



The aim of our calculation policy is to ensure that there is a consistent approach to calculation which will allow children to develop efficient and reliable methods for all the 4 operations. Alongside this, it will allow children to make connections across all mathematical concepts,

How is Maths taught at Cupernham Junior School?

CPA approach (concrete, pictorial and abstract approach).

At Cupernham, the CPA approach allows all children to learn mathematical concepts in a variety of different ways.

Concrete

The CPA approach starts with using concrete resources e.g dienes, counters to introduce a new concept.

Pictorial

Children then move to a pictorial representation of the concept (models and images). The combination of these allow children to see patterns and make connections.

Abstract

Children then move to an abstract representation where they are able to problem solve, replacing models and images for numbers and symbols. This allows greater links to be made, allowing children to master a concept.

Fluency

In order to support children's ability to problem solve, children are taught fluency skills. Fluency and the instant recall of key facts allows children to make links across concepts and choose the most efficient methods when problem solving.

Spiral curriculum

A spiral curriculum allows children to re-visit concepts, focusing on the smaller steps and ultimately mastering the concept. It allows for a deeper understanding of concepts through children being able to make connections and links across concepts.

Year 3

National Curriculum objectives including NC Ready to Progress criteria

Addition and subtraction

Add and subtract numbers mentally, including:

- a three-digit number and 1s
- a three-digit number and 10s
- a three-digit number and 100s
- Add and subtract numbers with up to 3 digits, using formal written methods of columnar addition and subtraction.
- Estimate the answer to a calculation and use inverse operations to check answers.
- Solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction

NC Ready to progress criteria.

- Calculating complements to 100 (the amount needed to make a total)
- Add and subtract up to 3 numbers using columnar methods.
- Manipulate the additive relationship:
Understand the inverse relationship between addition and subtraction, and how both relate to the part-part-whole structure.
Understand and use the commutative property of addition and understand the related property for subtraction.
- Secure fluency in addition and subtraction facts that bridge 10, through continued practice.

Multiplication and Division

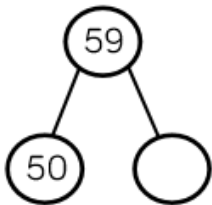
- recall and use multiplication and division facts for the 3,4 and 8 multiplication tables
- write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one digit numbers, using mental and progressing to formal written methods.
- Solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems in which n objects are connected to m objects.

NC Ready to progress criteria

- Apply known multiplication and division facts to solve contextual problems with different structures, including quotative and partitive division.
- Recall multiplication facts, and corresponding division facts, in the 10, 5, 2, 4 and 8 multiplication tables, and recognise products in these multiplication tables as multiples of the corresponding number.
- Apply place-value knowledge to known additive and multiplicative number facts (scaling facts by 10)



Year 3 Addition and subtraction.

Concrete	Pictorial	Abstract	Vocabulary																						
The use of place value counters or Diennes to add and subtract allows children to explore the structure of the calculation. Alongside this, the children are able to see the physical process of exchanging. Addition using PV counters <table border="1"><thead><tr><th>Hundreds</th><th>Tens</th><th>Ones</th></tr></thead><tbody><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr></tbody></table> $\begin{array}{r} 384 \\ + 237 \\ \hline 621 \\ 1\ 1 \end{array}$ Subtraction using PV counters <table border="1"><thead><tr><th>Hundreds</th><th>Tens</th><th>Ones</th></tr></thead><tbody><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr></tbody></table> $\begin{array}{r} 652 \\ - 207 \\ \hline 445 \end{array}$	Hundreds	Tens	Ones							Hundreds	Tens	Ones							A pictorial representation allows the foundations of the calculation to be understood. These are: Part and part- whole models  Bar modelling allows the foundations of the calculation to be understood. Part-Part-Whole Model  Missing Whole: Add Whole = Part + Part Missing Part: Subtract Part = Whole – Part In addition, it allows the process of using the inverse operation to be explored. <table border="1"><tr><td colspan="2">628</td></tr><tr><td>274</td><td>354</td></tr></table> $274 + 354 = 628$ $628 - 274 = 354$ $628 - 354 = 274$ Jottings using a place value grid allows the same process of exchanging to be visualized through highlighting the process of crossing tens and hundreds. 86 +48	628		274	354	Partitioning of the numbers into HTU's $128 + 7$ $100 + 20 + 8 + 7$ -Addition of the 1's to see if they have got 10 ones. -Exchange 10 ones for 1 ten -Addition of the 10's to see if they have got 10 tens. -Exchange 10 tens for 1 hundred -How many ones do they have? -How many tens do they have ? -How many hundreds to they have? Expanded column method. The number is partitioned into HTU but using a columnar layout. 328 + 212 $300 + 20 + 8$ $200 + 10 + 2$ 10 $500 + 40 + 0$	Partition Sum Exchange Units Tens Hundreds Digit Integer Commutative Re-grouping
Hundreds	Tens	Ones																							
																									
