KING'S FORD
ACADEMY

Maths Calculation Policy
2024

Inspires MAT

At King's Ford Academy, we believe that children should be introduce to the processes of calculation through practical, oral and mental activities.
As children begin to understand the underlying ideas they develop ways of recording to support their thinking and calculation methods, use particular methods that apply to special cases, and learn to interpret and use the signs and symbols involved.
It is important that we support all pupils in developing their mathematical thinking, both in order to improve the way in which they learn, as well as the learning itself. Good questioning can be used to develop pupils' ability to compare, modify and generalise, all building a deeper understanding of mathematics.

Our Lesson Structure

- **I do**

Explicit teacher model and instruction
During the 'I do' phase of the lesson, teachers tell students what they need to know and show them how to do what they need to do. Teachers, therefore, are, at this stage, involved in informing, explaining, modelling, and providing examples.

- **We do**

This stage of learning involves working on tasks together. Teachers and students use worked examples with some elements missing, to help students become more confident with the new learning.

- **You do**

This phase of the lesson involves students using what they have been taught. It can involve practising skills that they have just been shown. This can involve asking students to recreate what you have asked them to do. It can also involve simply answering practice questions and completing all the steps themselves.

CPA Approach
At King's Ford Academy we also use the CPA approach to our lessons. CPA stands for Concrete -> Pictorial -> Abstract.

C

- Concrete = maths concept is modelled with concrete materials

P

- Pictorial= maths concept is modelled with representational examples- such as drawings

A

- Abstract = Maths concept is modelled with numbers and symbols.

Oracy & Vocabulary Skills
What is oracy? Oracy is to speaking what numeracy is to maths. It's the ability to communicate verbally and structure your thoughts so that they make sense to other people.

- **Communicate and develop mathematical language** using a carefully sequenced, structured approach to introducing and reinforcing mathematical vocabulary throughout maths lessons, so pupils have the opportunity to work with word problems from the beginning of their learning. This is achieved through:
  - Sharing the key vocabulary at the beginning of every lesson in the 'Discover' section and insisting on its use throughout
  - Modelling clear sentence structures and expecting pupils to respond using a full sentence
  - Maths talk, allowing pupils to discuss their thinking and reasoning of the concepts being presented using stem sentences

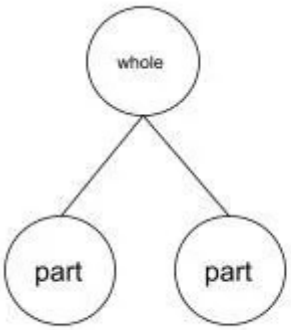
- **Think mathematically** and build resilience to the challenges they face within and across the subject by having the opportunity to:
    - Explore, wonder, question and conjecture- feeling safe to make mistakes and learn from these through exploring their own understanding and application of maths
    - Compare, classify, sort- using clear verbal reasoning as to how or why they have classified their objects- again with the confidence to explain and discuss their thoughts with their peers and their teachers
    - Experiment, play with possibilities, vary an aspect and see what happens- similar to how children learn to play with language in literacy- explore what happens when the changes are made, are there patterns that appear- if so what is happening and from this can they predict what will happen as the sequences continue?
    - Make theories and predictions and act purposefully to see what happens- making generalisations and exploring them both independently, with peers and with adults alike.

This policy contains the key pencil and paper procedures that will be taught within our school alongside practical resources. It has been written to ensure consistency and progression throughout the school and reflects a whole school agreement.

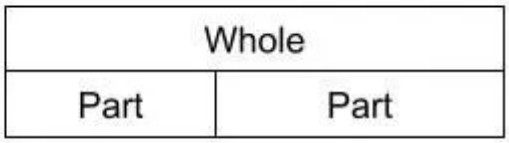
Representations you will see:

Part-Whole model & Bar model

The part whole model is a pictorial representation that shows the relationship between a whole and its parts. While usually constructed with just two parts, a whole number can be partitioned (split) into as many component parts as a person may choose. The bar model method is a way to represent the underlying structures of mathematical problems to aid problem solving.



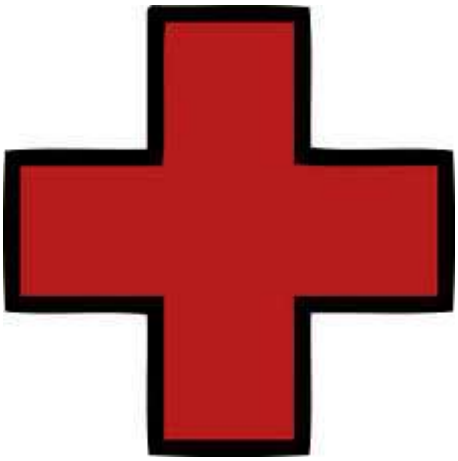
cherry diagram



Bar model

Within this document you will see the progression within each element of mathematics from EYFS up to Year 6, including the continuation of key vocabulary within each year group. The new vocabulary for each year group will be highlighted in **bold**

Addition

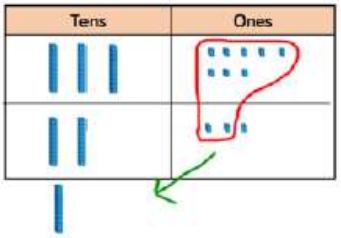


Pre-Key Stage 2

Ensure that children are confident with the methods outlined in the previous stage's guidance before moving on.

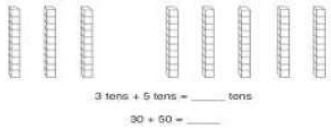
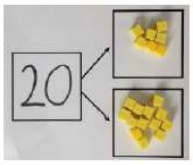
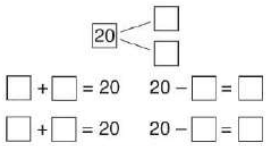
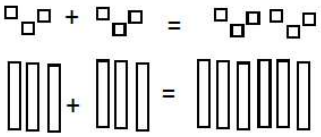
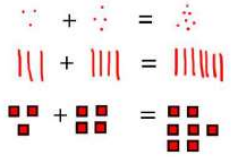
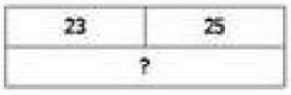
The use of practical manipulatives will still be used to add three one digit numbers, a 2 digit + 1 digit number and two 2 digit numbers.

Children move to more formal recording using the partitioning method, setting out as follows:



$$\begin{array}{r} 38 \\ +\ 23 \\ \hline 61 \\ \hline 1 \end{array}$$

This needs to be practiced in a concrete fashion, moving to pictorial before abstract representations are used.

Objective & Strategy	Concrete	Pictorial	Abstract
Adding multiples of ten	50= 30 = 20  Model using dienes and bead strings	 3 tens + 5 tens = _____ tens 30 + 50 = _____ Use representations for base ten.	20 + 30 = 50 70 = 50 + 20 40 + □ = 60
Use known number facts Part part whole	 Children explore ways of making numbers within 20		
Using known facts		 Children draw representations of H,T and O	3 + 4 = 7 *leads to* 30 + 40 = 70 *leads to* 300 + 400 = 700
Bar model	 3 + 4 = 7	 7 + 3 = 10	 23 + 25 = 48

Key Vocabulary

Add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, **sum, tens (T), ones (O), partition, column**

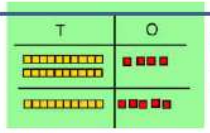
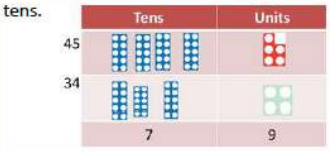
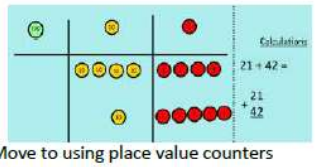
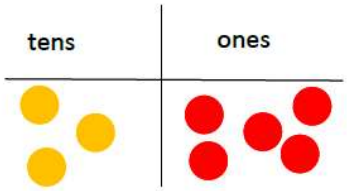
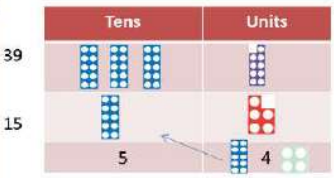
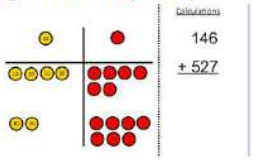
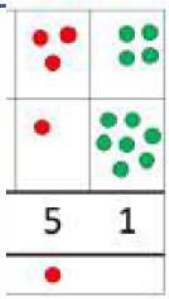
National Curriculum requirements

- Solve problems with addition
    - Using concrete objects and pictorial representations, including those involving numbers, quantities and measures
- Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100
- Add and subtract numbers using concrete objects, pictorial representations including mentally
- Show that addition of two numbers can be done in any order (commutative)
- Recognise and use the inverse relationship between addition and subtraction- using this to check calculations and solve missing number problems.

Year 3

When they are ready, children move on to the expanded written method supported by practical activities. We know children are ready for this method when they:

- Know addition and subtraction facts to 20
- They understand place value and can partition numbers

Objective & Strategy	Concrete	Pictorial	Abstract
Column Addition—no regrouping (friendly numbers) Add two or three 2 or 3-digit numbers.	 Model using Dienes or numicon Add together the ones first, then the tens.   Move to using place value counters	Children move to drawing the counters using a tens and one frame. 	2 2 3 + 1 1 4 3 3 7 Add the ones first, then the tens, then the hundreds.
Column Addition with regrouping.	 Exchange ten ones for a ten. Model using numicon and pv counters. 	 Children can draw a representation of the grid to further support their understanding, carrying the ten **underneath** the line	20 + 5 40 + 8 60 + 13 = 73 Start by partitioning the numbers before formal column to show the exchange. 536 + 85 621 1 1

Key Vocabulary

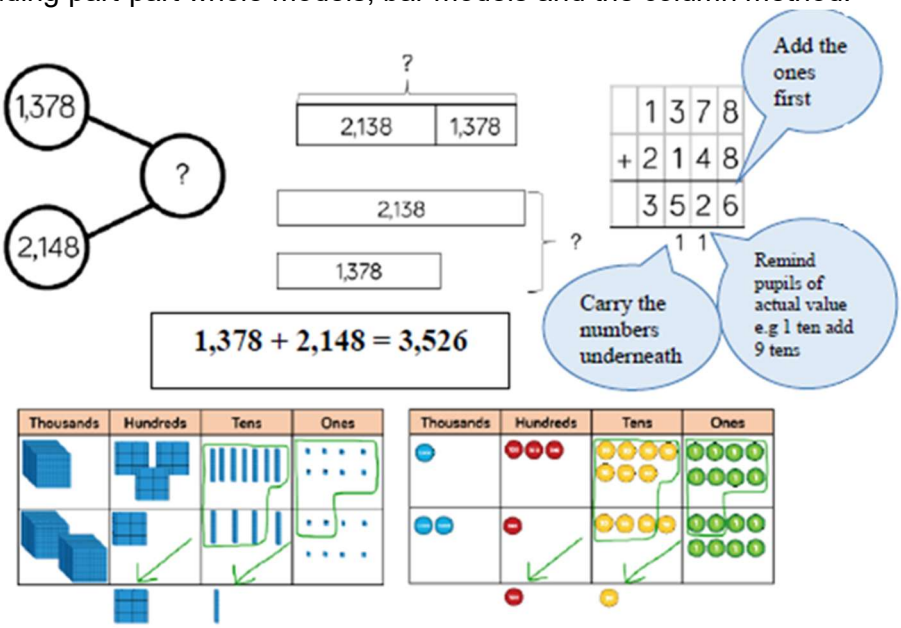
Add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens (T), ones (O), partition, **addition, column, increase**

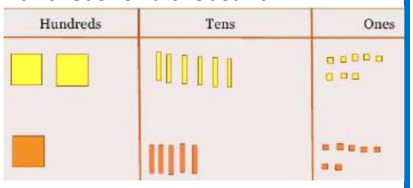
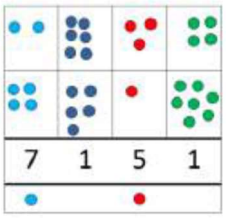
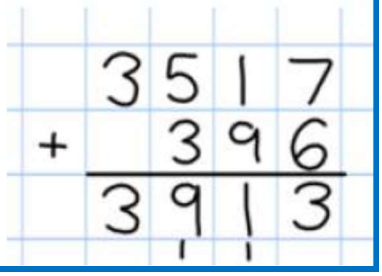
Nation Curriculum requirements:

- Add and subtract numbers mentally, including:
  - a three-digit number and ones
  - a three-digit number and tens
  - a three-digit number and hundreds
- add and subtract numbers with up to three digits, using formal written methods of column 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.

