LORD DERAMORE'S PRIMARY SCHOOL
MATHS CALCULATION PROGRESSION POLICY

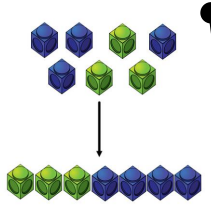
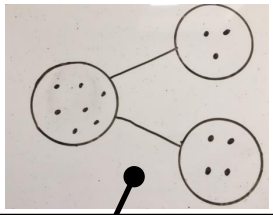
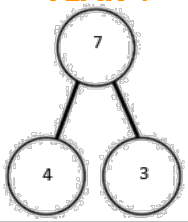
This policy has been developed using the White Rose Maths Hub Calculation Policy which sets out clear guidelines for the progression in calculation.

Adaptations of this scheme are for the benefit of staff to show the steps children have made in previous years and the steps that they are required to make this year. Each area also has a break down of objectives from the National Curriculum.

It is however a guide, and it is not to be used to the letter for every child. Each child has individual needs and they should not be moved on to the next stage unless absolutely confident in the stage they are currently working on.

The policy shows limited variations, therefore it is important that other representations are utilised when teaching to build a strong foundation across the content taught. "Variation offers a systematic way to look at mathematical exercises in terms of what is available for the learner to notice." (Marton, Runesson & Tsui, 2003)

HOW THIS POLICY IS DESIGNED

CONCRETE (Handleable materials)		PICTORIAL (Visual representations)		ABSTRACT (Number calculations)	
Combining two parts to make a whole Use other resources too e.g. eggs, shells, teddy bears, cars.	EARLY YEARS 	**Represent cubes using dots or crosses.** Could also put each part on a part whole model too.	YEAR 1 	**4 + 3 = 7** Four is a part, three is a part and the whole is seven.	YEAR 1 

Additional notes

Focus being taught

Year this is introduced

Example images

Progression from concrete, to pictorial, to abstract - sometimes across different years.

ADDITION CALCULATION PROGRESSION (PAGE 1 OF 2)

KEY LANGUAGE: add, altogether, count on, in addition, increase, more, more than, plus, sum, total, equal to, same as

CURRICULUM STATEMENTS AND PROGRESSION

EARLY YEARS
- Count reliably with numbers from 1 to 20.
- Say which number is one more than a given number.
- Use quantities and objects, they add two single-digit numbers.and count on to find the answer.

YEAR 1
- Represent and use number bonds within 20.
- Add one-digit and two-digit numbers to 20, including 0.
- Solve one step problems using concrete and pictorial representations and missing number problems.

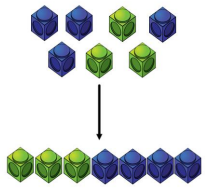
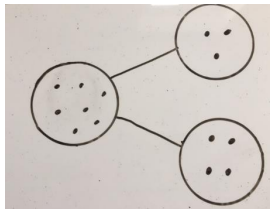
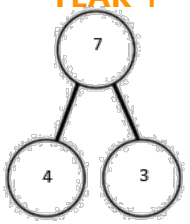
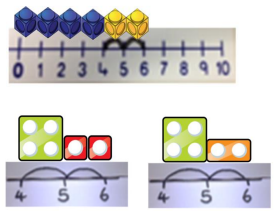
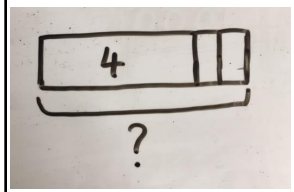
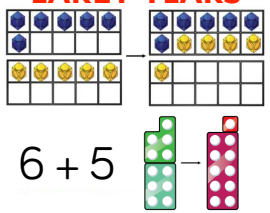
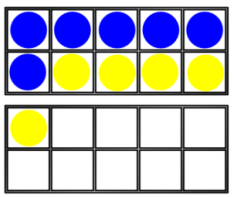
YEAR 2
- Recall and use facts to 20 fluently.
- Derive & use related facts to 100.
- Add: two-digit number and 1s; two-digit number and 10s; 2 two-digit numbers; 3 one-digit numbers.
- Show that addition of two numbers can be done in any order.