																									
Hundreds	Tens	Ones																							
																									
																									
628																									
274	354																								

Addition using Diennes

Without exchanging

h	t	o
2	1	5
+	1	3 2
3	4	7

h	t	o
2	1	5
+	1	3 2
3	4	7

With exchanging

h	t	o
2	8	7
+	1	0 5
3	9	2

h	t	o
2	8	7
+	1	0 5
3	9	2

Subtraction using Diennes

Without exchanging

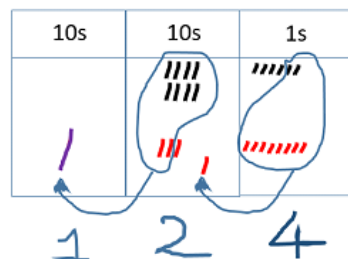
h	t	o
4	5	6
-	1	3 1
3	2	5

h	t	o
4	5	6
-	1	3 1
3	2	5

With exchanging

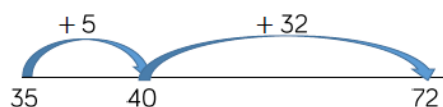
h	t	o
3	6	3
-	1	3 5
2	3	8

h	t	o
3	6	3
-	1	3 5
2	3	8

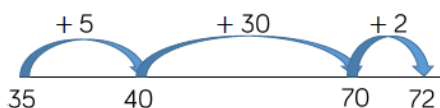


Number lines allow children to start to have a structure in which to add or subtract in smaller parts.

$$35 + 37 = 72$$



$$72 - 35 = 37$$



$$572 - 158 =$$

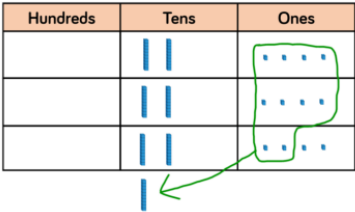
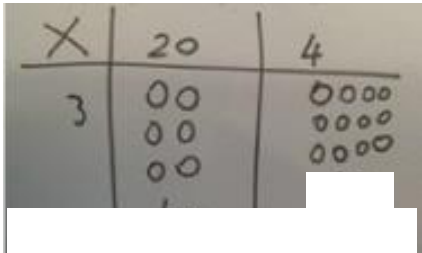
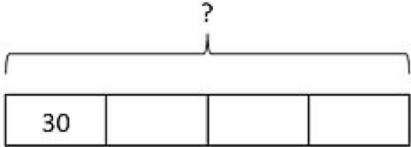
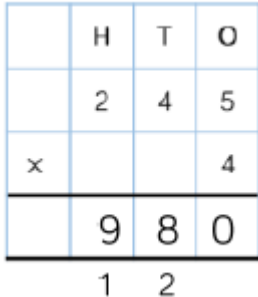
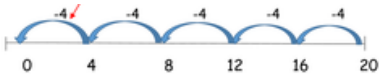
500	60	12
100	50	8
400	10	4