Year 4

Children continue to use the column method, addition the ones first, and carrying underneath the calculation where a new ten is formed. Their additions will include money and measures in meaningful contexts. Just like previous year groups, children will explore addition within the column method using mathematical ecquipment such as base ten and place value counters. They see the addition method in a variety of ways, including part-part whole models, bar models and the column method.



Objective & Strategy	Concrete	Pictorial	Abstract
Y4—add numbers with up to 4 digits	Children continue to use base ten or place value counters to add, exchanging ten ones for a ten and ten tens for a hundred and ten hundreds for a thousand. 	 Draw representations using place value grid.	Continue from previous work to carry hundreds as well as tens. Relate to money and measures. 

Key Vocabulary

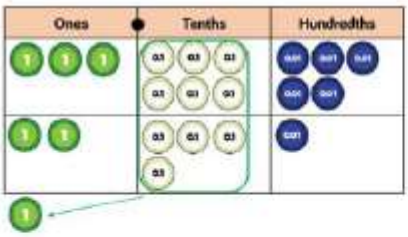
Add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens (T), ones (O), partition, addition, column, increase, **thousands (Th), hundreds (H), digits, inverse, bridging ten**

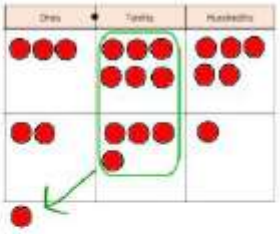
National curriculum requirements:

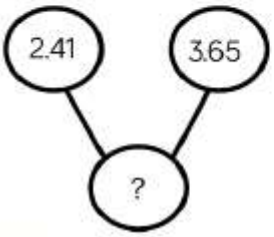
- add numbers with up to 4 digits, using the formal written methods of column addition and subtraction
- where appropriate estimate and use inverse operations to check answers to a calculation
- solve addition two-step problems in contexts, deciding which operations and methods to use and why.

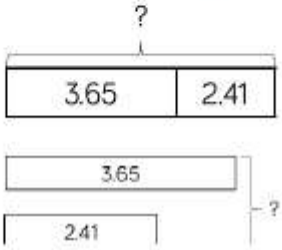
Year 5

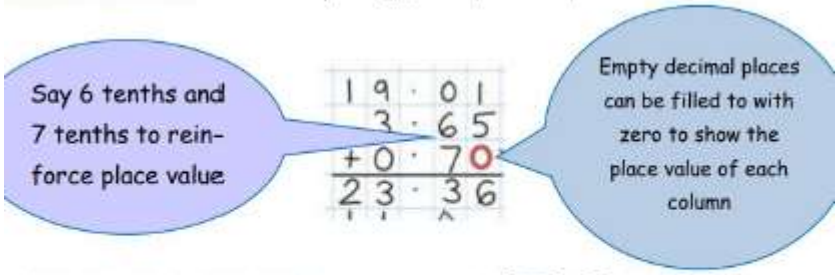
At this stage, children add numbers with more than 4 digits including money, measures and decimals with different numbers of decimal places. Place value counters on a grid are the most effective manipulative when adding decimals with 1,2 and then 3 decimal places.

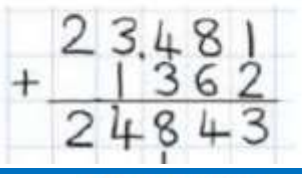












Objective & Strategy	Concrete	Pictorial	Abstract
Y5—add numbers with more than 4 digits. Add decimals with 2 decimal places, including money.	As year 4 tens ones tenths hundredths Introduce decimal place value counters and model exchange for addition.	2.37 + 81.79 tens ones tenths hundredths 6	72.8 + 54.6 127.4 1 1 £23 · 59 + £7 · 55 £31 · 14

Key vocabulary

Add, more, plus, and, make, altogether, total, equal to, equals, doubles, most, count on, number line, sum, tens (T), ones (O), partition, addition, column, increase, **carry, thousands(Th), hundreds (H), digits, inverse, decimal places, decimal points, tenths(t), hundredths(h), thousandths (th)**

National Curriculum requirements:

- add whole numbers with more than 4 digits, including using formal written methods
- add numbers mentally with increasingly large numbers
- Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy
- Solve addition multi-step problems in contexts, deciding which operations and methods to use and why

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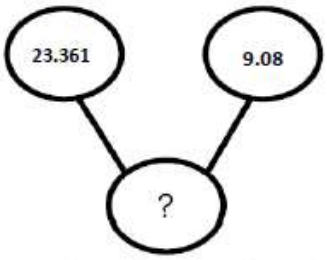
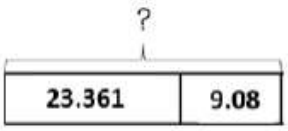
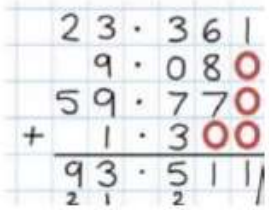
Year 6

In year 6, children should be able to add several numbers of increasing complexity. The written method should be efficiently applied to multi-step problems and the adding of numbers with varying amounts of decimals should be mastered.

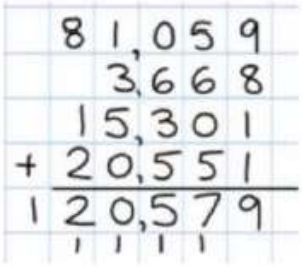


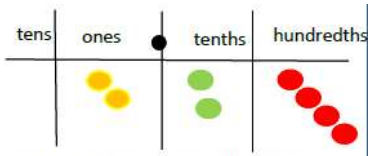
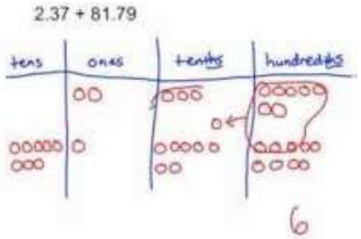
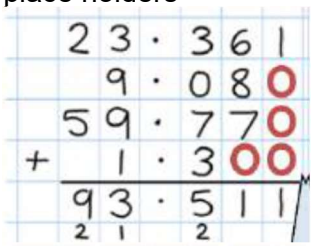
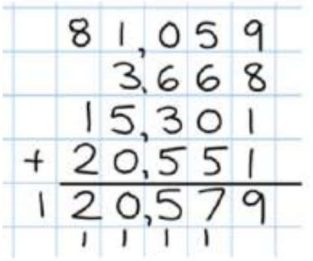




When calculating 23.361 + 9.08 + 59.77 +1.3, tenths, hundredths and thousandths should be correctly aligned, with the decimal point aligned vertically.

Pupils should apply their knowledge of a range of mental strategies; mental recall skills and informal and formal written methods when selecting the appropriate method to work out addition problems. Opportunities to discuss the appropriateness of methods need to be planned for.



Objective & Strategy	Concrete	Pictorial	Abstract
Y6—add several numbers of increasing complexity Including adding money, measure and decimals with different numbers of decimal points.	As Year 5  Introduce decimal place value counters and model exchange for addition.	As year 5  	Insert zeros (0) for place holders  

Key Vocabulary

Add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens (T), ones (O) partition, addition, **additive**, column, **bridging ten, bridging hundreds**, increase, carry, expanded, thousands (Th), Hundreds (H) digits, inverse, decimal places, decimal point, tenths (t), hundredths (h), thousandths (th)

National curriculum requirements:

- 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

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Subtraction

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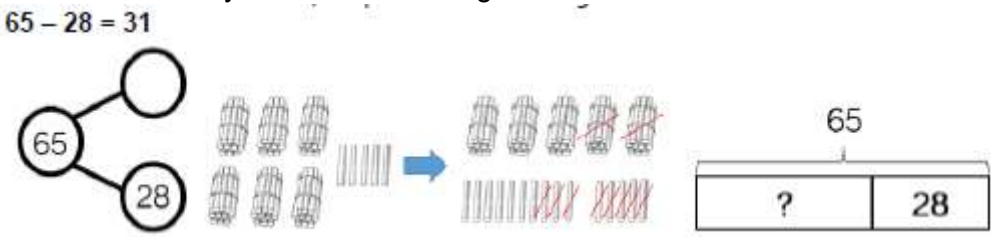
Pre-Key Stage 2

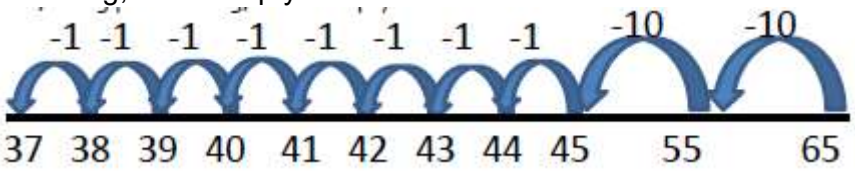
NB Ensure that children are confident with the methods outlined in the previous stage's guidance before moving on.

When children are confident, they move on to two digit numbers.

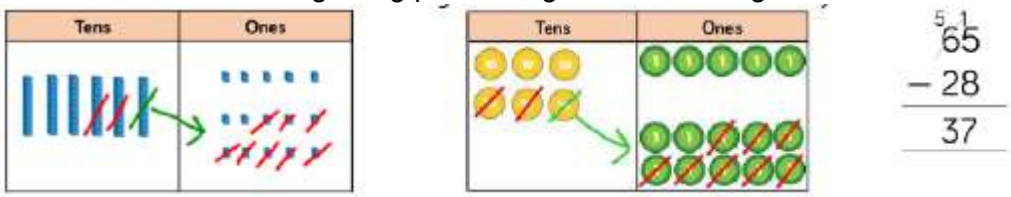


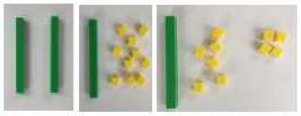
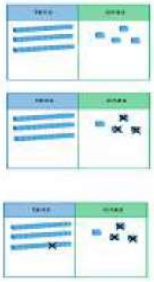
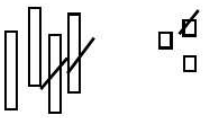
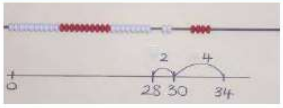
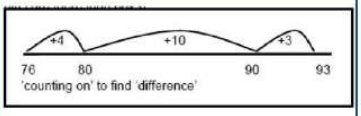
Children will use an empty number line in conjunction with a 100 square to show jumps of tens.

