Calculation Policy

St Laurence's
CE Primary School

A guide for teachers

'Mathematics is a creative and highly interconnected discipline essential to everyday life. A high-quality mathematics education provides a foundation for understanding the world, the ability to reason mathematically, an appreciation of the beauty and power of mathematics, and a sense of enjoyment and curiosity about the subject' - National Curriculum, 2014

Introduction

Our school uses the White Rose Hub's documents, who are leaders in the field of Mastery in Mathematics. This policy has been created to support the White Rose materials and our children at St. Laurence's.

This policy is a statement of the aims, principles and strategies for teaching and learning of calculation strategies in Mathematics. It is designed to help teachers and staff at St. Laurence's ensure that calculation is taught consistently across the school and to aid them in helping children who may need extra support or challenges.

The policy is set out in the four operations; addition, subtraction, multiplication and division. Within each specific area, there is a progression of skills, knowledge and layout for written methods, which have been organised into the appropriate year groups. The calculation strategies, which will be used, will reflect this ideology using concrete, pictorial and abstract recordings leading to more formal written methods. Mental methods and strategies will work in partnership with these methods.

The progression of mental methods and expectations complies with the National Curriculum Statements from July 2014.

At St. Laurence's it is important that staff always use correct mathematical language and encourage this from every pupil. This will take place in guided practice and oral and written feedback.

The basis of our maths calculation policy is that written methods are complementary to mental methods and should not be seen as separate from them. Children should use mental methods when appropriate, but calculations that they cannot do in their heads they use an efficient written method accurately and with confidence.

Developmental Aims

⇒To ensure consistency and progression in our approach to calculation and enable a smooth transition between year groups.

⇒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.

⇒To enable children to learn to interpret and use the signs and symbols.

⇒As children acquire secure mental methods of calculation and one efficient written method of calculation for addition, subtraction, multiplication and division, which they know they can rely on when mental methods are not appropriate.

⇒To ensure that children can use these methods accurately with confidence and understanding.

⇒At whatever stage in their learning, and whatever method is being used, children's methods of calculating will be underpinned by a secure and appropriate knowledge of number facts, along with the mental skills that are needed to carry out the process and judge if it was successful.

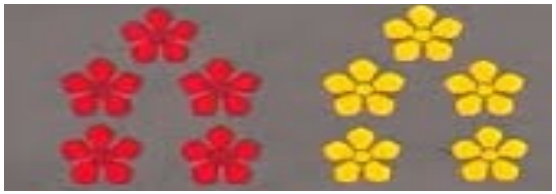
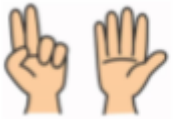
All year groups will offer CPA to children

	EYFS/Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Addition	Y1- Up to 100 Combining two parts to make a whole: part whole model Starting at the bigger number and counting on Regrouping to make 10 using ten frame	Adding three single digits Use of Dienes to combine two Numbers in columns to match the written method in year3.	Use place value counters alongside the compact written method.	Column method- regrouping (up to 4 digits)	Column method- regrouping	Column method- regrouping
Subtraction	Taking away ones Counting back Find the difference Part whole model Make 10 using the ten frame	Counting back Find the difference Part whole model Make 10	Use place value counters alongside the compact written method.	Column method (up to 4 digits)	Column method	Column method

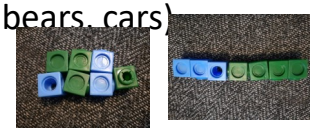
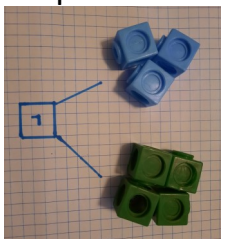
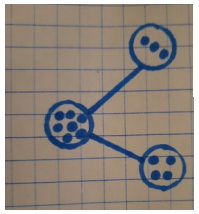
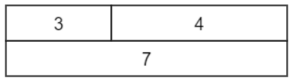
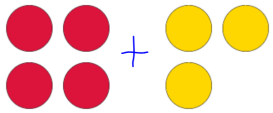
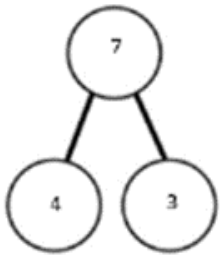
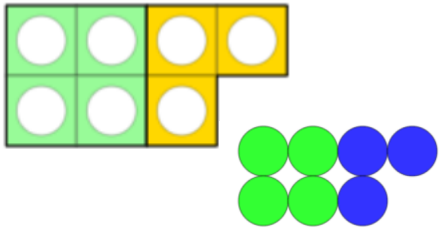
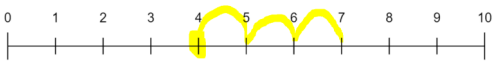
All year groups will offer CPA to children

Multiplication	Recognising and making equal groups Doubling	Arrays- showing commutative Multiplication 2x, 3x, 4x (doubling) 5x, 10x	Arrays, grid method and column method. 2d × 1d	Use the grid method (with arrays) alongside column multiplication (2 and 3 digit multiplied by 1 digit)	Compact multiplication (up to 4 digit numbers multiplied by 1 or 2 digits)	Compact multiplication (multi-digit up to 4 digits by a 2 digit number) Extend multiplication to mass, length, capacity etc.
Division	Sharing objects into groups Division as grouping e.g. I have 10 sweets and put them in groups of 2, how many groups do I have? 2x, 5x and 10x	Division as sharing Division as grouping Repeated subtraction Division with a remainder-using lollipop sticks – **GDS children only**	Division with a remainder using division as sharing and as grouping 2d divided by 1d using Dienes, place value counters and the short division method	Division with a remainder Short division (up to 3 digits by 1 digit)	Short division (up to 4 digits by a 1 digit number including Remainders which can be turned into fractions—make the link)	Short division Long division (chunking) with place value counters (up to 4 digits by a 2 digit number) Children should take and make into the tenths and hundredths to convert the remainder to decimals.

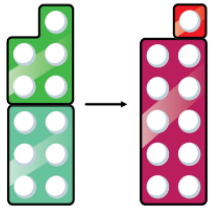
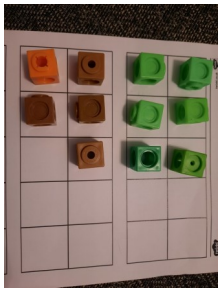
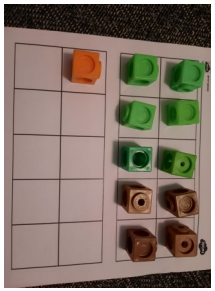
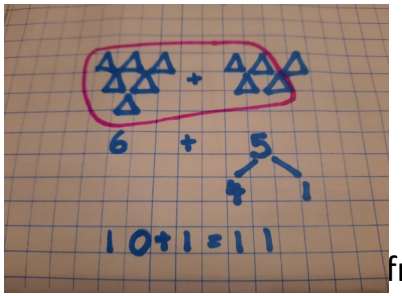
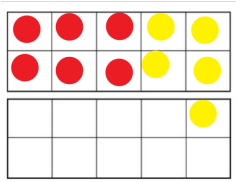
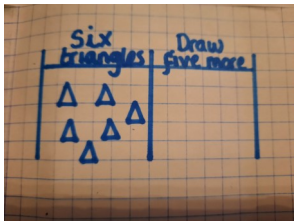
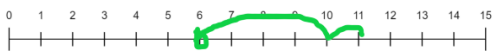
YR Addition +