Columnar method

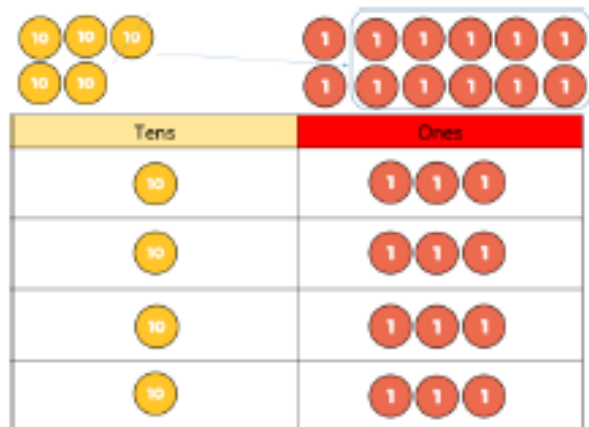
$$\begin{array}{r} 328 \\ + 212 \\ \hline \end{array}$$

$$540$$

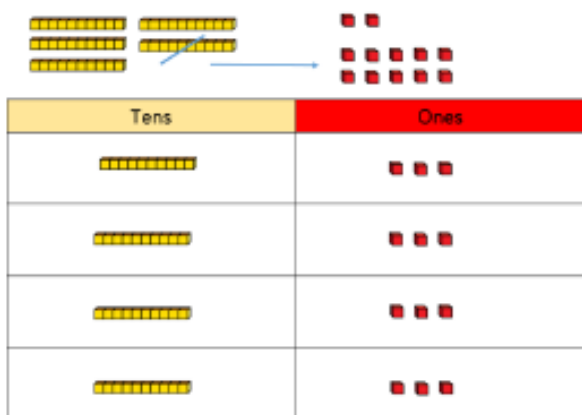
$$\begin{array}{r} 3 \quad 1 \\ 435 \\ - 273 \\ \hline 262 \end{array}$$

Concrete	Pictorial	Abstract	Vocabulary
The use of Diennes and place value counters shows how the number can be partitioned into tens and ones. 34 X 5   $\begin{array}{r} 24 \\ \times 3 \\ \hline 72 \\ 1 \end{array}$	Children can start to build on their understanding of arrays by drawing a grid to replace the Diennes or PV counters. Children then add the partitioned numbers to calculate the answer. 24 x 3 = 72  Bar models also allow children to visualize the calculation whilst also providing a structure with which to support their thinking.  $30 \times 4 = 120$	Children will move to using a short formal method of calculating up to 3 digits x 1.  A number line allows children to begin to see the process of chunking when dividing through repeated subtraction. 20 ÷ 4 = 5 	Groups of Arrays Multiple Partition Repeated addition Repeated subtraction Equal grouping Inverse Share

In the case of division they are used to show how the number can be grouped. They also allow children to see how they can re-group to complete the calculation.

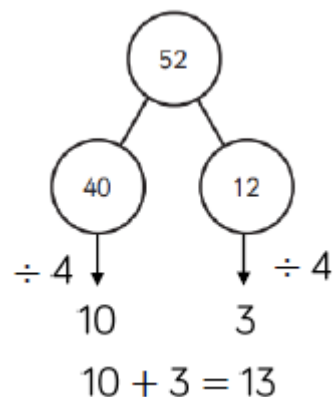


$$52 \div 4 = 13$$

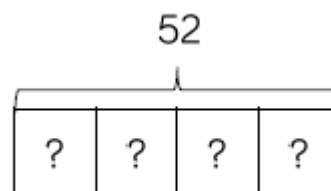


The use of whole and part whole models will allow children to build on their ideas of grouping to divide.

$$52 \div 4 = 13$$



Alongside this a bar model allows children to use the structure of grouping.



Year 4

National Curriculum objectives including NC Ready to Progress criteria



Addition and subtraction

- Add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate
- Estimate using the inverse operations to check answers to a calculation.
- Solve addition and subtraction two-step problems in context , deciding which operations and methods to use and why.