Subtraction, using partitioning, on an empty number line:



Children move to more formal recording using partitioning method, setting out as follows:



Objective & Strategy	Concrete	Pictorial	Abstract
Regroup a ten into ten ones	 Use a PV chart to show how to change a ten into ten ones, use the term 'take and make'	 20 — 4 =	20—4 = 16
Partitioning to subtract without regrouping. *'Friendly numbers'*	34—13 = 21  Use Dienes to show how to partition the number when subtracting without regrouping.	Children draw representations of Dienes and cross off.  43—21 = 22	43—21 = 22
Make ten strategy *Progression should be crossing one ten, crossing more than one ten, crossing the hundreds.*	 34—28 Use a bead bar or bead strings to model counting to next ten and the rest.	 Use a number line to count on to next ten and then the rest.	93—76 = 17

Key Vocabulary

Equal to, take, take-away, less, minus, subtract, leaves, difference between, how many more, how many fewer/less than, most, least, count back, how many left, how much less is…, difference, **count on, strategy, partition tens (T), ones (O)**

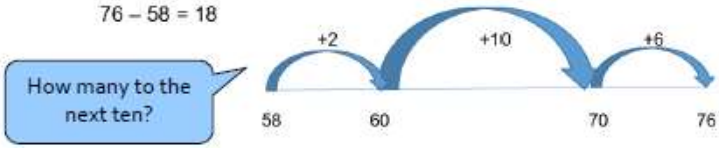
National curriculum requirements

- Solve problems with addition and subtraction:

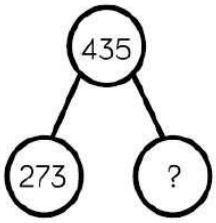
    - Using concrete objects and pictorial representations, including those involving numbers, quantities and measures
    - Applying their increasing knowledge of mental and written methods
- Recall and use subtraction facts to 20 fluently, and derive and use related facts up to 100
- Subtract numbers using concrete objects, pictorial representations, and mentally, including:
    - a two-digit number and ones
    - a two-digit number and tens
    - adding three one-digit numbers
- show that subtraction of one number from another cannot be done in any order
- recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems

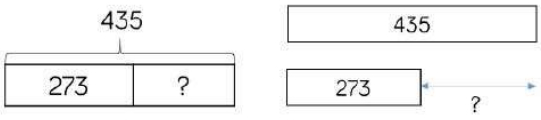
Year 3

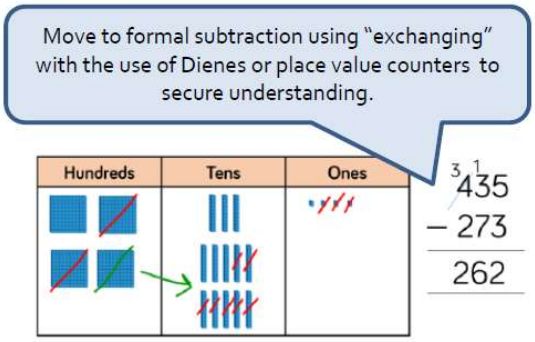
Subtract on an empty number line (ENL) by counting on. Children should understand when to count back where appropriate, using place value or number facts. This skill should be reinforced through mental work.

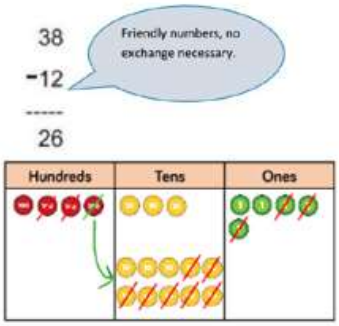


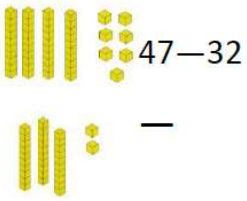
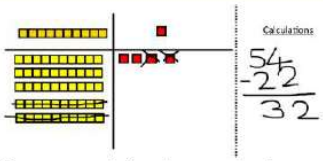
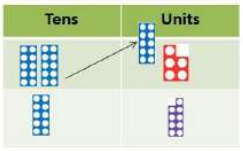
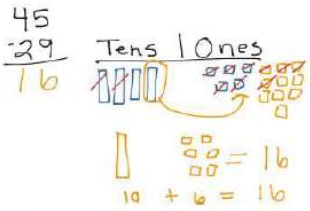
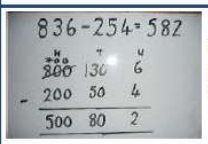
Children continue to use part-part whole models and bar models to represent their subtractions.









Objective & Strategy	Concrete	Pictorial	Abstract
Column subtraction without regrouping (friendly numbers)	 Use base 10 or Numicon to model	 Darw representations to support understanding	47 – 24 = 23 40 + 7 – 20 + 4 20 + 3 Intermediate step may be needed to lead to clear subtraction understanding. 
Column subtraction with regrouping	 Begin with base 10 or Numicon. Move to pv counters, modelling the exchange of a ten into tten ones. Use the phrase 'take and make' for exchange.	 Children may draw base ten or PV counters and cross off.	 Begin by partitioning into pv columns  Then move to formal method.

Key Vocabulary

Equal to, take, take-away, less, minus, subtract, leaves, difference between, how many more, how many fewer/ less than, most, least, count back, how many left, how much less is….., difference, count on, strategy, partition, tens (T) ones (O) **take and make, exchange, digit, value, hundreds (H)**

National Curriculum requirements

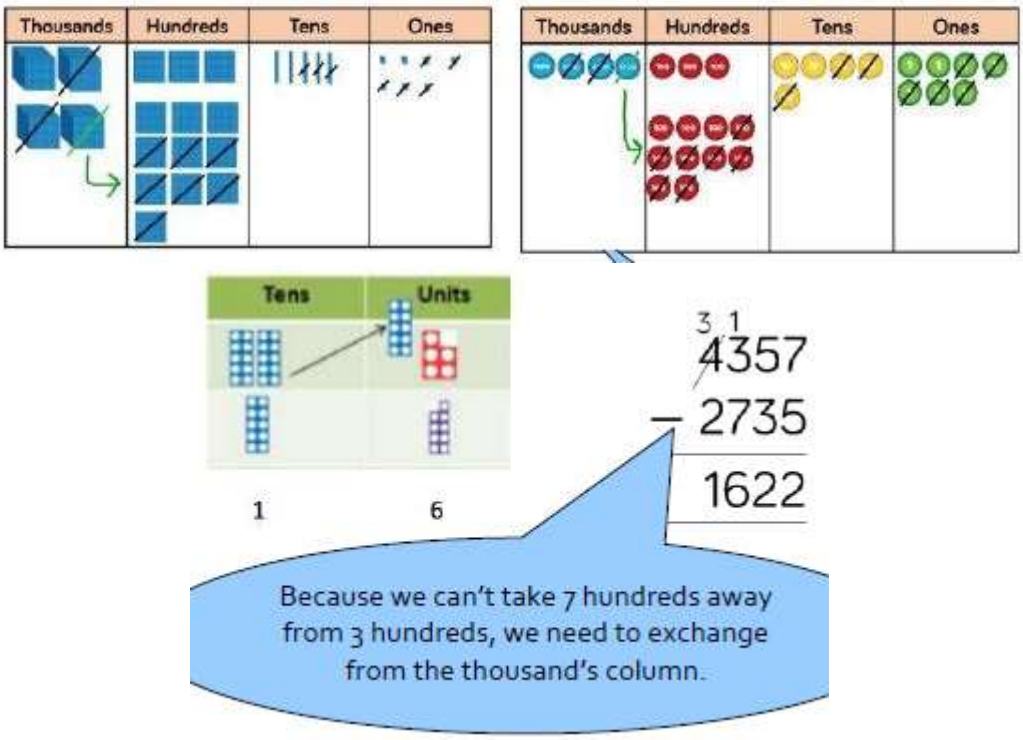
- subtract numbers mentally, including:
  - a three-digit number and ones
  - a three-digit number and tens
  - a three-digit and hundreds

Inspires MAT

- subtract numbers with up to three digits, using formal written methods of column 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 subtraction

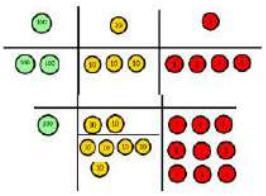
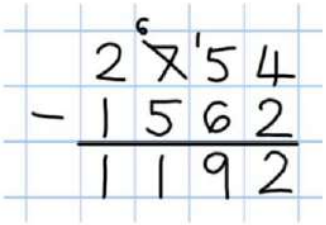
Year 4

Subtract using formal column subtraction, using mathematical manipulatives to build strong conceptual and fluent knowledge:



Use complementary addition to subtract amounts of money, and for subtractions where the larger number is a near multiple of 1000 or 100.

£20 - £6.37 = £13.63

Objective & Strategy	Concrete	Pictorial	Abstract
Subtracting tens and ones Year 4 subtract with up to 4 digits. *Introduce decimal subtraction through context of money*	234 - 179  Model process of exchange using Numicon, base ten and then move to PV counters.	Children to draw pv counters and show their exchange—see Y3	 Use the phrase 'take and make' for exchange

Key Vocabulary

Equal to, take, take-away, less, minus, subtract, leaves, difference between, how many more, how many fewer/less than, most, least, count back, how many left, how much less is ……, difference count on, strategy, partition, tens (T), ones (O) take and make, exchange, digit, value, hundreds (H) **inverse**

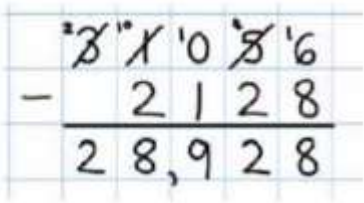
National Curriculum requirements

- subtract numbers with up to 4 digits using the formal written methods of column subtraction
- where appropriate estimate and use inverse operations to check answers to a calculation
- solve subtraction two-step problems in contexts, deciding which operations and methods to use and why

Year 5

At this stage, children subtract numbers with more than 4 digits including money, measures and decimals with different numbers of decimal places.

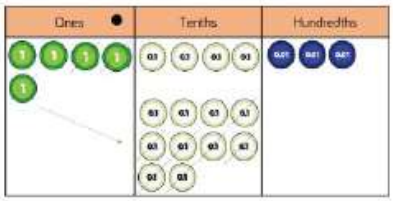
The language of place value will be used to throughout to ensure understanding.

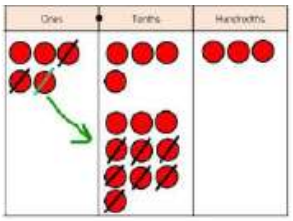


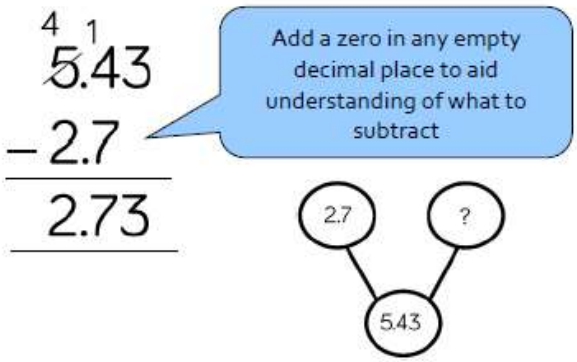
As for previous stage, counting up with an empty number line will be encouraged when the larger number is a multiple of 100, 1000 etc.