YEAR 3
- Add: three-digit number and 1s; three-digit number and 10s; three-digit number and 100s.
- Add three-digit numbers using written methods of columnar addition where appropriate.
- Add amounts of money to give change. (2 decimal places).
- Count up in tenths.

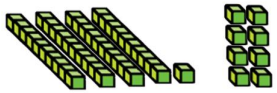
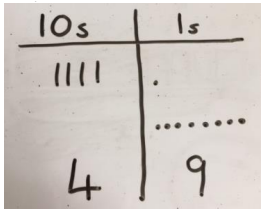
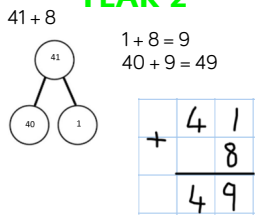
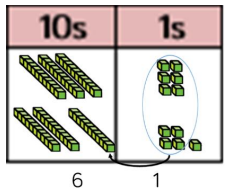
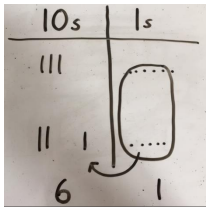
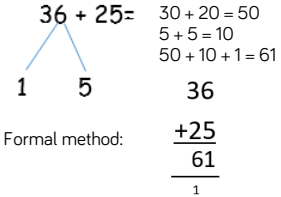
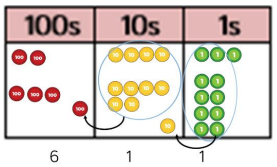
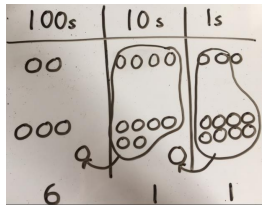
YEAR 4
- Add four-digit numbers using formal written methods of columnar addition where appropriate.
- Count up in hundredths.
- Solve subtraction two-step problems in contexts, during which operations and methods to use and why.

YEAR 5
- Add numbers with more than four digits using formal written methods of columnar addition.
- Solve addition multi-step problems in context deciding which operations and methods to use and why.

YEAR 6
- Add using simple formulae.
- Express missing number problems algebraically.
- Find pairs of numbers that satisfy an equation with two unknowns.
- Enumerate possibilities of combinations of 2 variables.

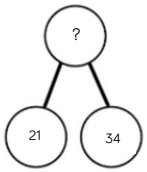
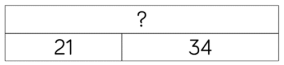
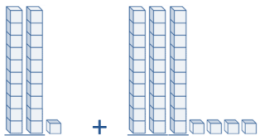
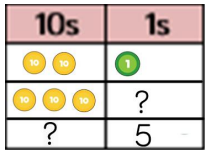
CONCRETE		PICTORIAL		ABSTRACT	
Combining two parts to make a whole Use other resources too e.g. eggs, shells, teddy bears, cars.	EARLY YEARS 	**Represent cubes using dots or crosses.** Could also put each part on a part whole model too.	YEAR 1 	**4 + 3 = 7** Four is a part, three is a part and the whole is seven.	YEAR 1 
Counting on using number lines. Using cubes or Numicon.	YEAR 1 	**Bar model** Encourages children to count on, rather than count all.	YEAR 1 	**Abstract number line** What is 2 more than 4? What is the sum of 2 & 4? What is the total of 4 and 2? 4 + 2 = ?	YEAR 1 
Regrouping to make 10. Using tens frames, counters, cubes & Numicon.	EARLY YEARS 	**Draw tens frame and counters/cubes.** Use other resources too e.g. eggs, shells, teddy bears, cars.	YEAR 1 	**Develop understanding of equality.** Including showing the calculation on both sides of the equals.	YEAR 1 6 + □ = 11 6 + 5 = 5 + □ 6 + 5 = □ + 4

ADDITION CALCULATION PROGRESSION (PAGE 2 OF 2)