Have an understanding of what “more” means and be able to say what is one more than a given number	
Children begin to combine groups of objects or pictures and use concrete apparatus	 
Solve simple problems using fingers and introduce Numicon when appropriate	  2 + 5 = 7
Children make a record in pictures, words, Numicon shapes or symbols of addition activities already carried out	  5 + 1 = 6
Children are encouraged to read number sentences aloud in different ways	“Three add two equals 5” “Four plus 3 makes 7” 3 + 2 = 5
Construct number sentences verbally, or by using cards to go with practical activities	
Number lines can be used alongside practical apparatus to solve addition calculations and word problems. Children “jump” along the number line to “count on”	3 + 1 = 4 

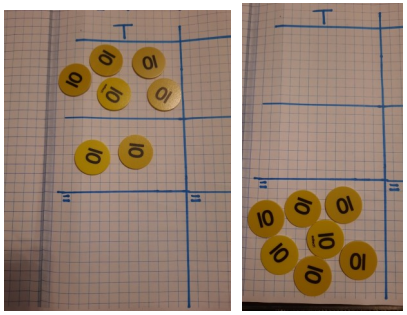
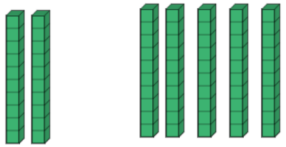
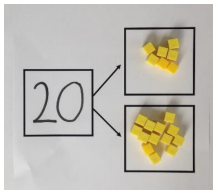
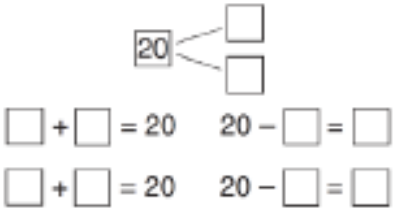
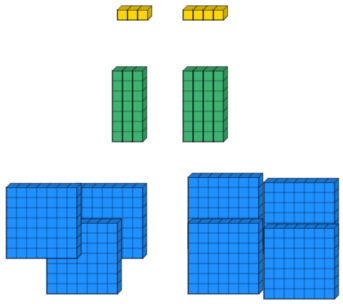
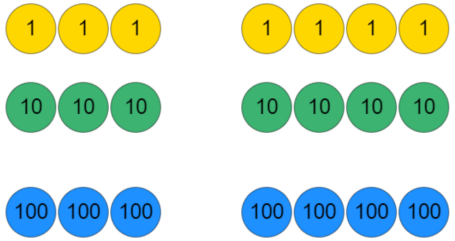
Y1 Addition +

Objective / Strategy	Concrete Cubes, numicon, bead string, counters, teddy bears, cars etc.	Pictorial Number line, bar model, part whole model etc	Abstract Number sentences, part whole model
Combining two parts to make a whole part: part -whole model	Add two numbers together as a group or in a bar(Other resources e.g. eggs, shells, teddy bears, cars)  Use part whole model. 	Use pictures to add two numbers together as a group or in a bar to represent the concrete tool   	Use the part-part whole diagram as shown above to move into the abstract. 4 + 3 = 7 7 = 4 + 3  4 + 3 = 7 Four is a part, 3 is a part and the whole is seven.
Starting at the bigger number and counting on	Start with the larger number and then count on to the smaller number 1 by 1  	Start at the larger number on the number line and count on in ones or in one jump to find the answer. 4 + 3 = 7  	Place the larger number in your head and count on the smaller number to find your answer 4 + 3 = 7 What is 3 more than 4? What is the total of 3 and 4?

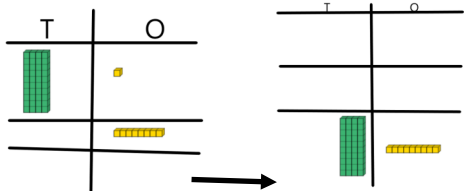
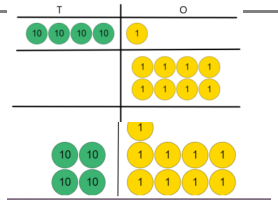
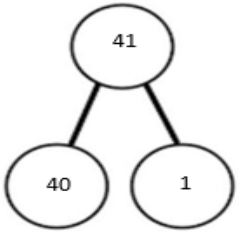
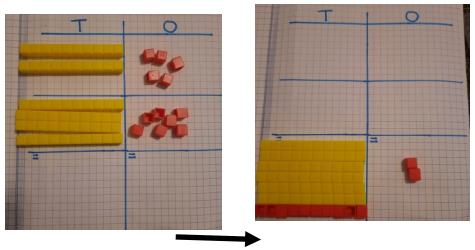
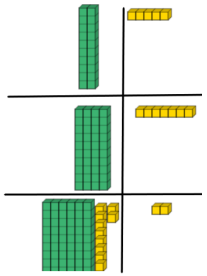
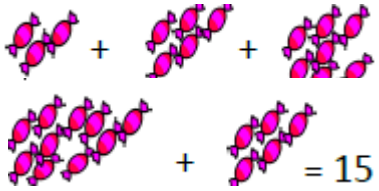
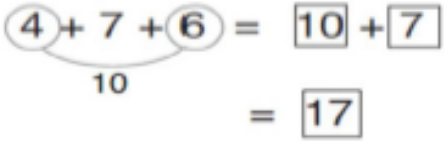
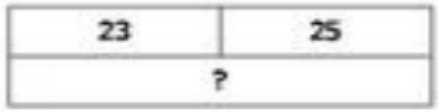
Y1 Addition +

Objective / Strategy	Concrete Cubes, numicon, bead string, counters, tens frame etc.	Pictorial Number line, part whole model, tens frame etc	Abstract Number sentences, missing number
Regrouping to make 10 *This is an essential skill for column addition later.*	Start with the bigger number and use the smaller number to make 10. Use ten frames.  6+5=11   Use number bonds to 10.	Use pictures. Regroup or partition the smaller number using the part whole model to make 10  frame and counters 	5 + 6 = 11 If I am at five, how many more do I need to make 10. How many more do I add on now? 6 + □ = 11 6 + 5 = 5 + □ 6 + 5 = □ + 4
Represent and use number bonds and related subtraction facts within 20	5 more than 6 	  	Emphasis should be on the language '5 more than 6 is equal to 11.' *'6 more than 5 is 11.'* *'11 is 6 more than 5.'*