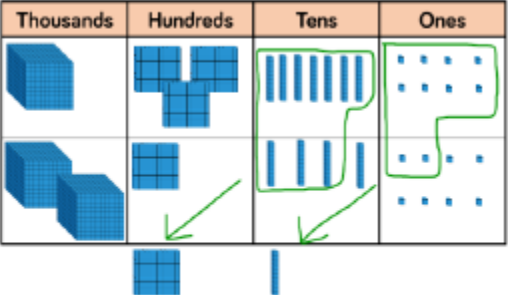
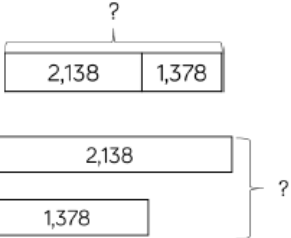
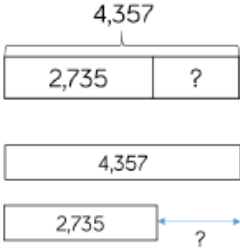
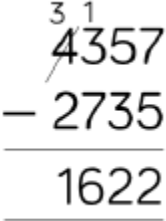
Multiplication and Division

- Recall multiplication and division facts for multiplication tables up to 12×12
- Use place value, known and derived facts to multiply and divide, mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers.
- Recognise and use factor pairs and commutativity in mental calculations.
- Multiply two-digit and three-digit numbers by a one-digit using formal written layout.
- Solve problems involving multiplying and adding, including using the distributive law to multiply two- digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects.

NC Ready to progress criteria.

- Recall multiplication and division facts up to 12×12 , and recognise products in multiplication tables as multiples of the corresponding number.
- Solve division problems, with two-digit dividends and one-digit divisors, that involve remainders, and interpret remainders appropriately according to the context
- Apply place-value knowledge to known additive and multiplicative number facts (scaling facts by 100)
- Multiply and divide whole numbers by 10 and 100 (keeping to whole number quotients); understand this as equivalent to making a number 10 or 100 times the size.
- Manipulate multiplication and division equations, and understand and apply the commutative property of multiplication.
- Understand and apply the distributive property of multiplication.

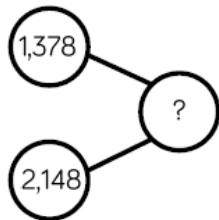
Year 4 Addition and Subtraction

Concrete	Pictorial	Abstract	Vocabulary
Children still continue to use Diennes and Place Value counters to consolidate their understanding of exchanging. 13178 + 2148 = 3526  	Bar models continue to allow children to visualize the calculation with a structure to support their thinking. It will also allow them to see the inverse of the calculation. 2138 + 1378 = 3516  4357 - 2735 = 1622  Children still continue to use whole and part whole models to provide structure to their thinking. 1378 + 2148 = 35216	Children build on their understanding of using column addition and subtraction, focusing on the concept of exchanging across the columns.  	Exchange Units Tens Hundreds Thousands Digit Integer Commutative Re-grouping

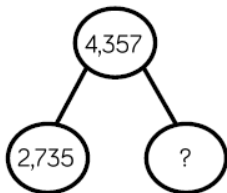
4357- 2735 = 1622

Thousands	Hundreds	Tens	Ones

Thousands	Hundreds	Tens	Ones



4357- 2735 = 1622



4,357	
2,735	?

4,357

2,735	?
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4357- 2735 = 1622			
Thousands	Hundreds	Tens	Ones
			

Thousands	Hundreds	Tens	Ones
			

1,378

?

2,148

?

4357- 2735 = 1622

4,357

2,735

?