CONCRETE		PICTORIAL		ABSTRACT	
TO + O using base 10. Continue to develop understanding of partitioning and place value.	YEAR 2 	**Represent TO + O base 10 in a place value chart.** E.g. lines for tens and dot/ crosses for ones.	YEAR 2 	**Introduce formal written methods.** Part whole models, column addition and written calculations.	YEAR 2 
TO + TO using base 10. Continue to develop understanding of partitioning and place value	YEAR 2 	**Represent TO + TO base 10 in a place value chart.** Circling any exchanges to show a clear understanding.	YEAR 2 	**Explore ways to make 10** Using partitioning methods and formal written methods such as column addition.	YEAR 2 GDS 
Use of place value counters to add HTO + TO, HTO + HTO etc. Chn understand when 10 ones are in the ones column, we exchange them for 1 ten etc.	YEAR 3 36 + 25 	**Represent place value counters in a place value chart.** Circling when exchanges are made.	YEAR 3 	**Column addition (formal written method)** Any exchanges shown underneath the line with links made to place value chart.	YEAR 3 243 +368 611 1 1

CONCEPTUAL VARIATIONS

Different ways to ask children to solve 21 + 34.

PART WHOLE MODEL	BAR MODEL	BASE 10	MISSING DIGIT PROBLEMS	ABSTRACT CALCULATIONS	WORD PROBLEMS	OPEN REASONING
				Calculate the sum of twenty-one and thirty-four. 21 + 34 = ☐ = 21 + 34 21 +34 ___	In Year 3, there are 21 children and in Year 4, there are 34 children. How many children in total?	21 + 34 = 55. Prove it

SUBTRACTION CALCULATION PROGRESSION (PAGE 1 OF 2)

KEY LANGUAGE: take away, less than, the difference, subtract, minus, fewer, decrease

CURRICULUM STATEMENTS AND PROGRESSION

EARLY YEARS
- Say which number is one less than a given number.
- Use quantities and objects, they subtract two single-digit numbers and count back to find the answer.

YEAR 1
- Represent and use number bonds and related subtraction facts within 20.
- Subtract one-digit and two-digit numbers to 20, including 0.
- Solve one step problems using concrete and pictorial representations and missing number problems.

YEAR 2
- Recall and use facts to 20 fluently.
- Derive & use related facts to 100.
- Subtract: two-digit number and 1s; two-digit number and 10s; 2 two-digit numbers.
- Show that subtraction of two numbers can not be done in any order.

YEAR 3
- Subtract: three-digit number and 1s; three-digit number and 10s; three-digit number and 100s.
- Subtract three-digit numbers using written methods of columnar subtraction where appropriate.
- Add amounts of money to give change. (2 decimal places).
- Count down in tenths.

YEAR 4
- Subtract four-digit numbers using formal written methods of columnar subtraction where appropriate.
- Count down in hundredths.
- Solve addition two-step problems in contexts, during which operations and methods to use and why.

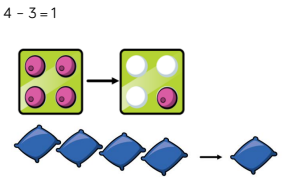
YEAR 5
- Subtract numbers with more than four digits using formal written methods of columnar subtraction.
- Solve subtraction multi-step problems in context deciding which operations and methods to use and why.

YEAR 6
- Subtract using simple formulae.
- Express missing number problems algebraically.
- Find pairs of numbers that satisfy an equation with two unknowns.
- Enumerate possibilities of combinations of 2 variables.

CONCRETE

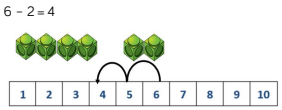
Physically taking away & removing objects.
Ten frames, Numicon, cubes, other items such as beanbags.

EARLY YEARS



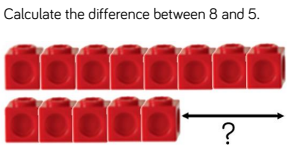
Counting back.
Using number lines or number tracks. Children start with 6 and count back 2.

EARLY YEARS



Finding the difference.
Using cubes, Numicon, Cuisenaire, rods, other objects can also be used.