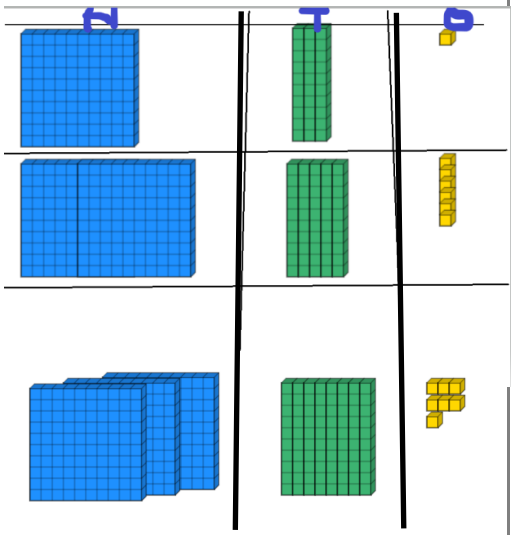
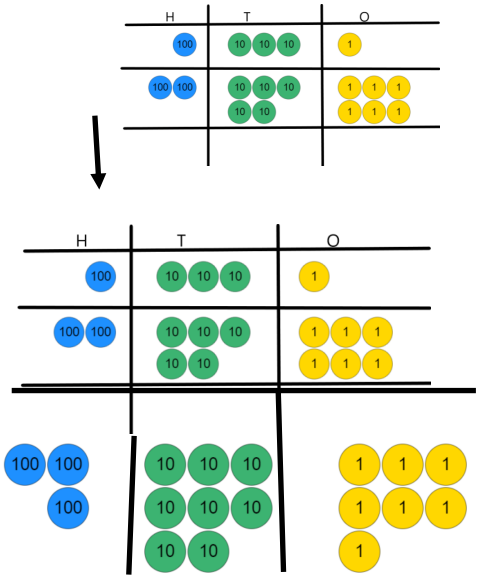
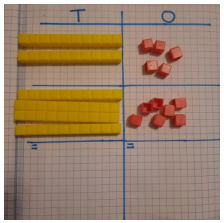
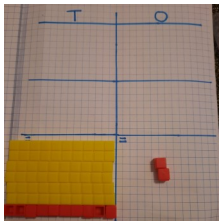
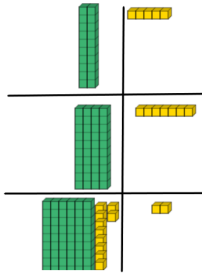
Y2 Addition +

Objective / Strategy	Concrete Dienes, place value counters	Pictorial Base ten, place value counters	Abstract Number sentences, missing numbers
Adding multiples of 10	70 = 50 + 20 	 2 tens + 5 tens = _____ tens 20+50 =	20 + 50 = 70 70 = 50 + 20 20 + □ = 70
Use known number facts Part part whole	Children explore ways of making numbers within 20 	 	□ + 1 = 20 20—1 = 1 + □ = 20 20—□ = 1
Using known facts using HTO		 	3+4=7 Leads to 30+40=70 Leads to 300+400=700

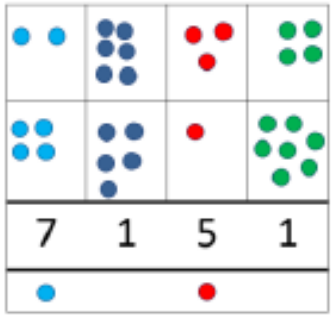
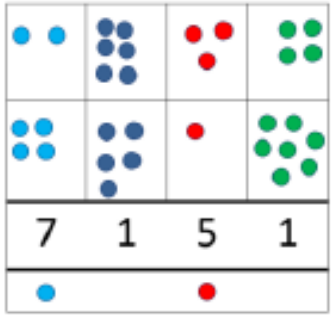
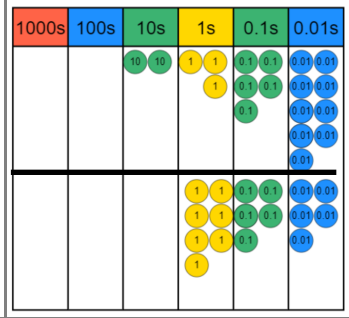
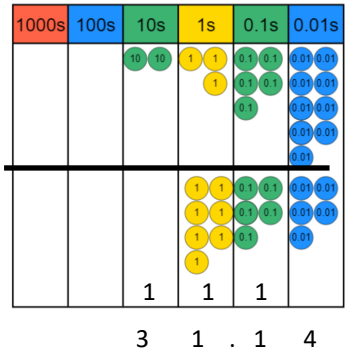
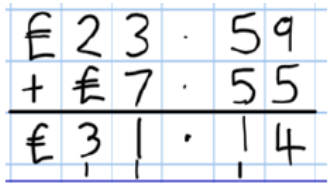
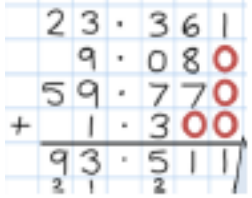
Y2 Addition +

Objective / Strategy	Concrete Dienes, place value counters, cubes	Pictorial Base ten, place value counters, bar models	Abstract Number sentences, missing numbers, part whole model
Add a two digit number and ones. Continue to develop understanding of partitioning and place value	41+8= 		41 + 8 1 + 8 = 9 40 + 9 = 49 
Add two 2-digit numbers	25 + 47 = 72 	25 + 47= 52 	25 + 47 72 Use the method with CP
Add three 1-digit numbers Number bonds	Combine to make 10 first if possible, or bridge 10 then add third digit 	Regroup and draw Representation 	Combine the two numbers that make/bridge ten then add on the third 
Bar model	 3 + 4 = 7	 7 + 3 = 10	 23 + 25 = 48

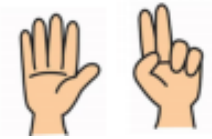
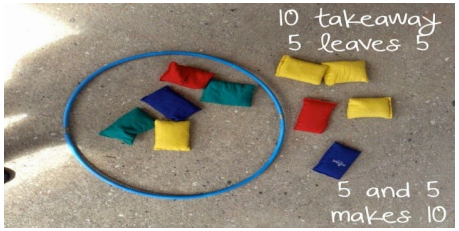
Y3 Addition +

Objective / Strategy	Concrete Dienes, place value counters, cubes	Pictorial Base ten, place value counters, bar models	Abstract Number sentences, missing numbers, part whole model
Column Addition—no regrouping (friendly numbers) Add two or three 2 or 3-digit numbers Commutative opera-tio	131 + 256 = Bring the dienes down 	131 + 256 = Bring counters down 	131 + 256 387 131 + _____ = 387 387 = 131 + 256
Column Addition with regrouping Commutative opera-tio	  25 + 47= 52	25 + 47= 52 	25 + 47 72 1 Use the method with CP