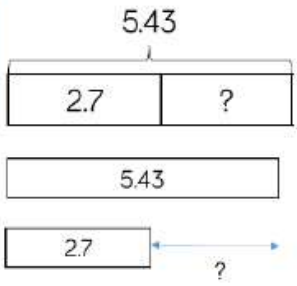
Subtract with decimal values, including mixtures of integers and decimals and aligning the decimal point.

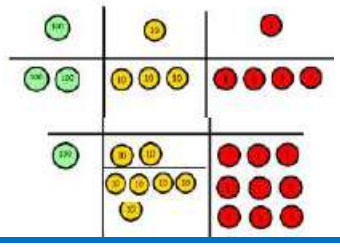
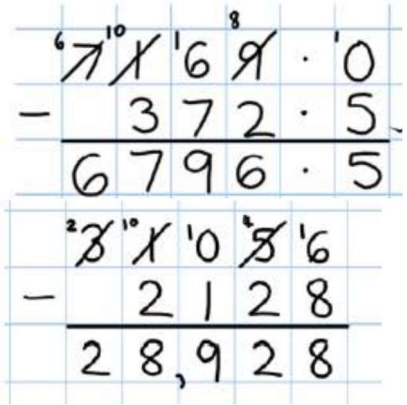
Children will continue to use mathematical manipulatives alongside other representations such as part-part whole and bar models.









Objective & Strategy	Concrete	Pictorial	Abstract
Year 5- Subtract with at least 4 digits, including money and measures. *Subtract with decimal values, including mixtures of integers and decimals and aligning the decimal*	As Year 4 Model process of exchange using Numicon, base ten and then move to PV counters 234 - 179 	Children to draw pv counters and show their exchange—see Y3	Use zeros for placeholders 

Key Vocabulary

Equal to, take, take-away, less, minus, subtract, leaves, difference between, how many more, how many fewer/less than, most, least, count back, how many left, how much less is….., difference, count on, strategy, partition, tens (T), ones (O) take and make, exchange, digit, value, hundreds (H) inverse, **tenths (t) hundredths (h) decimal point, decimal**

Inspires MAT

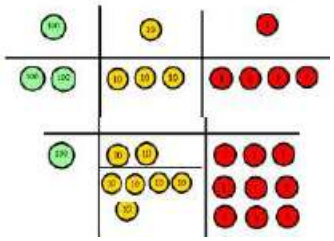
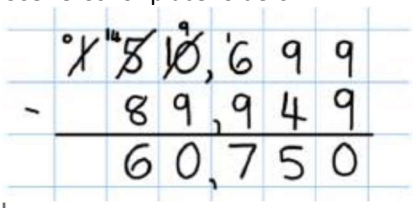
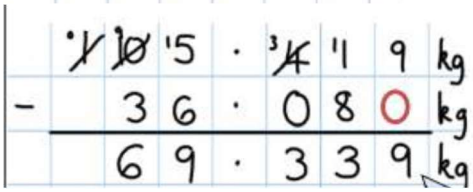
National Curriculum requirements

- subtract whole numbers with more than 4 digits, including formal written methods (column addition and subtraction
- subtract numbers mentally with increasingly large numbers
- use round to check answers to calculations and determine, in the context of a problem, levels of accuracy
- solve subtraction multi-step problems in contexts, deciding which operations and methods to use and why

Year 6

Year 6 continue to develop the formal written method for subtraction with both larger integers and decimals in an abstract formal method approach. Some children may still need to use concrete and pictorial representations using base 10, place value counters and bar models. They apply this method when working in contexts such as money and measures.

Pupils should apply their knowledge of a range of mental strategies, mental recall skills, informal and formal written methods when selecting the appropriate method to work out subtraction problems. Opportunities to discuss the appropriateness of methods need to be planned for.

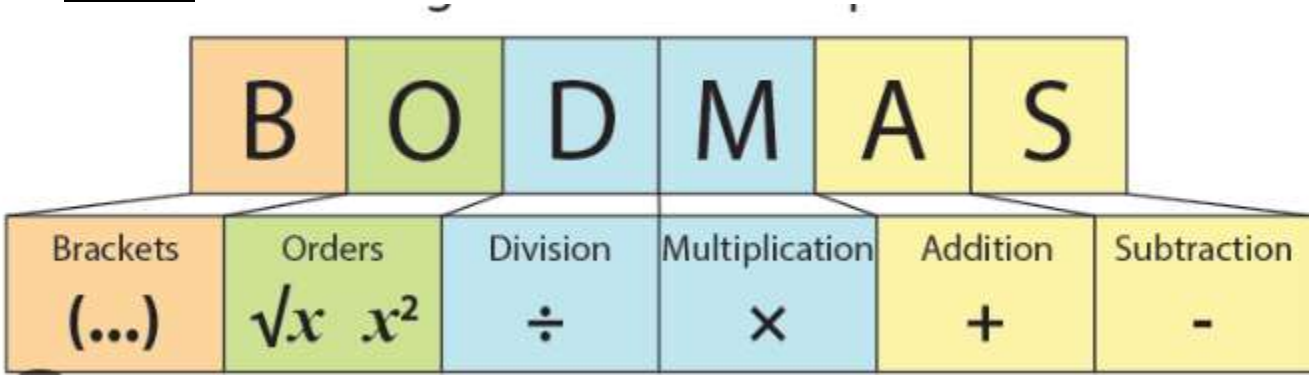
Objective & Strategy	Concrete	Pictorial	Abstract
Year 6—Subtract with increasingly large and more complex numbers and decimal values.	As Year 4 Model process of exchange using Numicon, base ten and then move to PV counters 234 - 179 	Children to draw pv counters and show their exchange—see Y3	Use zeros for placeholders   subtract in context of money, measures, including decimals with different numbers of decimal places.

Key Vocabulary

Minuend, subtrahend, equal to, take, take-away, less, minus, subtract, leaves, difference between, how many more, how many fewer/less than, most, least, count back, how many left, how much less is…., difference, count on, strategy, partition, tens (T) ones (O), take and make, exchange, digit, value, hundreds (H), inverse, tenths (t) hundredths (h) thousandths (th) decimal point, decimal

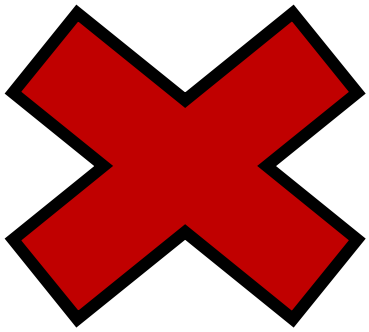
National Curriculum Requirements

- use their knowledge of the order of operations to carry out calculations involving the four operations **BODMAS**



- solve subtraction multi-step problems in contexts, deciding which operations and methods to use and why
- use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.

Multiplication

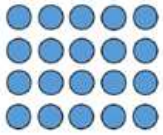


Inspires MAT

Pre-Key Stage 2

Starting from zero, make equal jumps on a number line to work out multiplication facts and write multiplication sentences. Children can skip count with the 2,3, 5 and 10s.

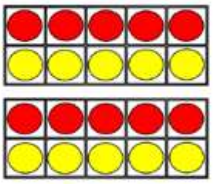
Use arrays, Numicon and visual representations to help with calculations and to teach children to understand the commutative law of multiplication.

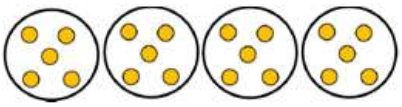


$5+5+5+5=20$

$4\times5=20$

$5\times4=20$





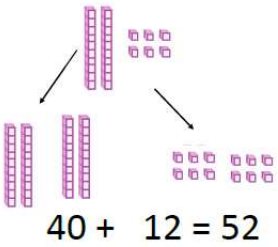
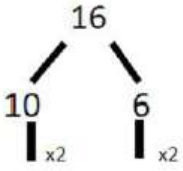
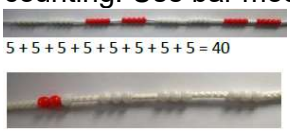
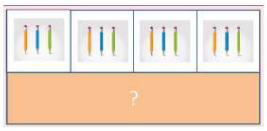
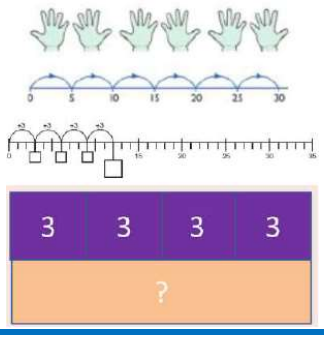
Use repeated addition on an empty number line: 6 x 5 = 30

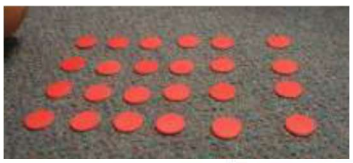
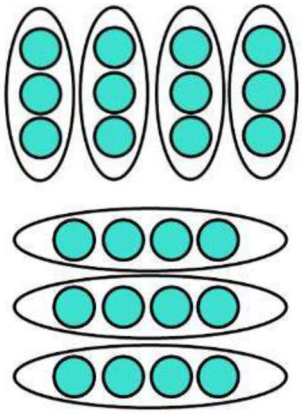
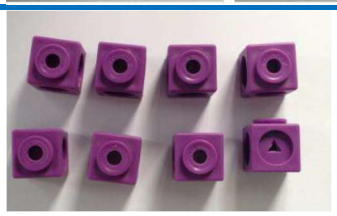
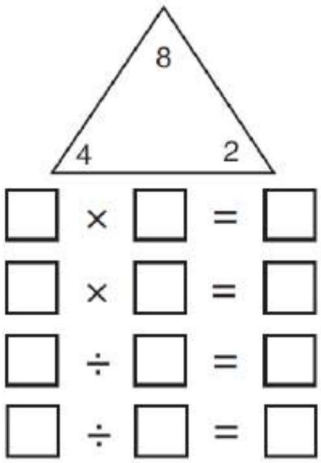
Learn doubles to double 20

Begin to double multiples of 5 to 100

Begin to double two-digit numbers less than 50 with 1s digits of 1, 2, 3 4 or 5

22 x 2 =

Objective & Strategy	Concrete	Pictorial	Abstract
Doubling	Model doubling using dienes and PV counters.  40 + 12 = 52	Draw pictures and representations to show how to double numbers	Partition a number and then double each part before recombining it back together.  16 10 x2 6 x2 20 + 12 = 32
Counting in multiples of 2, 3, 4, 5, 10 from 0 (repeated addition)	Count the groups as children are skip counting, children may use their fingers as they are skip counting. Use bar models.  5+5+5+5+5+5+5+5=40 	Number lines, counting sticks and bar models should be used to show representation of counting in multiples.  3 3 3 3 ?	Count in multiples of a number aloud. Write sequences with multiples of numbers. 0, 2, 4, 6, 8, 10 0, 3, 6, 9, 12, 15 0, 5, 10, 15, 20, 25 , 30 $4\times3=\square$

Multiplication is commutative	Create arrays using counters and cubes and Numicon.    Pupils should understand that an array can represent different equations and that, as multiplication is commutative, the order of the multiplication does not affect the answer.  	Use representations of arrays to show different calculations and explore commutativity. 	$12 = 3 \times 4$ $12 = 4 \times 3$ Use an array to write multiplication sentences and reinforce repeated addition.  5 + 5 + 5 = 15 3 + 3 + 3 + 3 + 3 = 15 5 x 3 = 15 3 x 5 = 15
Using the inverse This should be taught alongside division, so pupils learn how they work alongside each other.			2 x 4 = 8 4 x 2 = 8 8 ÷ 2 = 4 8 ÷ 4 = 2 8 = 2 x 4 8 = 4 x 2 2 = 8 ÷ 4 4 = 8÷ 2 Show all 8 related fact family sentences.