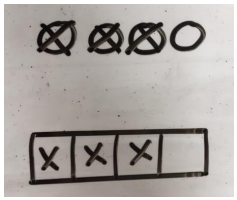
YEAR 1



PICTORIAL

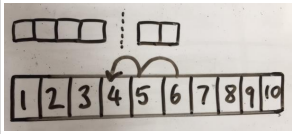
Draw concrete resources.
They then cross out the correct amount. The bar model can also be used.

EARLY YEARS



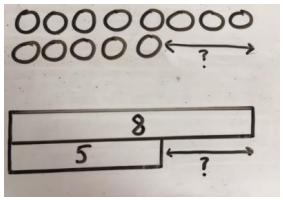
Represent concrete pictorially.
Children to represent what they see pictorially e.g. using bar models.

YEAR 1



Draw concrete objects.
Show what they have used, or use a bar model to illustrate what they need to calculate.

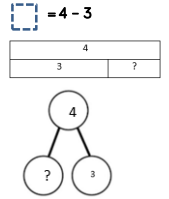
YEAR 1



ABSTRACT

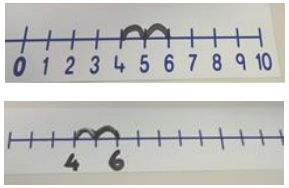
4 - 3 = 1
Three is a part, one is a part and the whole is four.

YEAR 1



Number line or number track.
Children represent calculation and show jumps. Encourage to use an empty number line.

YEAR 1

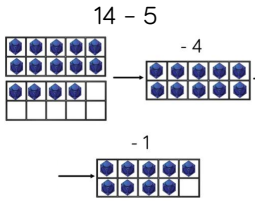
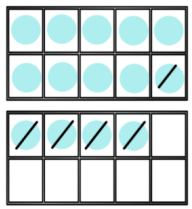
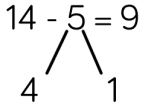
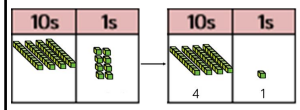
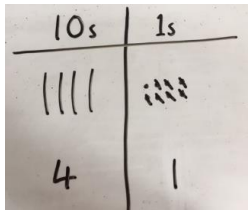
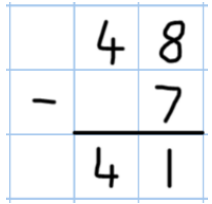
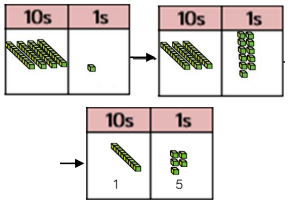
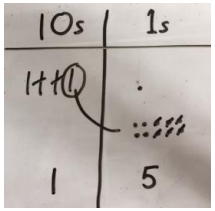
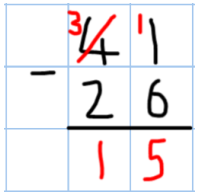
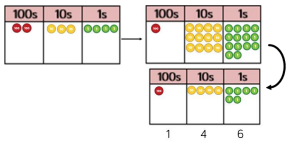
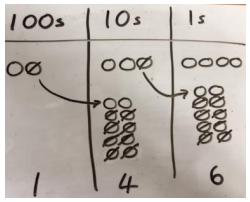


Explore why calculations have the same difference.
e.g. 9 - 6 = 8 - 5 = 7 - 4

YEAR 1

8 – 5, the difference is ☐

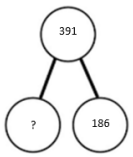
SUBTRACTION CALCULATION PROGRESSION (PAGE 2 OF 2)