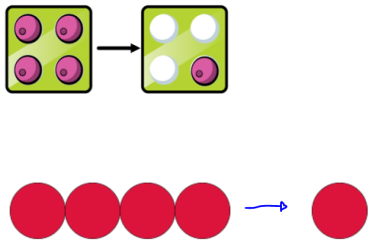
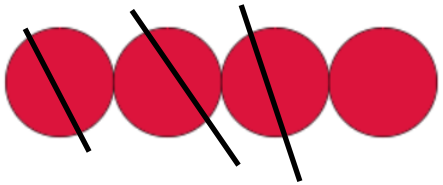
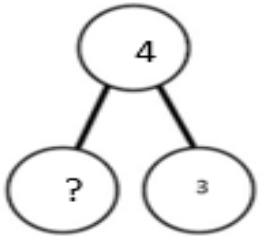
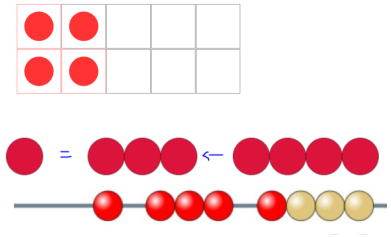
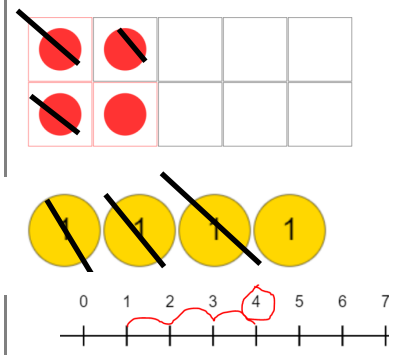
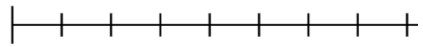
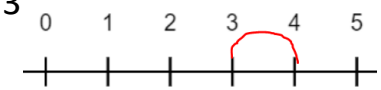
Y4,5,6 Addition +

Objective / Strategy	Concrete Counters, place value counters	Pictorial - Drawing counters on a place value grid	Abstract Compact method
Y4 Add numbers with up to 4 digits	Use counters on a place value grid 2634 + 4517 = 7151 	Draw representations using place value grid 	Move from expanded method onto carrying hundreds as well as tens Relate to money and measures 2634 + 4517 7151 1 1
Y5 Add numbers with more than 4 digits Add decimals with 2 decimal places with regrouping, including money	Bring the counters down to add 23.59 + 7.55 = 31.14 	23.59 + 7.55 = 31.14 	
Y6 Add several numbers of increasing complexity.	As Year 5 Including adding money, measures and decimals with different decimal points	As Year 5	Insert zeros for place holders 

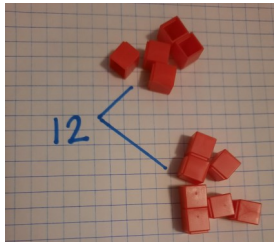
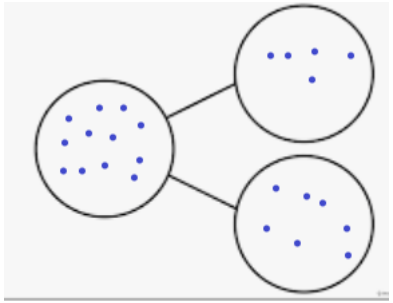
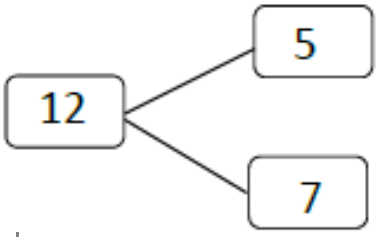
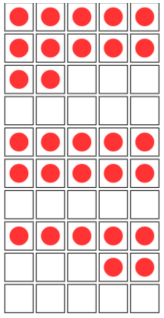
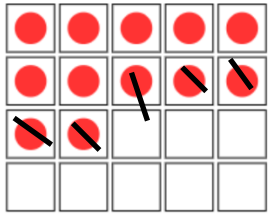
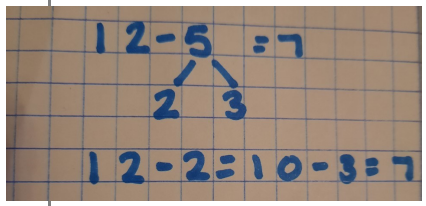
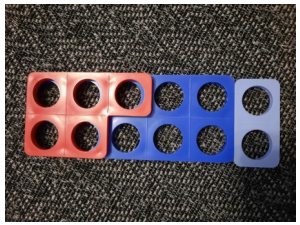
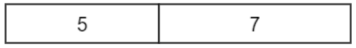
YR Subtraction -

Have an understanding of what “less and fewer” means and be able to say what is one less than a given number.	
Children begin to use objects, pictures and concrete appa-ratus to relate subtraction to taking away and counting how many objects are left	 5 – 1 = 4
Solve simple problems using fingers and introduce Numicon where appropriate.	  5 – 3 = 2
Children make a record in objects, pictures, words, Numicon shapes or symbols of subtraction activities already carried out	
Children are encouraged to read number sentences aloud in different ways	“Seven take 5 is 2” “7 subtract 5 makes 2” 7—5 = 2
Construct number sentences verbally, or by using cards to go with practical activities	
Number lines can be used alongside practical apparatus to solve subtraction calculations and word problems “jump” back to “count down“ the number line	

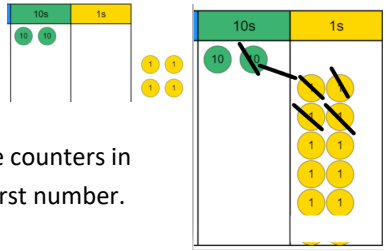
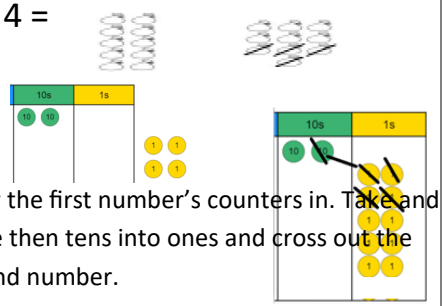
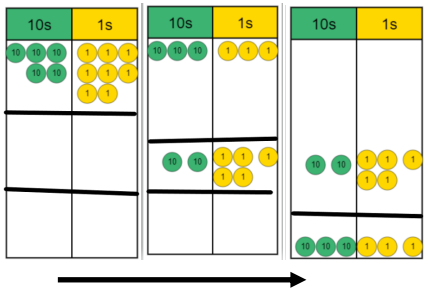
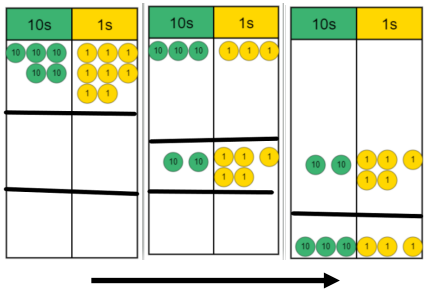
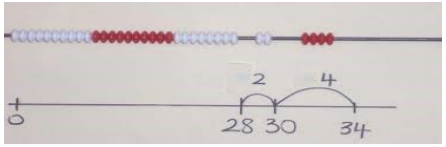
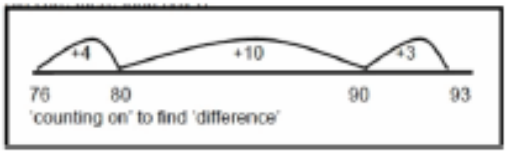
Y1 Subtraction -

Objective / Strategy	Concrete Tens frame, numicon with pegs, cubes, bead string	Pictorial Pictures, number line	Abstract Number sentences
Taking away ones	4 – 3 = 1 	4—3 = 1 	4- 3 =  __= 4 – 3
Counting back	Move objects/beads away from the group, counting backwards 4—3 = 1 	4—3 =1 	Encourage children to use an empty number line  Put 4 in your head, count back 3. What number are you at?
Find the Difference	Calculate the difference between 4 and 3.	Count on using a number line to find the difference between 4 and 3 	Hannah has 4 sweets and her sister has 3. How many more does Hannah have?