Key Vocabulary

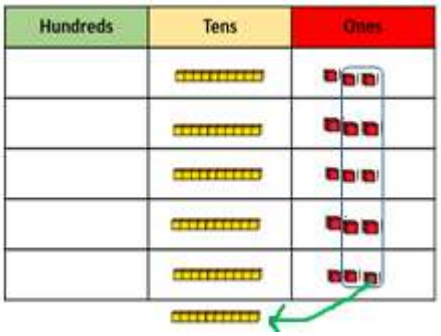
groups of, lots of, times, **array, altogether**, multiply, **count, multiplied by, repeated addition, column, row, sets of, equal groups, times as big as, once, twice, three times...**

National Curriculum requirements

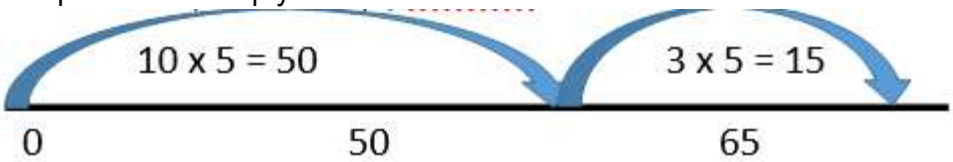
- Count in steps of 2, 3 and 5 from zero and in 10s from any number
- Know the 2X, 5X and 10X tables and begin to say how many 10s are in 40 or how many 5s are in 30; recognise odd and even answers
- Write and calculate number statements using x and = signs
- Show that multiplication can be done in any order
- Solve a range of problems involving multiplication, using concrete objects, arrays, repeated addition, Numicon, mental methods and multiplication facts.

Year 3

Children continue to use practical manipulatives to show multiplication as groups of using Dienes, Numicon and place value counters. Partitioning method is used for multiplication of a teen number by a one-digit number:



13 x 5 = 65 (Partition 13 into 10 + 3)
10 x 5 = 50
3 x 5 = 15
50 + 15 = 65
This can also be complete on an empty numberline:

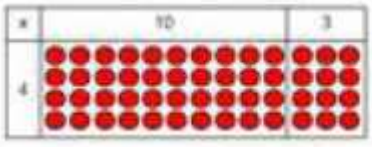
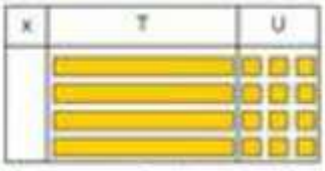
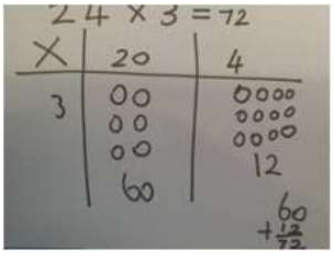
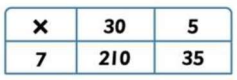


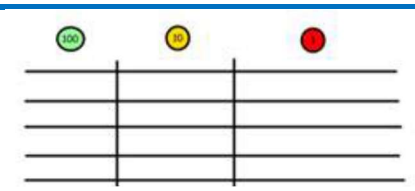
This will lead into expanded short multiplication:

14	
x8	
32	(8 x 4)
80	(8 x 10)
112	

14 x 8 = 112

Children continue to use arrays where appropriate

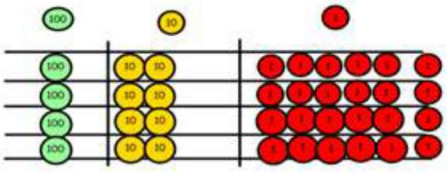
Objective & Strategy	Concrete	Pictorial	Abstract
Grid method	Show the links with arrays to first introduce the grid method.  4 rows of 10 4 rows of 3 Move onto base ten to move towards a more compact method.  4 rows of 13 Move on to place value counters to show how we are finding groups of a number. We are multiplying by 4 so we need 4 rows	Children can represent their work with place value counters in a way that they understand. They can draw the counters using colours to show different amounts or just use the circles in the different columns to show their thinking as shown below.  Bar model are used to explore missing numbers	Start with multiplying by one digit numbers and showing the clear addition alongside the grid.  210 + 35 = 245 Moving forward, multiply by a 2 digit number showing the different rows within the grid method.



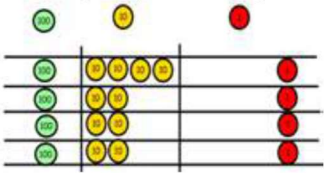
Calculations

4 x 126

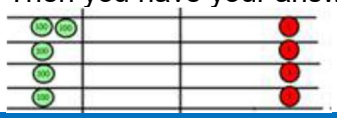
Fill each row with 126

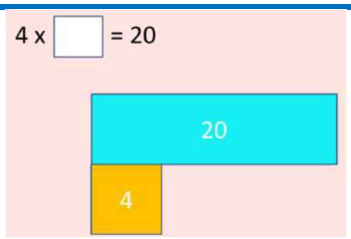


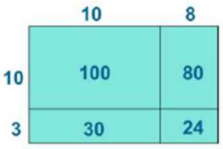
Add up each column, starting with the ones
making any exchanges needed



Then you have your answer.







Key Vocabulary

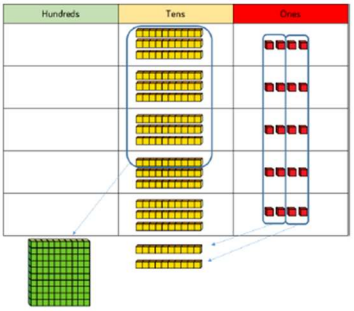
groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, sets of, equal groups, times as big as, once, twice, three times…, **partition, multiple, product, tens, units, value**

National Curriculum requirements

- Understand that multiplication is commutative, e.g. 4 x 8 is the same as 8 x 4.
- Know the 2x, 3x, 4x, 5x, 8x, 10x. All tables need to be learned to 12th multiple.
- Multiply any 2-digit number by 10 or a single-digit number by 100;
- Understand the effect of multiplying whole numbers by 10 and 100.
- Multiply a 1 digit number by a 2 digit number starting to use the expanded written method.
- Solve multiplication problems involving missing numbers

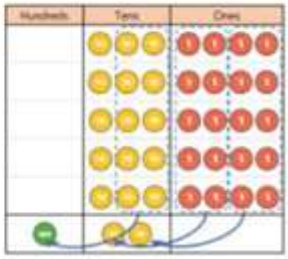
Year 4

Children continue to explore and refine the method of expanded short multiplication, moving into short multiplication methods. Children will continue to use mathematical manipulatives to further strengthen conceptual understanding.



34 x 5 = 170

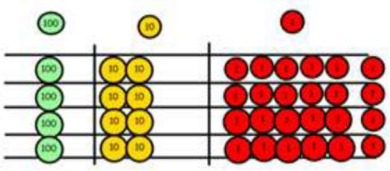
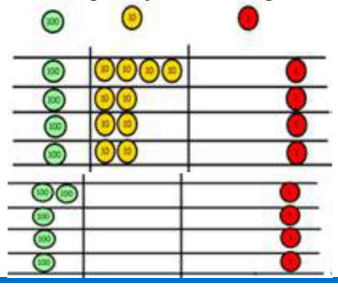
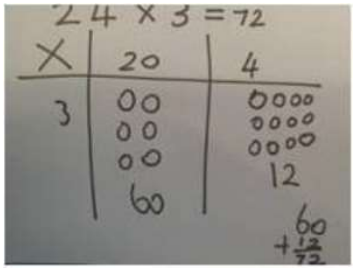
	H	T	O	
		3	4	
×			5	
		2	0	(5 × 4)
+	1	5	0	(5 × 30)
	1	7	0	



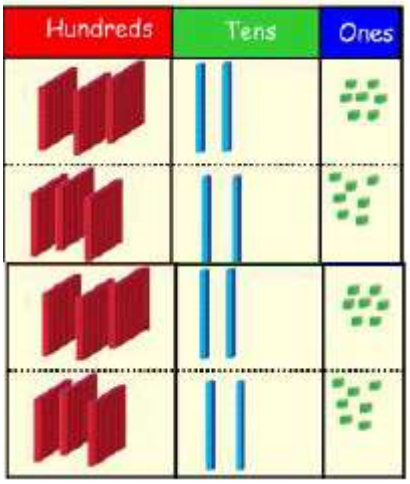
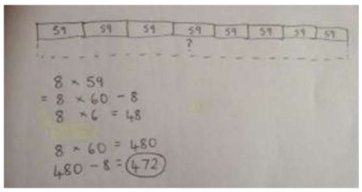
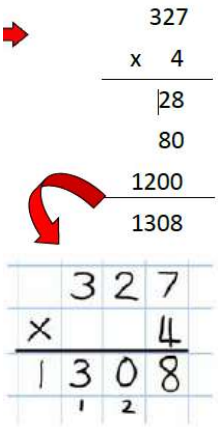
Children will refine the recording of the expanded short multiplication where appropriate and lead on to short multiplication (formal method) of a three–digit number multiplied by a one- digit number when they are ready:

	H	T	O	
		3	4	
×			5	
	1	7	0	
	1	2		

Use the language of place value to develop understanding. Ensure that the digit 'carried over' is written under the line in the correct column.

Objective & Strategy	Concrete	Pictorial	Abstract
Grid method recap from year 3 for 2 digits x 1 digit Move to multiplying 3 digit numbers by 1 digit. (year 4 expectation)	Use place value counters to show how we are finding groups of a number. We are multiplying by 4 so we need 4 rows Fill each row with 126  Calculations 4 x 126 Add up each column, starting with the ones making any exchanges needed 	Children can represent their work with place value counters in a way that they understand. They can draw the counters using colours to show different amounts or just use the circles in the different columns to show their thinking as shown below. 	Start with multiplying by one digit numbers and showing the clear addition alongside the grid. × | 30 | 5 7 | 210 | 35 210 + 35 = 245

Inspires MAT

Column multiplication	Children can continue to be supported by place value counters at the stage of multiplication. This initially done where there is no regrouping. 321 x 2 = 642  It is important at this stage that they always Multiply the ones first.	<table><tr><td>x</td><td>300</td><td>20</td><td>7</td></tr><tr><td>4</td><td>1200</td><td>80</td><td>28</td></tr></table> The grid method my be used to show how this relates to a formal written method.  Bar modelling and number lines can support learners when solving problems with multiplication alongside the formal written methods.	

Key Vocabulary

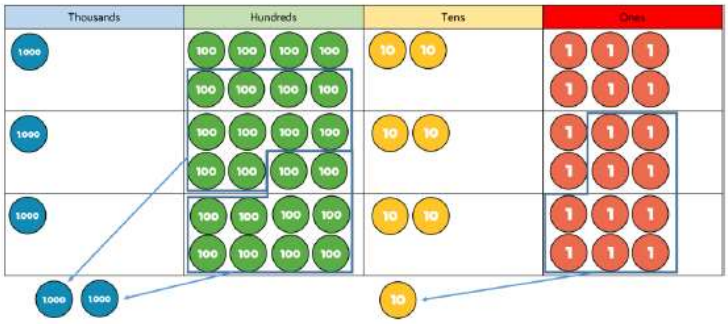
groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, sets of, equal groups, times as big as, once, twice, three times…, partition, multiple, product, tens, units, value, **inverse**

National Curriculum requirements

• Multiply 1 and 2 digit numbers by 10, 100 and 1000; to understand place value in decimal numbers with one place.
• Know and recite all the times tables up to 12th multiple; include multiplying by 0 (e.g. 5 x 0 = 0, 7 x 0 = 0) or by 1 (e.g. 5 x 1 = 5, ½ x 1 = ½).
• Multiply 1- digit numbers by 2-digit or friendly 3-digit numbers using expanded written method and begin to use the formal written method.
• Find doubles to double 100 and beyond, using partitioning
• Begin to double amounts of money
• Use doubling as strategy for multiplying by 2, 4, 8
• Count in multiples of 6, 7, 9, 25 and 1000

Year 5

In year 5, children will move towards more complex numbers. Initially, they will refine the method from year 4 by multiplying 4 digit numbers by a single digit, then move on to multiplying by 2 – digit numbers.