CONCRETE		PICTORIAL		ABSTRACT	
Making 10 e.g. using ten frames.	**YEAR 1** 	**Present ten frame pictorially.** Also discussing what they did to make 10.	**YEAR 1** 	**Show how to make 10.** Using partitioning of the subtrahend.	**YEAR 1**  14 - 4 = 10 10 - 1 = 9
Column method without having to exchange. Using base 10 to calculate.	**YEAR 2** 	**Represent base 10.** Show calculations pictorially drawing out columns.	**YEAR 2** 	**Column subtraction (formal written method)** No exchanges to be completed at this stage.	**YEAR 2 (GDS)** 
Column method with exchanges required. Using base 10 to calculate.	**YEAR 3** 	**Represent base 10 pictorially.** Children must remember to show the exchange.	**YEAR 3** 	**Column subtraction (formal written method)** Children must understand that when they have exchanged the 10 they still have 41 because 41 = 30 + 11.	**YEAR 3** 
Column method. Using place value counters.	**YEAR 4** 	**Represent place value counters in a place value chart.** Mustn't forget to show what has been exchanged.	**YEAR 4** 	**Column subtraction (formal written method)** Children must understand what has happened when they have crossed out digits.	**YEAR 4** 

CONCEPTUAL VARIATIONS

Different ways to ask children to solve 391 - 186.

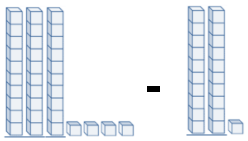
PART WHOLE



BAR MODEL

391	
186	?

BASE 10

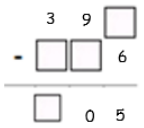


MISSING DIGIT PROBLEMS

□ = 391 − 186

ABSTRACT CALCULATIONS

391
-186
____



WORD PROBLEMS

Raj spent £391, Timmy spent £186. How much more did Raj spend?

OPEN REASONING

What is 186 less than 391?

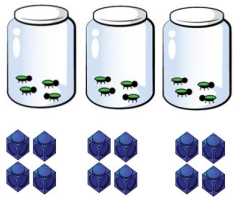
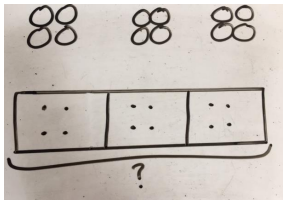
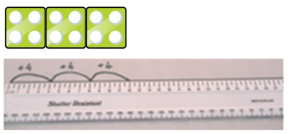
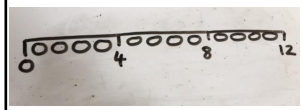
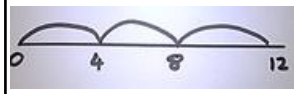
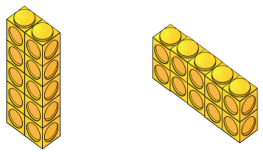
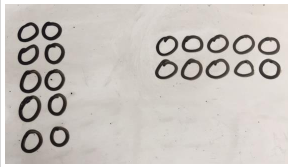
Prove it.

MULTIPLICATION CALCULATION PROGRESSION (PAGE 1 OF 2)

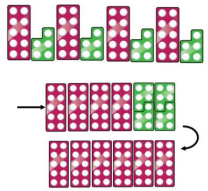
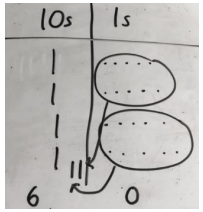
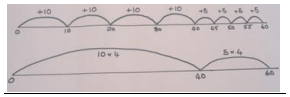
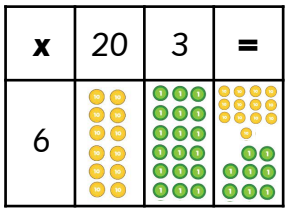
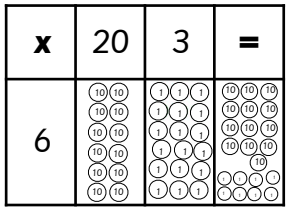
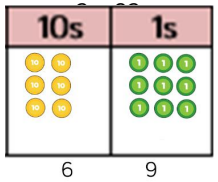
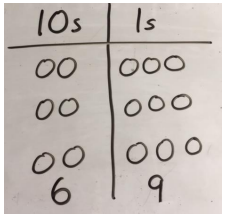
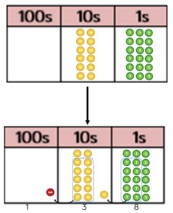
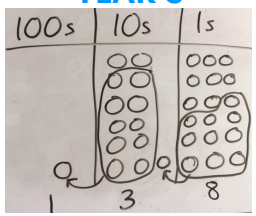
KEY LANGUAGE: double, times, multiplied by, the product of, groups of, lots of, equal groups