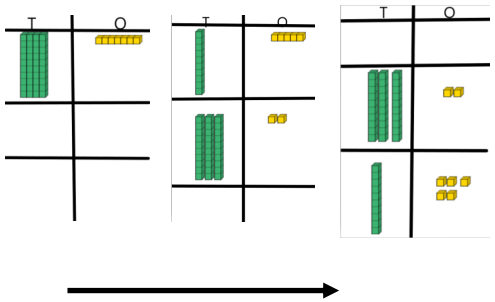
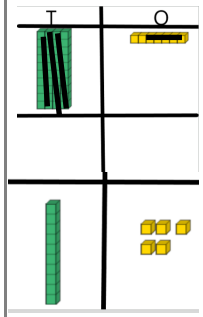
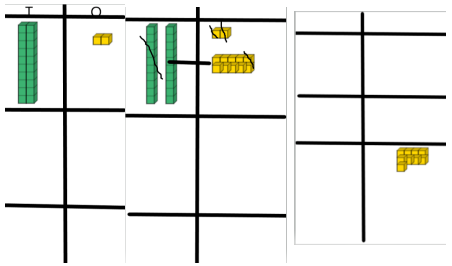
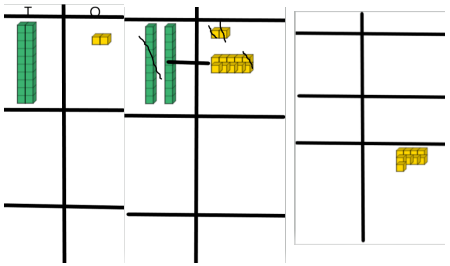
Y1 Subtraction -

Objective / Strategy	Concrete Part whole model with cubes/counters, tens frame	Pictorial Part whole model, tens frame	Abstract Number sentence, missing numbers, part whole model
Represent and use number bonds and related subtraction facts within 20 Part Part Whole model	If 12 is the whole and 5 is one of the parts, what 's the other part? 		Move to using numbers within the part whole model 
Making 10	Using ten frames. 12 – 5  -2 first to make 10 - 3	Children to present the ten frame pictorially and discuss what they did to make 10 	Children to show how they can make 10 by partitioning 
Bar model	12—5 = 7 		12—5 = 7 12—7 = 5 5 + 7 = 12

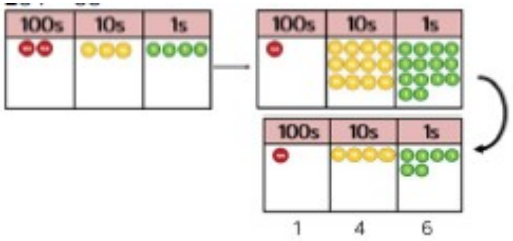
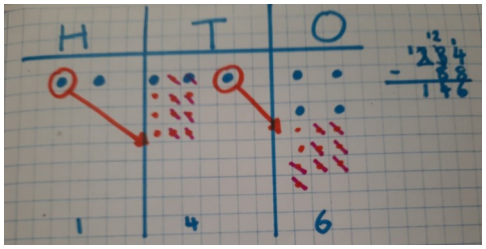
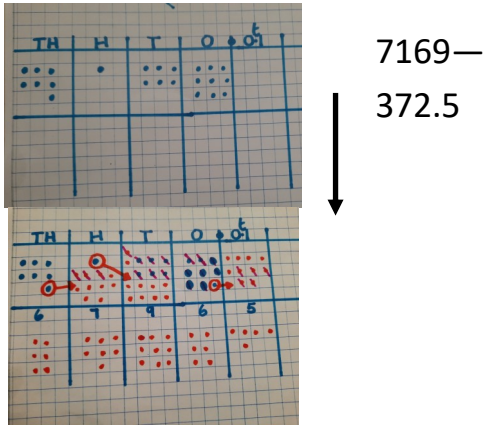
Y2 Subtraction -

Objective / Strategy	Concrete Dienes, bead string, counters	Pictorial Place value grid, pictures	Abstract
Regroup a ten into ten ones using Take and make	20—4 =  Place the counters in for the first number. Take and make the tens into ones and take the second number away.	20— 4 =  Draw the first number's counters in. Take and make then tens into ones and cross out the second number.	20 — 4 = 16
Partitioning to subtract without regrouping	58—25 = 	58—25 = 	58—25 =
Make ten strategy *Progression should be crossing one ten, crossing more than one ten, crossing the hundreds.*	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—17 =

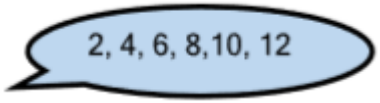
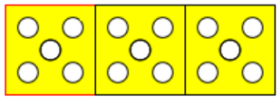
Y3 Subtraction -

Objective / Strategy	Concrete - Dienes, numicons with pegs, place value counters	Pictorial Base ten, counters	Abstract Compact method
Column subtraction without regrouping	47—32 	47—32 	Compact method 47 - 32 15
Column subtraction with regrouping Begin with Dienes Move to place value counters, modelling the exchange of a ten in o ones. Use the phrase 'take and make' for exchange	 22—13		Compact method 1 12 2 2 - 13 9

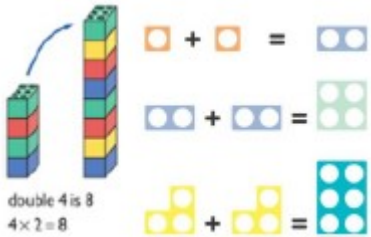
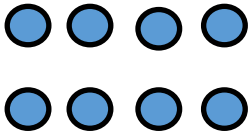
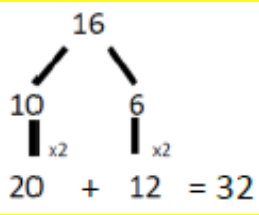
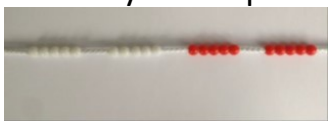
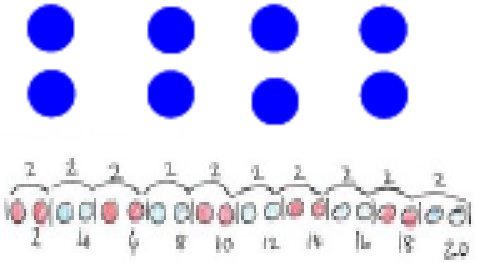
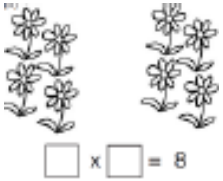
Y4,5,6 Subtraction -