4,357

2,735

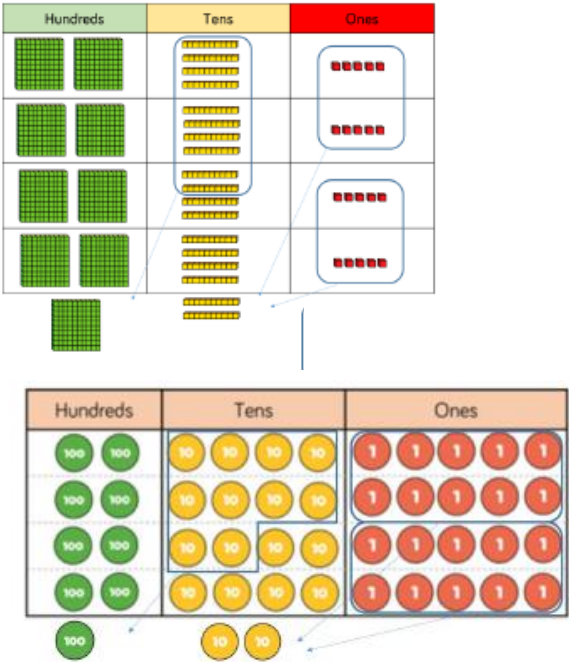
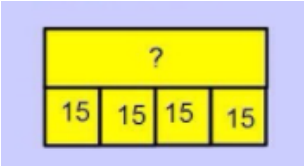
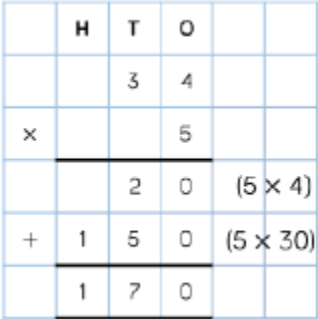
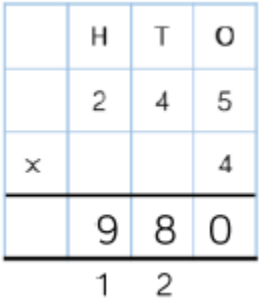
?

4,357

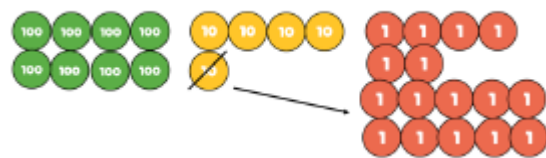
2,735

?

Year 4 Multiplication and Division

Concrete	Pictorial	Abstract	Vocabulary
Children continue to use Diennes and Place value counters to support their thinking and understanding of multiplication and division. They continue to explore the idea of re-grouping using the Diennes and PV counters. 245 x 4 = 980  Children continue to explore the idea that division is sharing using Diennes and Place Value counters, supporting the idea of re-grouping .	Children continue to use a bar model to provide the structure for their thinking when multiplying. 15 x 4 	Children will move to start using an expanded column method when multiplying to allow the children to see the steps required. e.g 34 x 5 = 170  Children will then move to short multiplication by 1 digit. e.g 245 x 4 = 980 	Groups of Arrays Multiple Partition Repeated addition Equal grouping Inverse Share multiply

$$844 \div 4 = 211$$



H	T	O
100 100	10	1
100 100	10	1
100 100	10	1
100 100	10	1

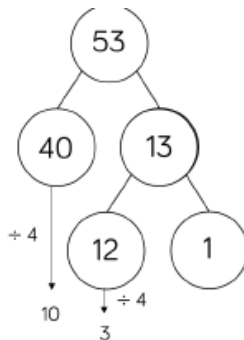
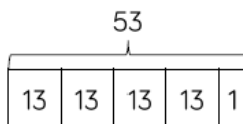
Children move to see division with remainders. The use of place value counters or Diennes allows children to see what is left over by leaving them outside the place value grid. **e.g $54 \div 4 = 13 \text{ r } 1$**

Tens	Ones
10	4
10	4
10	4
10	4

Tens	Ones
10	4
10	4
10	4
10	4

Children continue to use a bar model and whole/part whole models to provide a structure for their thinking in division. The images allow children to see the concept of grouping and how many are left outside the group.