CURRICULUM STATEMENTS AND PROGRESSION

EARLY YEARS	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
▸ They solve problems by doubling.	▸ Solve one-step problems involving multiplication, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.	▸ Recall and use multiplication facts for 2, 5 & 10 multiplication tables, including recognising odd and even numbers. ▸ Calculate mathematical statements for multiplication within the multiplication tables and write them using the multiplication and equals signs.	▸ Recall and use multiplication facts for 3,4 and 8 multiplication tables. ▸ Write and calculate mathematical statements for multiplication using the multiplication tables that they know, including for two-digit numbers one-digit, using mental and progressing to formal written methods.	▸ Recall multiplication facts for tables to 12 x 12. ▸ Use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; multiplying together 3 numbers. ▸ Multiply two-digit and three digit numbers by a one-digit number using formal written layout.	▸ Multiply numbers up to 4-digits by a 1 or 2 digit number using formal written method including long multiplication for 2 digit numbers.	▸ Multiply multi-digit numbers up to 4 digits by a two-digit whole number using formal written method of long multiplication. ▸ Multiply 1 digit number with up to 2 decimal places by whole numbers.

CONCRETE		PICTORIAL		ABSTRACT	
Repeated groups/repeated addition 3 x 4, 4 + 4 + 4, there are 3 equal groups with 4 in each group	YEAR 1 	**Use pictures/bar models** Represent practical resources with diagrams or models.	YEAR 1 	**Written calculations** Working alongside concrete/ pictorial to solidify understanding	YEAR 1 3 x 4 = 12 4 + 4 + 4 = 12
Number lines These help to show repeated groups. Cuisenaire rods can be used too.	YEAR 1 3 x 4 	**Number line** Pictorially show representations alongside the number line.	YEAR 1 3 x 4 	**Number line with jumps** Abstract number line showing three jumps of four.	YEAR 1 
Object arrays Counters, cubes or other objects can be used to illustrate commutativity.	YEAR 1 	**Arrays represented pictorially** Children can either draw the objects or alternative representations of them.	YEAR 2 	**Arrays written as calculation** Children must be able to use an array in a range of calculations.	YEAR 2 10 = 2 × 5 5 × 2 = 10 2 + 2 + 2 + 2 + 2 = 10 10 = 5 + 5

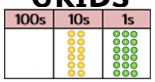
MULTIPLICATION CALCULATION PROGRESSION (PAGE 2 OF 2)

CONCRETE		PICTORIAL		ABSTRACT	
Partition to multiply Using Numicon, base 10 or Cuisenaire rods.	YEAR 3 	**Represent concrete manipulatives** Drawing out the me	YEAR 3 	**Show steps taken** Encourage children to show these steps and a number line can also be used.	YEAR 3 4 x 15 10 5 10 x 4 = 40 5 x 4 = 20 40 + 20 = 60 
Grid method Using place value counters, straws, or base 10 in grid method format	YEAR 3 	**Grid method** Visually represent place value counters with exchanges shown.	YEAR 3 	**Grid method** Children must be confident with partitioning and can use materials alongside to aid understanding.	YEAR 3 x | 20 | 3 | = 6 | 120 | 18 | 138
Formal column method Using place value counters or base 10.	YEAR 3 	**Draw counters** Show the calculations using pictorial representations.	YEAR 3 	**Record method** Children to record the steps are taking to show understanding.	YEAR 3 3 x 23 20 3 3 x 20 = 60 3 x 3 = 9 60 + 9 = 69 23 x 3 69
Formal column method Using place value counters	YEAR 3  6 x 23	**Represent counters/base 10 pictorially** Show exchanges visually also (as seen in image)	YEAR 3 	**Formal written method** A clear focus and connection must be made between each row and what they numbers represent.	YEAR 3 6 x 23 = 23 x 6 138 1 1 YEAR 5 1 2 4 x 2 6 7 4 4 2 4 8 0 3 2 2 4 1 1 Answer: 3224

CONCEPTUAL VARIATIONS

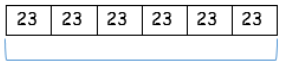
Different ways to ask children to solve 6 x 23

PLACE VALUE GRIDS



What is the calculation?
What is the product?