Objective / Strategy	Concrete Place value counters	Pictorial Base ten	Abstract Compact method
Y4 Subtract with up to 4 digits Introduce decimal subtraction through context of money	Model process of exchange using Dienes and then move to place value counters 234 – 88 	234—88 	Formal column method. Children must understand what has happened when they have crossed out digits Use the phrase ‘take and make’ for ex-change $\begin{array}{r} 2\overset{3}{\cancel{3}}\overset{1}{4} \\ -\ 88 \\ \hline 6 \end{array}$
Y5 Subtract with at least 4 digits, including money and measures Subtract with decimal values	As Year 4	 7169— 372.5	Use zeros for place-holders $\begin{array}{r} \overset{6}{\cancel{7}}\overset{10}{\cancel{1}}\overset{9}{\cancel{6}}\overset{8}{\cancel{9}}\cdot\overset{}{0} \\ -\ 3\,7\,2\cdot 5 \\ \hline 6\,7\,9\,6\cdot 5 \end{array}$
Y6 Subtract with large and more complex numbers and decimal values	As above	Pictorial representation of dienes will always be drawn the same way. Lines for the tens and small circles for the ones	$\begin{array}{r} \overset{}{\cancel{1}}\overset{}{\cancel{8}}\overset{}{\cancel{0}},6\,9\,9 \\ -\ 8\,9,9\,4\,9 \\ \hline 6\,0,7\,5\,0 \end{array}$ $\begin{array}{r} \overset{}{\cancel{1}}\overset{}{\cancel{0}}5\cdot\overset{}{\cancel{1}}1\ 9\ \text{kg} \\ -\ 3\,6\cdot 0\,8\,0\ \text{kg} \\ \hline 6\,9\cdot 3\,3\,9\ \text{kg} \end{array}$

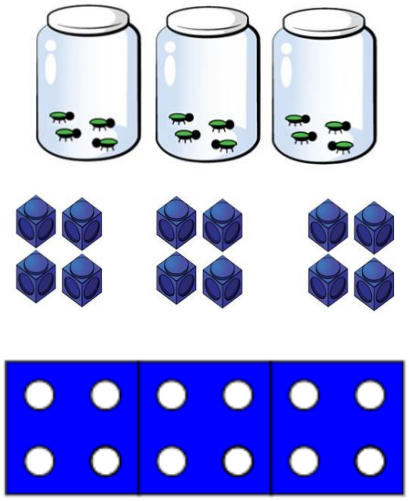
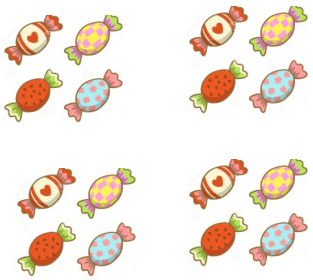
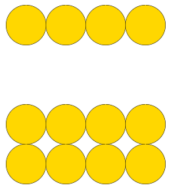
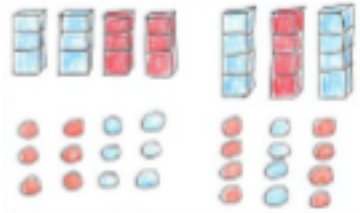
YR Multiplication x

The link between addition and multiplication can be introduced through doubling and reinforced through repeated addition of the same number	
Children begin with mostly pictorial representations	 How many groups of 2 are there? 3 groups of 2 = 6
Real life contexts and use of practical equipment to count in repeated groups of the same size	 How many wheels are there altogether?  How much money do I have?
Count in twos, fives and tens, both aloud and with objects, such as Numicon or other concrete apparatus	
Children are encouraged to read number sentences aloud in different ways	"Five groups of two makes ten" "Three lots of two makes six"
Children are given multiplication problems set in a real life context and are encouraged to visualise the problem	"How many fingers on two hands?"  "How many dots on 3 die (5s) ?"  "How many legs on four ducks?" 

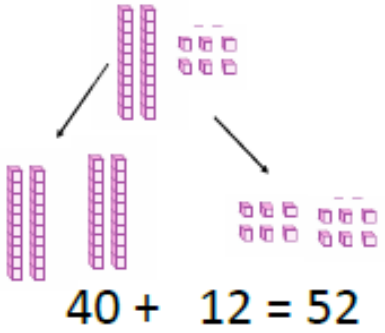
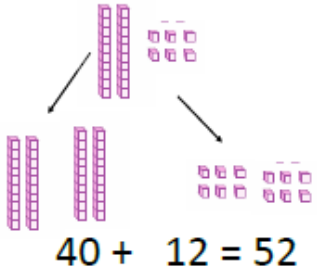
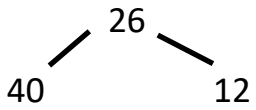
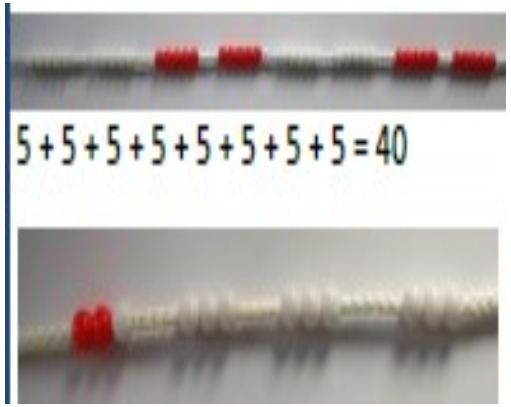
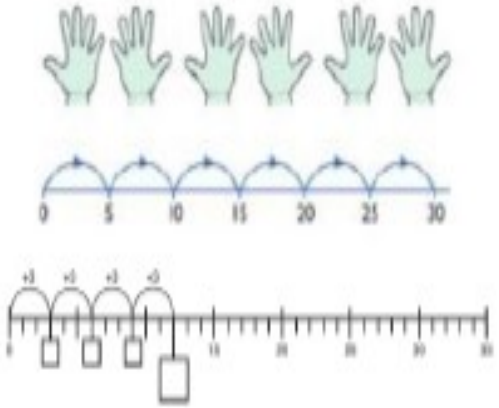
Y1 Multiplication x

Objective / Strategy	Concrete Cubes, numicon, bead string, counters	Pictorial Counters, numberlines	Abstract
Doubling	Use practical activities using manipulatives including cubes and Numicon to demonstrate doubling 	Draw pictures to show how to double numbers Double 4 = 8 	Partition a number and then double each part before recombining it back together 
Counting in multiples	Count the groups as children are skip counting, children may use their fingers as they are skip counting  	Children make representations to show counting in multiples 	Count in multiples of a number aloud Write sequences with multiples of numbers. 2, 4, 6, 8, 10 5, 10, 15, 20, 25 , 30
Making equal groups and counting the total	Use manipulatives to create equal groups 	Draw and make representations 	2 x 4 = 8