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

Once again, the language of place value is revised to ensure understanding. The digit that is 'carried over' is written under the line in the correct column.

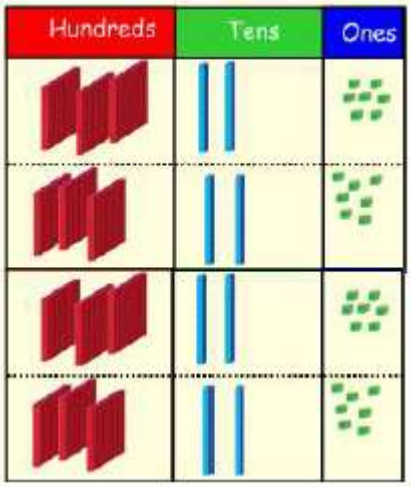
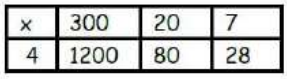
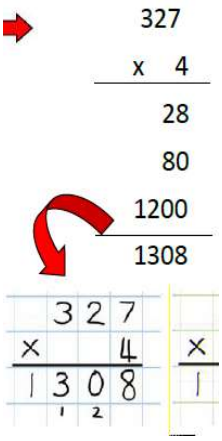
HTH	TTH	TH	H	T	0
		7	2	3	0
	X			2	1
		7	2	3	0
1	4	4	6	0	0
1	5	1	8	3	0

7230 x 1 on the 1st row

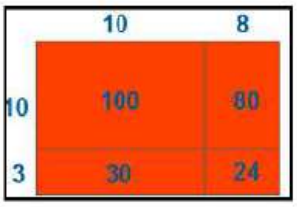
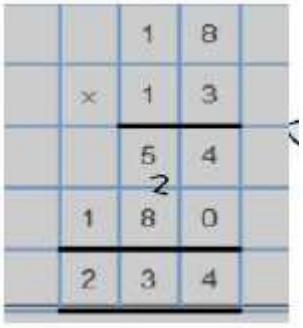
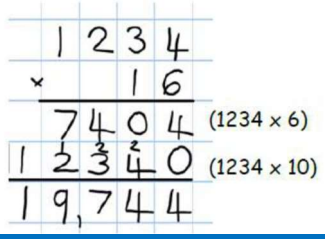
7230 x 20 on the 2nd row.

Show multiplying by 10 by

putting zero in ones column first.

Objective & Strategy	Concrete	Pictorial	Abstract
Column Multiplication for 3 and 4 digits x 1 digit.	 It is important at this stage that they always multiply the ones first. Children can continue to be supported by place value counters at the stage of multiplication. This initially done where there is no regrouping. 321 x 2 = 642		

Inspires MAT

Column multiplication	Manipulatives may still be used with the corresponding long multiplication modelled alongside.	Continue to use bar modelling to support problem solving 	 18 x 3 on the first row (8 x 3 =24, carrying the 2 for 20, then 1 x 3) 18 x 10 on the 2nd row. Show multiplying by 10 by Putting zero in units first 

Key Vocabulary

groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, sets of, equal groups, times as big as, once, twice, three times…, partition, multiple, product, tens, units, value, inverse, **square, factor, integer, decimal, short/long multiplication, 'carry'**

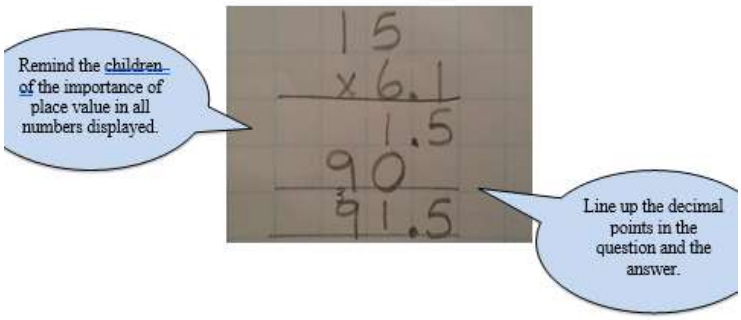
National Curriculum requirements

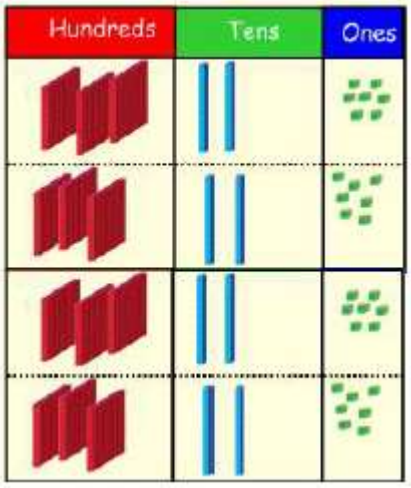
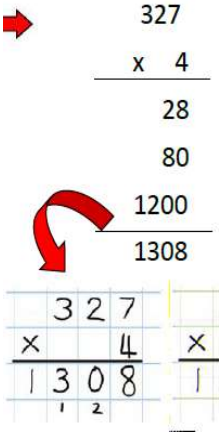
- Know and recite all times tables including division facts.
- Multiply 2- and 3-digit numbers by numbers ≤12 ; multiply
- 2-digit by 2-digit numbers.
- Identify multiples and factors, using knowledge of multiplication tables up to 12 x 12
- Scale up or down by a factor of 2, 5 or 10
- Multiply integers and decimals by 10, 100, 1000
- Recognise and use squared, cubes and their notations

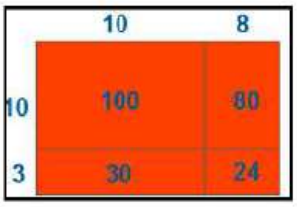
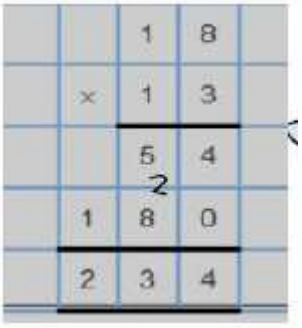
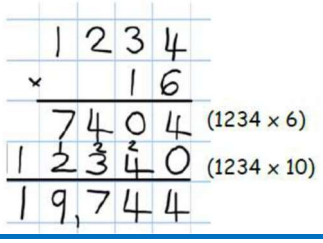
Year 6

In year 6, children will use short and long multiplication, as in year 5, and multiply decimals with up to 2 decimal places by a single digit.

TTh	Th	H	T	O
	2	7	3	9
×			2	8
2 (2)	1 (5)	9 (3)	1 (7)	2
5 (1)	4	7 (1)	8	0
7	6	6	9	2
		(1)		



Objective & Strategy	Concrete	Pictorial	Abstract
Column Multiplication for 3 and 4 digits x 1 digit. **(As in Year 5)**	 It is important at this stage that they always multiply the ones first. Children can continue to be supported by place value counters at the stage of multiplication. This initially done where there is no regrouping. 321 x 2 = 642		

Column multiplication **(As in Year 5)**	Manipulatives may still be used with the corresponding long multiplication modelled alongside.	Continue to use bar modelling to support problem solving 	 18 x 3 on the first row (8 x 3 =24, carrying the 2 for 20, then 1 x 3) 18 x 10 on the 2nd row. Show multiplying by 10 by Putting zero in units first 

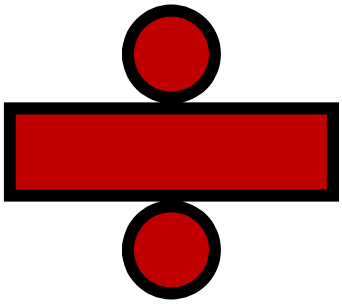
Key Vocabulary

groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, sets of, equal groups, times as big as, once, twice, three times…, partition, multiple, product, tens, units, value, inverse, square, factor, integer, decimal, short/long multiplication, 'carry', **tenths, hundredths, decimal**

National Curriculum requirements

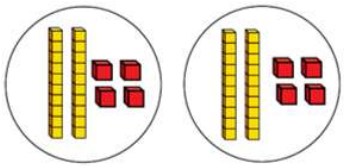
- Recall multiplication facts up to 12 x 12
- Use short multiplication to multiply a 1-digit number by a number with up to 4 digits
- Use long multiplication to multiply a 2-digit by a number with up to 4 digits
- Use short multiplication to multiply a 1-digit number by a number with one or two decimal places, including amounts of money.
- Multiply fractions and mixed numbers by whole numbers.
- Multiply fractions by proper fractions.
- Use percentages for comparison and calculate simple percentages.
- Estimate answers using rounding and approximation

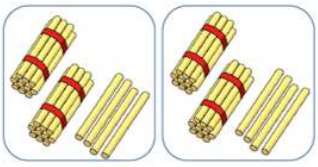
Division

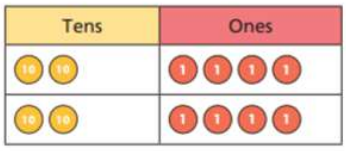


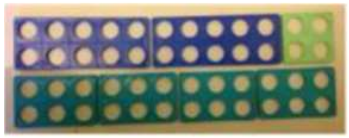
Pre-Key Stage 2

Using objects, Numicon, arrays, pictorial representations and grouping on a number line, children will develop their understanding of division further.

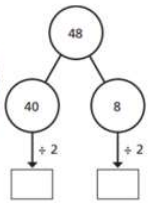








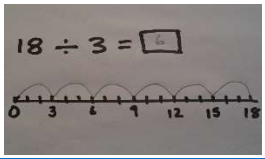
As children become more confident, they partition the number using a part-part whole model to divide.

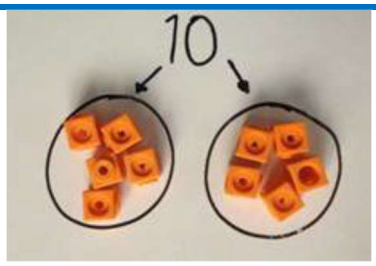
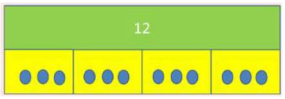
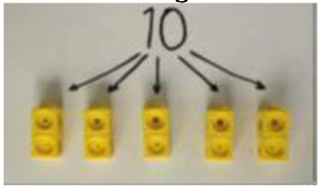
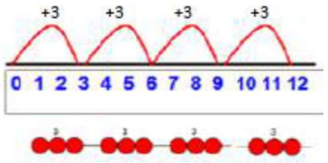


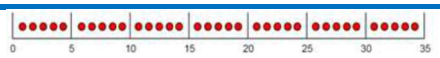
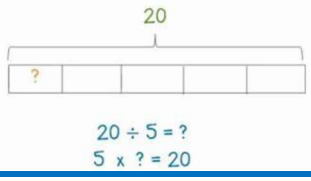
When children are ready, use an empty number line to count forwards:

18 ÷ 3 = 6

In this method, children group from zero in equal jumps to find out, 'how many groups of _ make _.'