BAR MODEL



PLACE VALUE COUNTERS

With the counters, prove that
6 x 23 = 138

MISSING DIGIT PROBLEMS

☐ = 6 x 23

ABSTRACT CALCULATIONS

6 x 23
23 x 6

WORD PROBLEMS

Mai had to swim 23 lengths, 6 times a week. How many lengths did she swim in one week?

VARIED LANGUAGE

Find the product of 6 and 23.
How many will I have if I have 23 groups of 6?

DIVISION CALCULATION PROGRESSION (PAGE 1 OF 2)

KEY LANGUAGE: share, group, divide, divided by, half

CURRICULUM STATEMENTS AND PROGRESSION

EARLY YEARS	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
▸ They solve problems by sharing and halving.	▸ Solve one-step problems involving division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.	▸ Recall and use division facts for 2, 5 & 10 multiplication tables, including recognising odd and even numbers. ▸ Calculate mathematical statements for division within the multiplication tables and write them using the division and equals signs.	▸ Recall and use division facts for 3,4 and 8 multiplication tables. ▸ Write and calculate mathematical statements for division using the multiplication tables that they know, including for two-digit numbers one-digit, using mental and progressing to formal written methods.	▸ Recall division facts for tables to 12 x 12. ▸ Use place value, known and derived facts to multiply and divide mentally, including: dividing by 1.	▸ Divide numbers up to 4 digits by 1 digit using formal written method of short division and interpret remainders appropriately for the context.	▸ Divide numbers up to 4 digits by a two-digit whole number using formal written method of long division, and interpret remainders as whole number remainders, fractions or by rounding, as appropriate for context. ▸ Divide numbers up to 4 digits by a two-digit number using formal written method of short division where appropriate. Interpreting remainders according to the context.

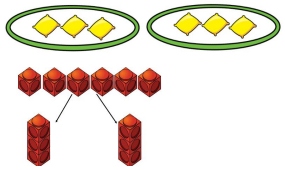
CONCRETE

Sharing

Use a range of objects

YEAR 1

6 ÷ 2

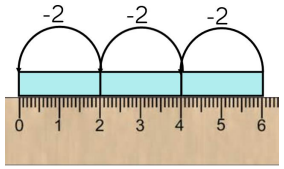


Repeated subtraction

Cuisenaire rods used above a ruler.

YEAR 2

6 ÷ 2



Remainders with lollipop sticks

Use of lollipops in the form of wholes. Cuisenaire rods above ruler can also be used.

YEAR 3

13 ÷ 4

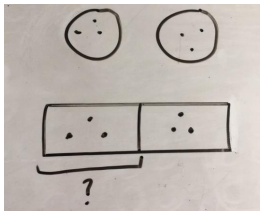
Squares are made because we are dividing by 4.

PICTORIAL

Represent sharing

Use pictorial representations and examples of concrete objects.

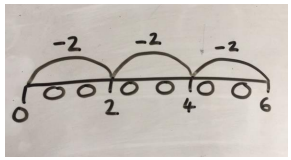
YEAR 1



Represent repeated subtraction

Use pictorial representations to show the relationship between the subtraction and concrete materials.

YEAR 2

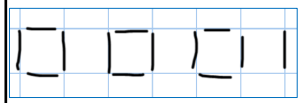


Represent sticks pictorially

As shown, there are 3 whole squares with 1 left over

YEAR 3

13 ÷ 4



ABSTRACT

Bar modelling

Children should also be encouraged to use their 2 times tables facts.