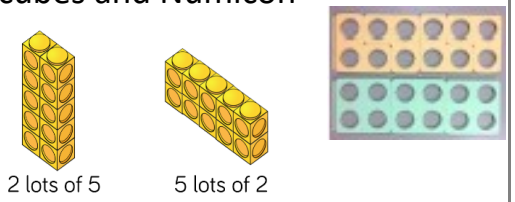
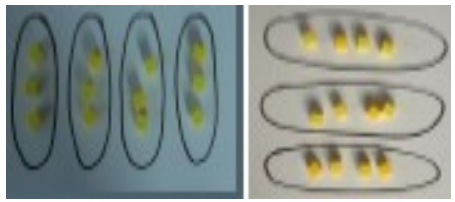
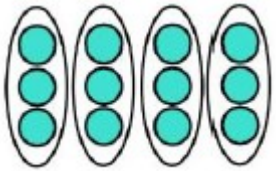
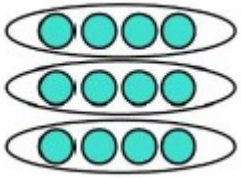
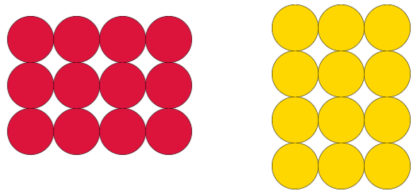
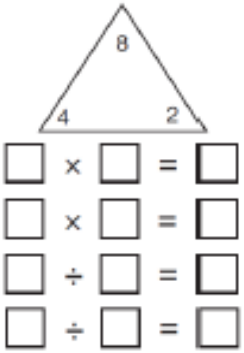
Y1 Multiplication x

Objective / Strategy	Concrete - Tool	Pictorial - Picture	Abstract
Repeated addition	Use different objects to add equal groups 	Use pictorial including number lines to solve problem There are 4 sweets in a bag. How many sweets in 5 bags? 	Write addition sentences to describe objects and pictures 3 × 4 = 12 4 + 4 + 4 = 12
Understanding arrays	Use objects laid out in arrays to find the answers to 2 lots 4, 4 lots of 6 etc 	Draw representations of arrays to show understanding 	3 x 4 = 12 4 x 3 = 12

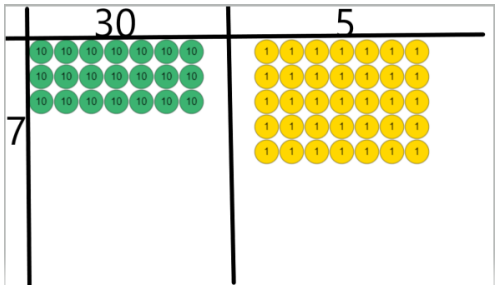
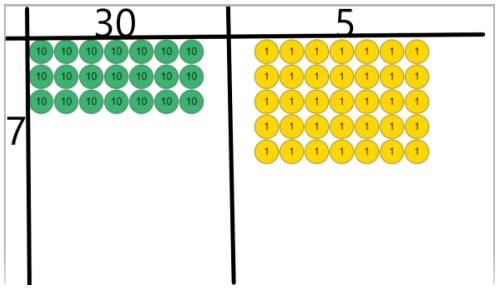
Y2 Multiplication x

Objective / Strategy	Concrete - Tool	Pictorial - Picture	Abstract
Doubling	Model doubling using Dienes and place value counters 	Draw pictures and representations to show how to double numbers 	Partition a number and then double each part before recombining it back together  40 + 12 = 52
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 	Number lines, counting sticks and bar models should be used to show representation of counting in multiples 	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 $4 \times 3 = \square$

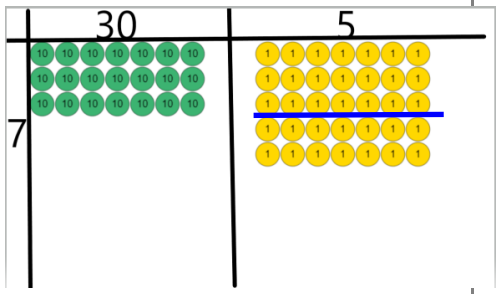
Y2 Multiplication x

Objective / Strategy	Concrete - Tool	Pictorial - Picture	Abstract
Multiplication is Commutative 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	Create arrays using counters and cubes and Numicon  2 lots of 5 5 lots of 2 	Use representations of arrays to show different calculations and explore commutativity  	12 = 3 × 4 12 = 4 × 3 4 + 4 + 4 = 12 3 + 3 + 3 + 3 = 12 
Using the Inverse This should be taught alongside division, so pupils learn how they work alongside each other	Use cubes to show multiplication and division fact families 		Show all 8 related fact families 2 x 4 = 8 2 = 8 ÷ 4 4 x 2 = 8 4 = 8÷ 2 8 = 2 x 4 8 ÷ 4 = 2 8 = 4 x 2 8 ÷ 2 = 4

Y3 Multiplication x

Objective / Strategy	Concrete Counters and dienes	Pictorial Counters, base ten, arrays	Abstract Grid method, column method
Grid method strategy to be moved to written method. 2d x 1d only			Start with multiplying by one digit numbers and showing the clear addition alongside the grid

When using arrays for multiplication, encourage children to find out how they can total the arrays without counting each counter.

