3 REMAINDER 5 ↑ dividend ↑ divisor ↑ quotient ↑ remainder

Year 3 Partitioning	 To find the number of sweets each person gets, divide 68 by 2. 68 ÷ 2 = ☐ Step 1 Divide 6 tens by 2. Step 2 Divide 8 ones by 2. Step 3 Add the results. 68 ÷ 2 = 30 + 4 = 34 Partitioning with regrouping

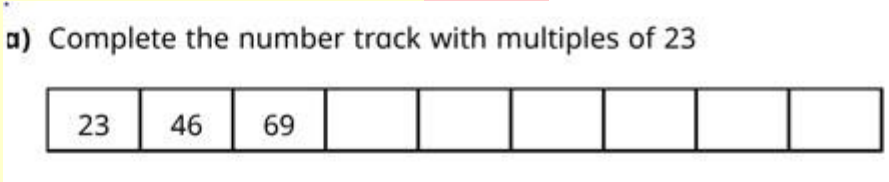
	 To find the number of ice creams in each box, divide 52 by 4. 52 ÷ 4 = ☐ Step 1 Split 52 into 40 and 12. Step 2 Divide the tens by 4. Step 3 Regroup 1 ten into 10 ones.

Year 3 Short Division	 42 ÷ 3= **Concrete/pictorial**: Start with the biggest place value, we are sharing 40 into three groups. We can put 1 ten in each group and we have 1 ten left over.  We exchange this ten for ten ones and then share the ones equally among the groups. We look at how much in 1 group so the answer is 14.  **Abstract**: Begin with divisions that divide equally with no remainder.
	Move onto divisions with a remainder. Finally move into decimal places to divide the total accurately. $\begin{array}{r\|l} & 8\ \ 6\ \ r\ \ 2 \\ \hline 5 & 4\ \ 3\ \ {}^{3}2 \end{array}$ $\begin{array}{r\|l} & 2\ \ 1\ \ 8 \\ \hline 4 & 8\ \ 7\ \ {}^{3}2 \end{array}$

Year 6

Long division

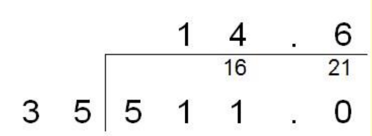
Concrete/Pictorial: To build on the work from short division, emulating the chidlren using number lines. To create their own number tracks which can be used to solve long division, i..e 156 divided by 23.



a) Complete the number track with multiples of 23

23	46	69						

Abstract:



**Year groups indicate when a calculation method is first introduced. This is guidance only. Some children may be introduced to methods earlier or later.*