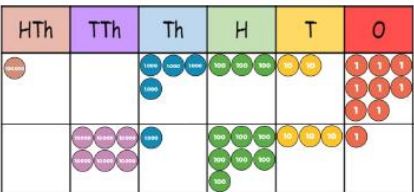
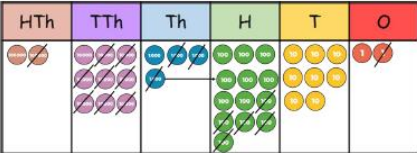
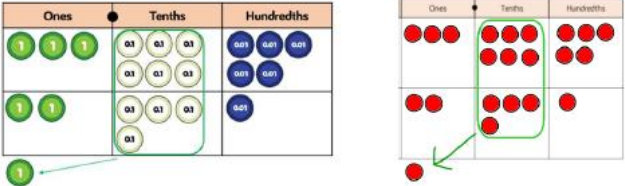
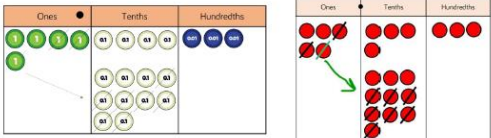
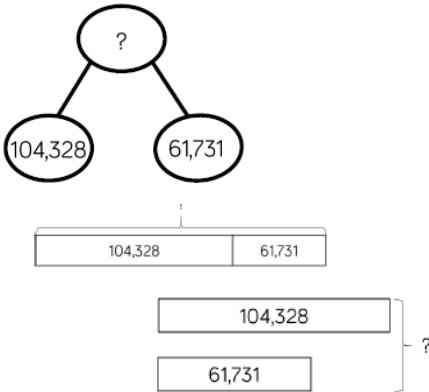
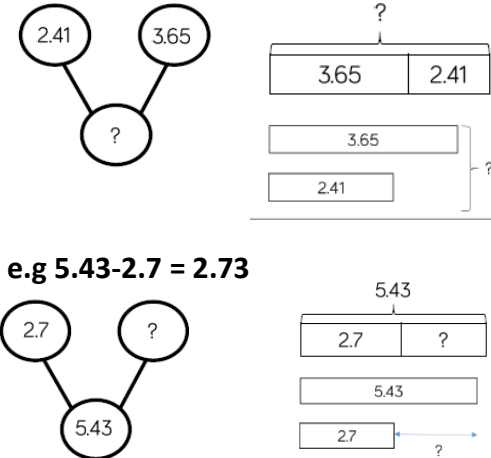
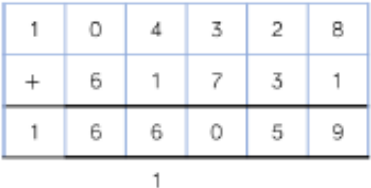
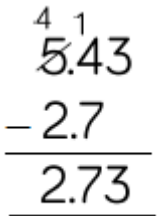
e.g $54 \div 4 = 13 \text{ r } 1$

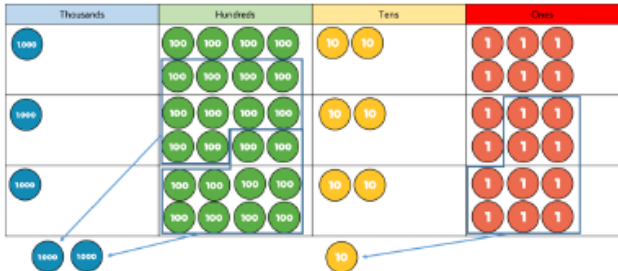


Children start to use short division when division, focusing on how many groups of the divisor there are.