Objective & Strategy	Concrete	Pictorial	Abstract
Division as sharing	 I have 10 cubes, can you share them equally in 2 groups?	Children use pictures or shapes to share quantities.  8 shared between 2 is 4 Children use bar modelling to show and support understanding.  12 ÷ 4 = 3	12 ÷ 3 = 4
Division as grouping	Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding. 	Use number lines for grouping  12 ÷ 3 = 4	28 ÷ 7 = 4 Divide 28 into 7 groups. How many are in each group?

		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. 	

Key Vocabulary

share, share equally, one each, two each..., group, equal groups of, lots of, array, **divide, divided by, divided into, division, grouping, number line, left, left over**

National Curriculum requirements

•Count in steps of 2, 3, and 5 from 0

•Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers.

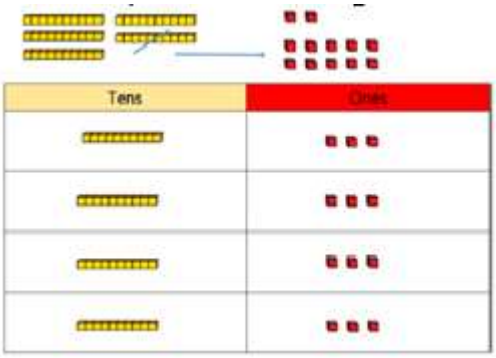
•Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the x, ÷ and = signs.

•Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot.

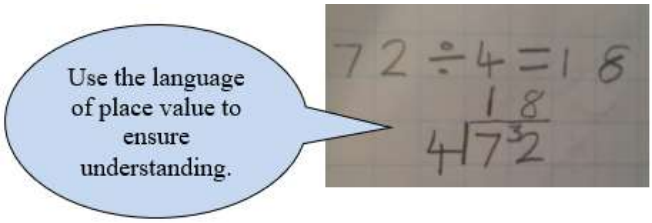
•Solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts.

Year 3

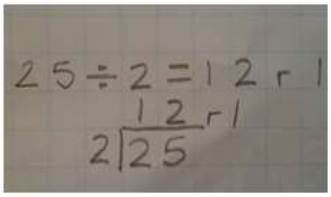
In year 3 children will continue to use practical resources, pictures, diagrams, number lines, arrays and the ÷ sign to record division calculations.



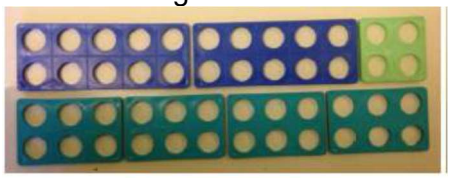
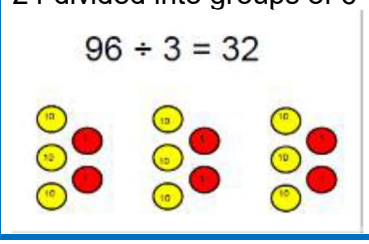
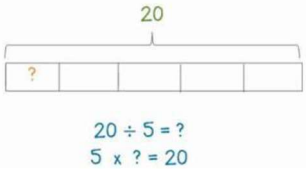
Children will use the formal layout using multiplication/division facts that they know through the learning of their tables:

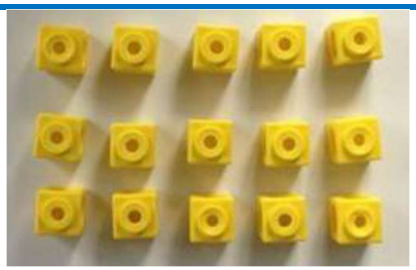
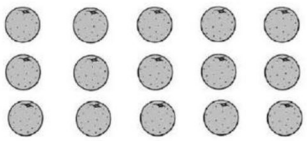
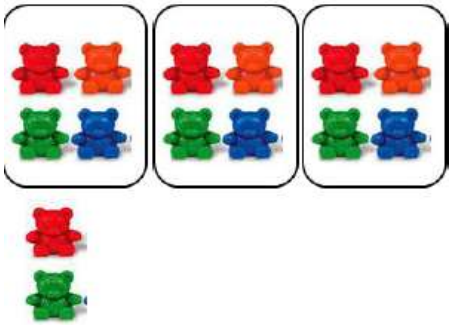
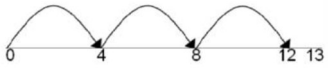
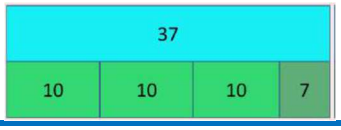


They will continue to use the formal written layout (above) then progress on to the formal written method of short division.



Although remainders are not specifically referred to until year 5, it may be appropriate to introduce them when dealing with practical contexts.

Objective & Strategy	Concrete	Pictorial	Abstract
Division as grouping	Use cubes, counters, objects or place value counters to aid understanding.  24 divided into groups of 6 = 4 	Continue to use bar modelling to aid solving division problems. 	How many groups of 6 in 24? 24 ÷ 6 = 4

Division with arrays	 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	Draw an array and use lines to split the array into groups to make multiplication and division sentences 	Find the inverse of multiplication and division sentences by creating eight linking number sentences. 7 x 4 = 28 4 x 7 = 28 28 ÷ 7 = 4 28 ÷ 4 = 7 28 = 7 x 4 28 = 4 x 7 4 = 28 ÷ 7 7 = 28 ÷ 4
Division with remainders.	14 ÷ 3 = Divide objects between groups and see how much is left over 	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.  Use bar models to show division with remainders. 	Complete written divisions and show the remainder using r. 

Key Vocabulary

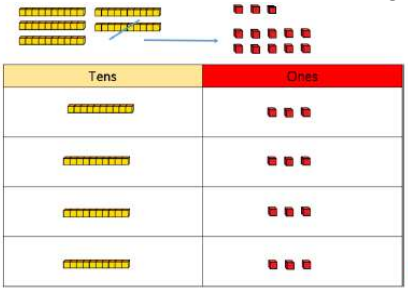
share, share equally, one each, two each..., group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, **inverse, short division, 'carry', remainder, multiple**

National Curriculum requirements

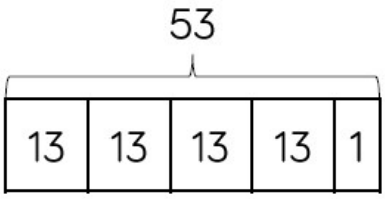
•Recall and use division facts for the 2, 3, 4, 5, 8 and 10 multiplication tables
•Write and calculate mathematical statements for division using the multiplication tables that they know, including for two-digit numbers divided by one digit
•Solve problems, in contexts, and including missing number problems, involving division.
•Pupils develop efficient mental methods, for example, using division facts (e.g. using 3 × 2 = 6, 6 ÷ 3 = 2 and 2 = 6 ÷ 3) to derive related facts (30 × 2 = 60, so 60 ÷ 3 = 20 and 20 = 60 ÷ 3).
•Pupils develop reliable written methods for division, starting with calculations of 2-digit numbers by 1-digit numbers using an ENL.
•Halve even numbers up to 50 and multiples of ten to 100
•Perform divisions within the tables including those with remainders, e.g. 38 ÷ 5.

Year 4

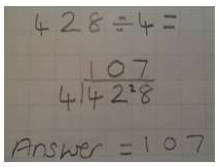
Children will practise and refine the formal method for short division where appropriate and lead on to more complex examples involving three digit numbers and remainders. Children will still need to use physical manipulatives to understand the concept of exchange.



or

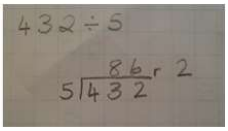


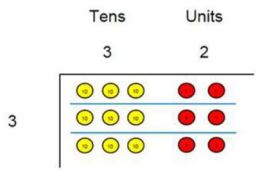
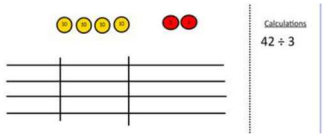
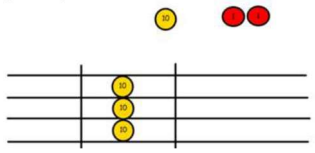
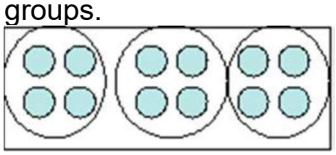
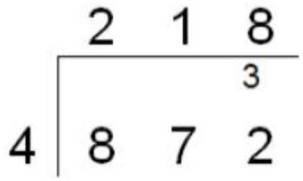
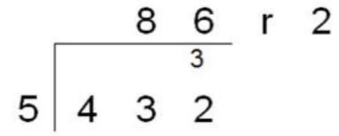
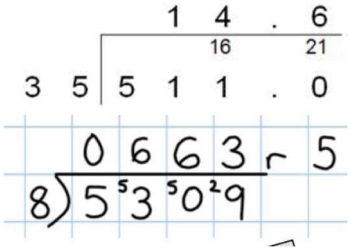
NB: Children will be reminded of the importance of accurate place value and keeping digits in the correct squares.

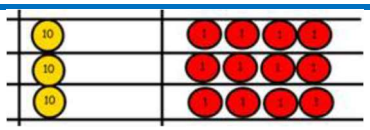


In examples such as this, the importance of the zero will be a focus to ensure understanding.

Move on to short division with remainders if children are confident in above methods.



Objective & Strategy	Concrete	Pictorial	Abstract
Divide at least 3 digit numbers by 1 digit. Short Division	96 ÷ 3  Use place value counters to divide using the bus stop method alongside 42 ÷ 3=  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.	Students can continue to use drawn diagrams with dots or circles to help them divide numbers into equal groups.  Encourage them to move towards counting in multiples to divide more efficiently.	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. 

	 We look how much in 1 group so the answer is 14.		

Key Vocabulary

share, share equally, one each, two each..., group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, inverse, short division, 'carry', **remainder,** multiple, **divisible by, factor**

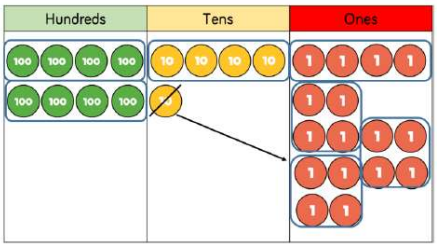
National Curriculum requirements

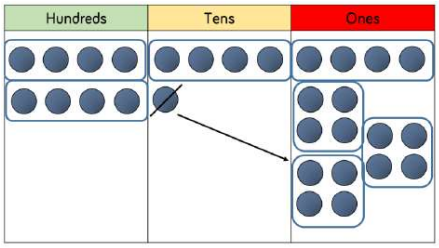
•Use a written method to divide a 2-digit or a 3-digit number by a single-digit number.
•Give remainders as whole numbers.
•Recall multiplication and division facts for all numbers up to 12 x 12.
•Use place value, known and derived facts to multiply and divide mentally, including: multiplying and dividing by 10 and 100 and 1.
•Pupils practise to become fluent in the formal written method of short division with exact answers when dividing by a one-digit number
•Pupils practise mental methods and extend this to three-digit numbers to derive facts, for example 200 × 3 = 600 so 600 ÷ 3 = 200
•Pupils solve two-step problems in contexts, choosing the appropriate operation, working with increasingly harder numbers. This should include correspondence questions such as three cakes shared equally between 10 children.