YEAR 2

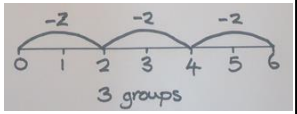
6 ÷ 2

3	3

Number line

Abstract method used to represent the equal groups that have been subtracted

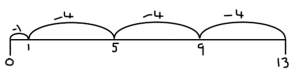
YEAR 2



Number line

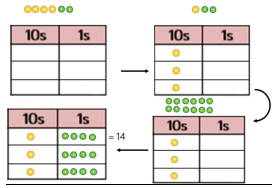
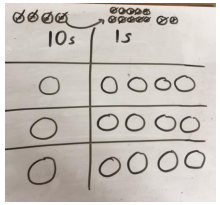
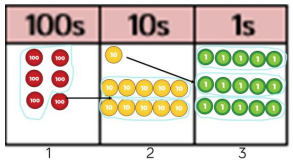
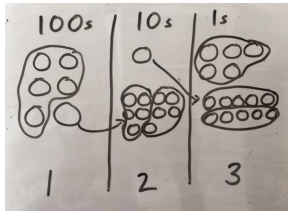
Children should be encouraged to use their times tables facts. They could also represent addition on a number line.

YEAR 3

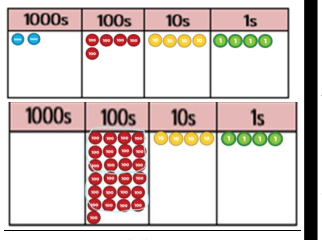
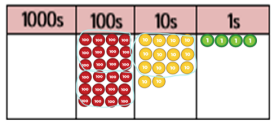
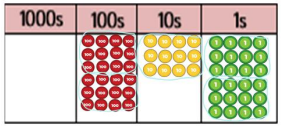


'3 groups of 4, with 1 left over.'

DIVISION CALCULATION PROGRESSION (PAGE 2 OF 2)

CONCRETE		PICTORIAL		ABSTRACT	
Sharing place value counters Children use place value counters to identify where exchanges are made.	**YEAR 4** 42 ÷ 3 = 14 	**Represent place value counters** Visual representations help to build further relationships with calculation.	**YEAR 4** 	**Written calculations** Children to be able to make sense of the place value counters and write calculations to show the process.	**YEAR 4** 42 ÷ 3 42 = 30 + 12 30 ÷ 3 = 10 12 ÷ 3 = 4 10 + 4 = 14
Short division with place value counters Using place value counters to group calculations and identify exchanges.	**YEAR 5** 615 ÷ 5 	**Represent place value counters** Pictorially representing the short division calculation with place value counters solidifies understanding.	**YEAR 5** 	**Short division** Children to use this method to scaffold the calculation	**YEAR 5** $5\overline{)615}$ = 123

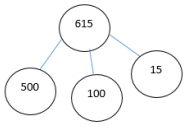
YEAR 5 LONG DIVISION PROCESS OF 2544 ÷ 12 WITH PLACE VALUE COUNTERS & WRITTEN METHOD

STEP 1		STEP 2		STEP 3	
We can't group 2 thousands into groups of 12 so we must exchange them. We can group 24 hundreds into groups of 12 which leaves 1 hundred.	 $12\overline{)2544}$ = 02, 24, 1	After exchanging the hundred, we have 14 tens. We can group 12 tens into a group of 12 which leaves 2 tens.	 $12\overline{)2544}$ = 021, 24, 14, 12, 2	After exchanging the two tens, we have 24 ones. We can group 24 ones into 2 groups of 12, which leaves no remainders.	 $12\overline{)2544}$ = 0212, 24, 14, 12, 24, 24, 0

CONCEPTUAL VARIATIONS

Different ways to ask children to solve 615 ÷ 5

PART WHOLE MODEL



PLACE VALUE GRIDS

What is the calculation?
What is the answer?

MISSING DIGIT PROBLEMS

615 ÷ 5 =

☐ = 615 ÷ 5

ABSTRACT CALCULATIONS

$5\overline{)615}$

WORD PROBLEMS

I have £615 and share it equally between 5 bank accounts. How much will be in each account?

OPEN REASONING

What is 615 shared between 5?

Prove it.