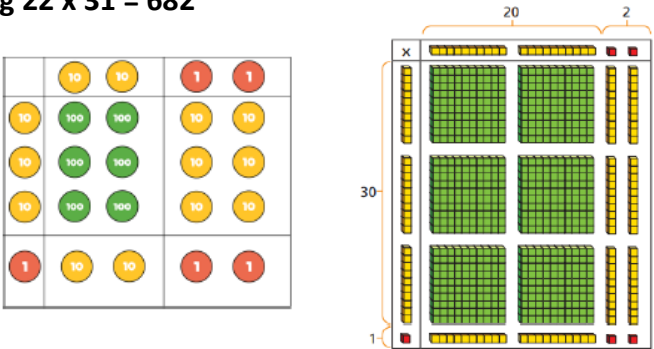
		1	3	
	4	5	1	2

Year 5

Concrete	Pictorial	Abstract	Vocabulary
Year 5 addition and subtraction In Y5 the most effective concrete resource to use when adding more than 4 digits is Place value counters e.g $104,328 + 61\,731 = 166,059$  e.g $294,382 - 182,501 = 111,881$  When adding decimals, they also allow children to visualize the place value grid and the position of each number within it. e.g $3.65 + 2.41$  e.g $5.43 - 2.7 = 2.73$ 	In Y5 children continue to use whole and part whole models. They allow them to continue to secure their thinking as well as bar models with both providing a structure in which to approach the calculation. e.g $104,328 + 61,731 = 166,059$  e.g $5.43 - 2.7 = 2.73$ 	Children are encouraged in Y5 to focus on using a formal column method to complete addition and subtraction calculations to ensure efficiency. e.g $104,328 + 61,731 = 166,059$  e.g $5.43 - 2.7 = 2.73$ 	Exchange Units Tens Hundreds Thousands Hundred thousands Digit Integer Re-grouping

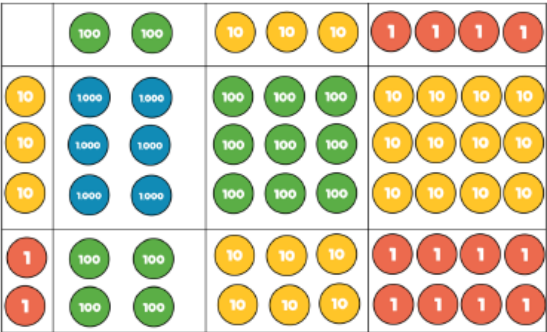
Concrete	Pictorial	Abstract	Vocabulary																					
Y5 Multiplication and Division Multiplication Children will start to multiply 4 digits by 1. The use of place value counters will allow them to clearly see how the numbers move within the number system. E.g 1826 x 3 = 5478  When multiplying 2 digits by 2 digits, children will benefit from using the area model with either diennes or place value counters as they can visualize the size of the numbers they are using. It will also allow them make links to their previous understanding of finding the area of a rectangle and multiplying 1 side by the other.	Before moving to short multiplication, the grid method allows children to make a link with the area model, matching it but without the concrete resources. <table><tr><td>×</td><td>20</td><td>2</td></tr><tr><td>30</td><td>600</td><td>60</td></tr><tr><td>1</td><td>20</td><td>2</td></tr></table> This image also works when multiplying 3 digits by 2 digits. <table><tr><td>×</td><td>200</td><td>30</td><td>4</td></tr><tr><td>30</td><td>6,000</td><td>900</td><td>120</td></tr><tr><td>2</td><td>400</td><td>60</td><td>8</td></tr></table>	×	20	2	30	600	60	1	20	2	×	200	30	4	30	6,000	900	120	2	400	60	8	Children continue to develop their understanding of short multiplication. Children should be encouraged to move to short multiplication whilst making links to the grid method. To support their thinking if children are not secure in their times tables, they should use a multiplication grid to support their thinking. This applies to whether multiplying 4 digits by 1, 4 digits by 2, 2 digits by 2 digits or 3 digits by 2 digits. Children should only move to 4 digits by 2 digits when secure and confident in their understanding. Ensure children are consistent in the process of moving digits across the place value grid	Multiple Grid method Partition
×	20	2																						
30	600	60																						
1	20	2																						
×	200	30	4																					
30	6,000	900	120																					
2	400	60	8																					

e.g $22 \times 31 = 682$



The area model also supports their thinking when calculating 3 digits by 2 digits as it builds on the same principle of 1 side x by another side.

e.g $234 \times 32 = 7488$



	Th	H	T	O
	1	8	2	6
x				3
	5	4	7	8
	2		1	

Th	H	T	O
	2	3	4
x		3	2
	4	6	8
1 7	1 0	2	0
7	4	8	8

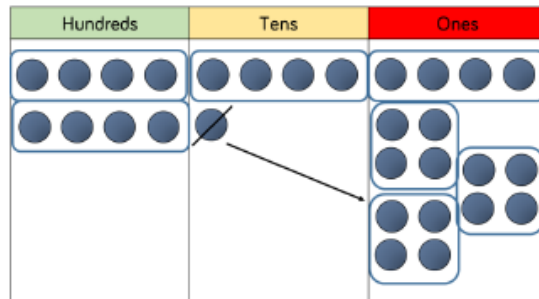
TTh	Th	H	T	O
	2	7	3	9
x			2	8
2	1	9	1	2
2	5	3	7	
1	5	4	7	8
	7	6	6	9
				2