Year 5

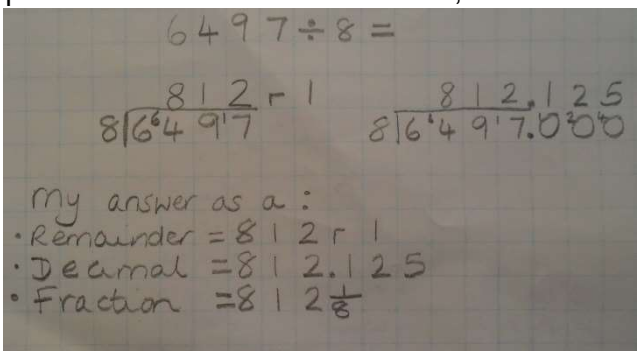
In year 5, children will be able to use the short division method to divide numbers up to 4 digits by a one-digit number. For those who are more confident, they could progress to dividing by two-digit numbers.

		2	1	4
	4	8	5	$^{1}6$





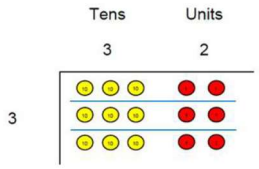
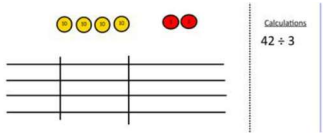
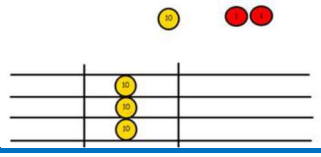
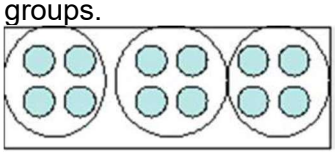
Children are taught how to express their answers as remainders, decimals or fractions.



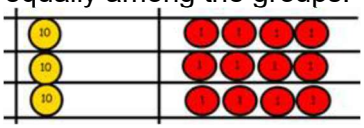
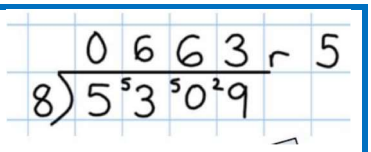
In addition, children should be able to interpret remainders appropriately for real life contexts, including using money and measures.

Rounding up or down?

Each CD rack holds 12 CDs. If Jenny has 134 CDs, how many racks will she need to hold all her CDs?

Objective & Strategy	Concrete	Pictorial	Abstract
Divide at least 3 digit numbers by 1 digit. Short Division **(As in Year 4)**	96 ÷ 3  Use place value counters to divide using the bus stop method alongside 42 ÷ 3=  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. 	Students can continue to use drawn diagrams with dots or circles to help them divide numbers into equal groups.  Encourage them to move towards counting in multiples to divide more efficiently.	Begin with divisions that divide equally with no remainder. $\begin{array}{r} 218 \\ 4\overline{)8\,7\,2} \\ \quad 3 \end{array}$ Move onto divisions with a remainder. $\begin{array}{r} 86\ r\ 2 \\ 5\overline{)4\,3\,2} \\ \quad 3 \end{array}$ Finally move into decimal places to divide the total accurately. $\begin{array}{r} 14.6 \\ 35\overline{)511.0} \\ \quad 16\quad 21 \end{array}$

Inspires MAT

	We exchange this ten for ten ones and then share the ones equally among the groups.  We look how much in 1 group so the answer is 14.		

Key Vocabulary

share, share equally, one each, two each..., group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, inverse, short division, 'carry', remainder, multiple, divisible by**, factor quotient, prime number, prime factors, composite number (non-prime**)

National Curriculum requirements

•Recall multiplication and division facts for all numbers up to 12 x 12 (as in Y4).
•Multiply and divide numbers mentally, drawing upon known facts.
•Identify multiples and factors, including finding all factor pairs of a number, and common factors of two number.
•Solve problems involving multiplication and division where larger numbers are decomposed into their factors.
•Multiply and divide whole numbers and those involving decimals by 10, 100 and 1000.
•Use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers.
•Work out whether a number up to 100 is prime, and recall prime numbers to 19
•Divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context
•Use multiplication and division as inverses. Interpret non-integer answers to division by expressing results in different ways according to the context, including with remainders, as fractions, as decimals or by rounding (e.g. 98 ÷ 4 = 24 r 2 = 241/2 = 24.5 ≈ 25).

Year 6

Children should continue to use the short division method taught in previous years becoming more accurate and precise in their pictorial and abstract understanding and representation.

	0	4	8	9
15	7	$^{7}3$	$^{13}3$	$^{13}5$

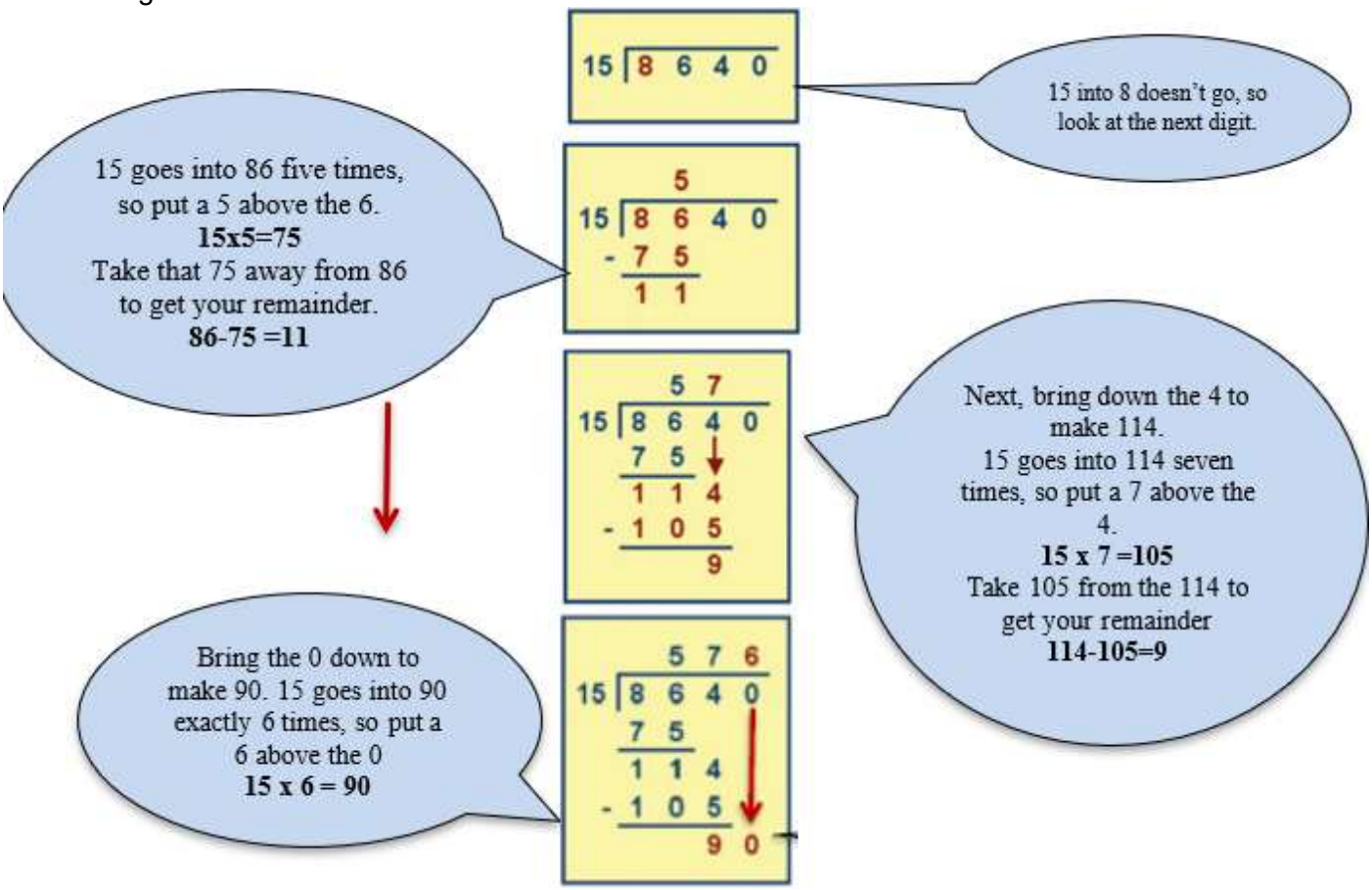
They move on to dividing by two-digit numbers using long division. As in year 5, real life contexts will be used.

Chunking method of division:

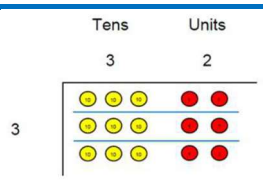
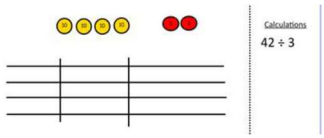
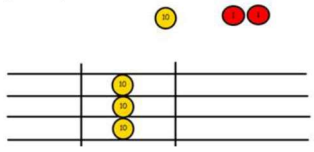
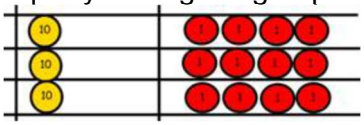
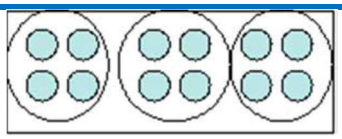
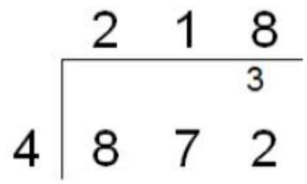
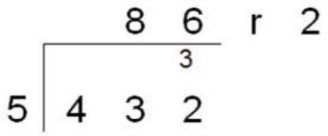
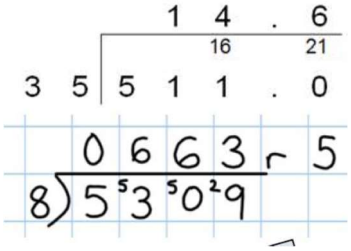
		0	3	6	
1	2	4	3	2	(×30)
	–	3	6	0	
			7	2	(×6)
	–		7	2	
				0	

$12 \times 1 = 12$
$12 \times 2 = 24$
$12 \times 3 = 36$
$12 \times 4 = 48$
$12 \times 5 = 60$
$12 \times 6 = 72$
$12 \times 7 = 84$
$12 \times 8 = 96$
$12 \times 7 = 108$
$12 \times 10 = 120$

Formal long division method: 8640 ÷15 =



Objective & Strategy	Concrete	Pictorial	Abstract
Divide at least 3 digit numbers by 1 digit. Short Division	96 ÷ 3	Students can continue to use drawn diagrams with dots or circles to help them divide numbers into equal groups.	Begin with divisions that divide equally with no

(As in Year 4)	 Use place value counters to divide using the bus stop method alongside 42 ÷ 3=  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 how much in 1 group so the answer is 14.	 Encourage them to move towards counting in multiples to divide more efficiently.	remainder.  Move onto divisions with a remainder.  Finally move into decimal places to divide the total accurately. 

Key Vocabulary

share, share equally, one each, two each..., group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, inverse, short division, 'carry', remainder, multiple, divisible by, factor quotient, prime number, prime factors, composite number (non-prime) **common factor**

National Curriculum requirements

•Recall and use multiplication and division facts for all numbers to 12 x 12 for more complex calculations
•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. Use short division where appropriate.
•Perform mental calculations, including with mixed operations and large numbers.
•Identify common factors, common multiples and prime numbers.
•Solve problems involving all 4 operations.
•Use estimation to check answers to calculations and determine accuracy, in the context of a problem.
•Use written division methods in cases where the answer has up to two decimal places.
•Solve problems which require answers to be rounded to specified degrees of accuracy.