Concrete

Division

When dividing, children continue to use place value counters and diennes, continuing to consolidating their thinking by grouping.

e.g $856 \div 4 = 214$



Pictorial

Children move from using using concrete resources to drawing counters within the place value grid and grouping them.

Abstract

The idea of grouping is continued through short division of a 3 digit number by a 1 digit number. Children should be encouraged to move to this method when there is more than 1 exchange.

		2	1	4
	4	8	5	16

Vocabulary

Remainder
Grouping
Exchange

The same concept is applied when dividing with 4 digits by 1 digit **e.g** $8532 \div 2 = 4266$

Th	H	T	O
1,000 1,000	100 100	10 10	1 1
1,000 1,000	100 100	10 → 1	1 1
1,000 1,000	100 → 10	10 10	1 1
1,000 1,000		10 10	1 1
		10 10	1 1
		10 10	1 1
		10 10	

Year 6

National Curriculum objectives including NC Ready to Progress criteria



Addition, subtraction, multiplication and division

- Multiply multi-digit numbers up to 4 digits by a two digit whole number using the formal written method of long multiplication
- Divide numbers up to 4 digits by a two digit whole number using the formal written method of long division and interpret remainders as whole number remainders, fractions or by rounding, as appropriate for the context.
- Divide numbers up to 4 digits by a two digit number using the formal written method of short division where appropriate, interpreting remainders according to the context.
- Divide numbers up to 4 digits by a two digit using the formal written method of short division where appropriate, interpreting remainders according to the context.
- Perform mental calculations, including with mixed operations and large numbers.
- Use their knowledge of the order of operations to carry out calculations involving the four operations.
- Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.
- Solve problems involving addition, subtraction ,multiplication and division.
- Use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.

NC Ready to progress criteria.

- Understand that 2 numbers can be related additively or multiplicatively, and quantify additive and multiplicative relationships (multiplicative relationships restricted to multiplication by a whole number.
- Use a given additive or multiplicative calculation to derive or complete a related calculation, using arithmetic properties, inverse relationships, and place-value understanding.
- Solve problems involving ratio relationships.
- Solve problems with 2 unknowns

Concrete	Pictorial	Abstract	Vocabulary																														
Addition and subtraction In Y6, the methods used in Y5 when adding or subtracting more than 4 digits continue to be used across all 3 concepts.																																	
Multiplication In Y6, the methods used in Y5 for multiplying 4 digits by 2 digits continue to be used across all 3 concepts.																																	
Division		In Y6 children start to divide up to 4 digits by 2 digits. Children should develop and consolidate their understanding of this using formal methods, rather than with concrete resources or pictorial models. This is due to them being less effective in developing and underpinning their understanding. e.g $432 \div 12 = 36$ <table><tr><td></td><td></td><td>0</td><td>3</td><td>6</td></tr><tr><td></td><td>12</td><td>4</td><td>⁴3</td><td>⁷2</td></tr></table> Using a formal method, allows children to use their knowledge of noting down known multiples to support their thinking, especially with larger multiples. e.g $7335 \div 15 = 489$ <table><tr><td></td><td>0</td><td>4</td><td>8</td><td>9</td></tr><tr><td>15</td><td>7</td><td>⁷3</td><td>¹³3</td><td>¹³5</td></tr></table> <table><tr><td>15</td><td>30</td><td>45</td><td>60</td><td>75</td><td>90</td><td>105</td><td>120</td><td>135</td><td>150</td></tr></table>			0	3	6		12	4	⁴ 3	⁷ 2		0	4	8	9	15	7	⁷ 3	¹³ 3	¹³ 5	15	30	45	60	75	90	105	120	135	150	
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