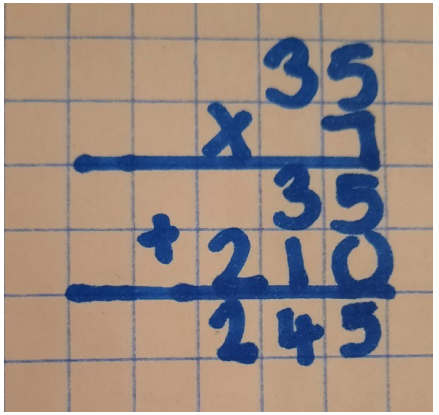


I know 2 x 7 is 14

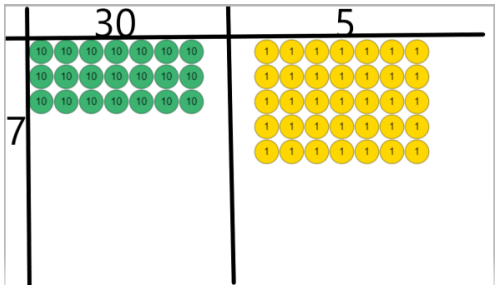
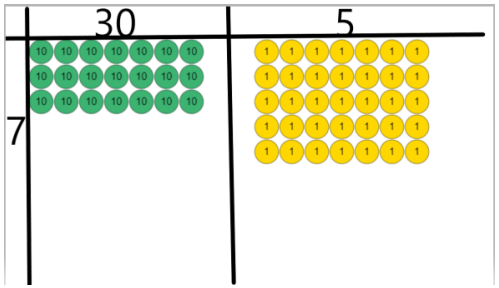
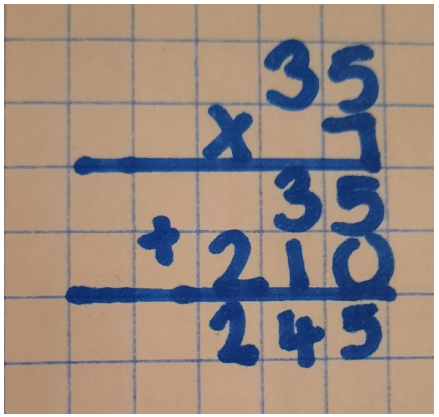
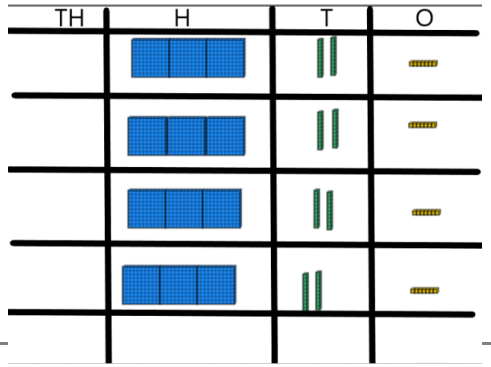
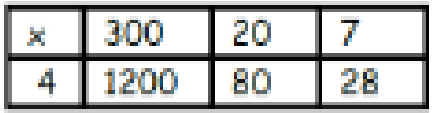
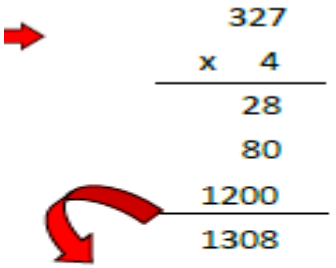
And I know 3 x 7 = 31

×	30	5
7	210	35

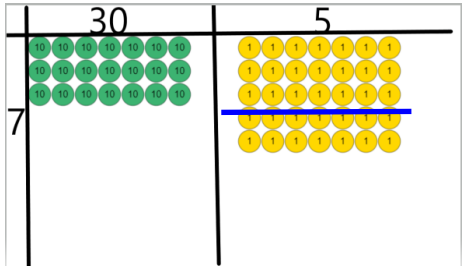
210 + 35 = 245



Y4 Multiplication x

Objective / Strategy	Concrete Counters and dienes	Pictorial Counters, base ten, arrays	Abstract Grid method, column method
Grid method recap from year 3 for 2 digits x 1 digit			 210 + 35 = 245 
Column Multiplication 3d x 1d	This is initially done where there is no regrouping. 327 x 4 = 1303 	 Number lines can support learners when solving problems with multiplication alongside the formal written methods	

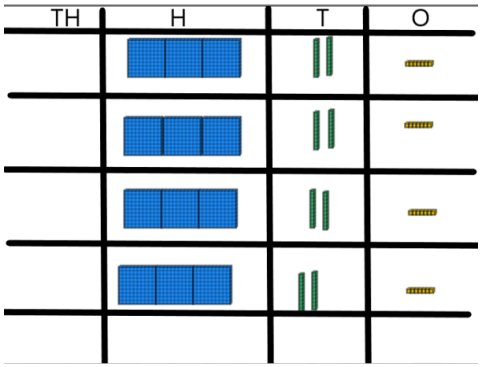
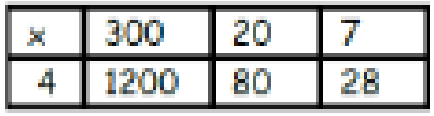
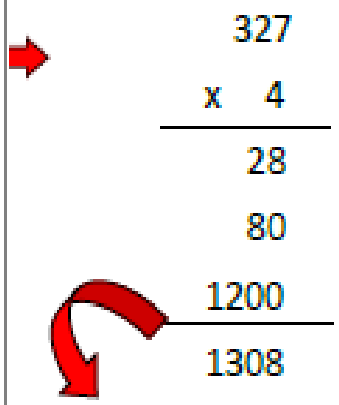
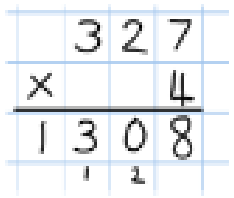
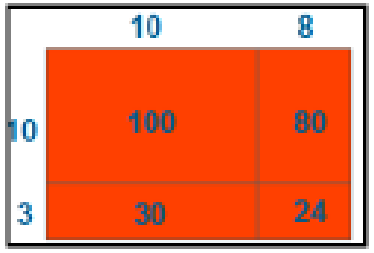
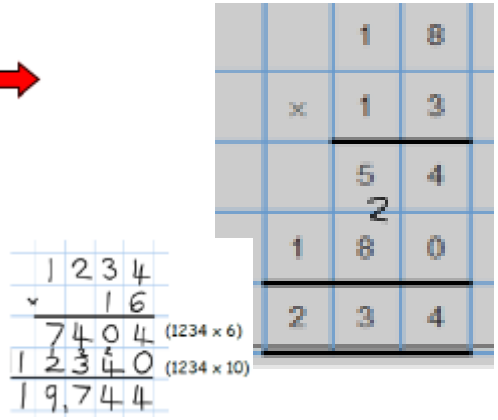
When using arrays for multiplication, encourage children to find out how they can total the arrays without counting each counter.



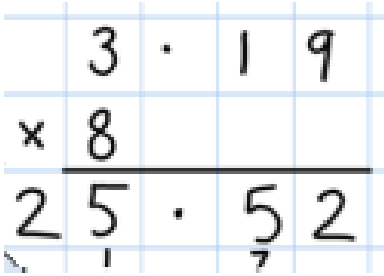
I know 2 x 7 is 14

And I know 3 x 7 = 31

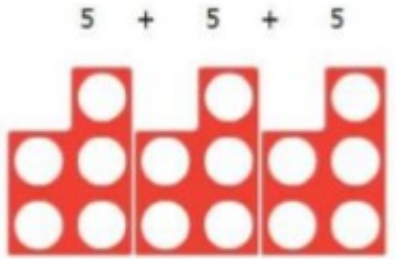
Y5,6 Multiplication x

Objective / Strategy	Concrete - Tool	Pictorial - Picture	Abstract
Column Multiplication for 3 and 4 digits x 1 digit	This is initially done where there is no regrouping. 327 x 4 = 1308 	 Number lines can support learners when solving problems with multiplication alongside the formal written methods	  This may lead to a compact method.
Column multiplication	Manipulatives may still be used with the corresponding long multiplication modelled alongside		

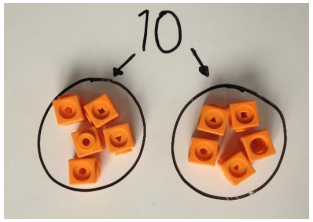
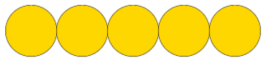
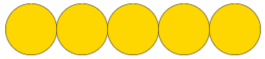
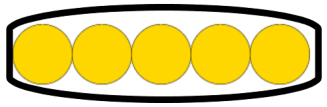
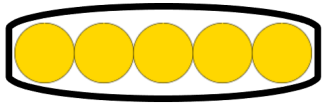
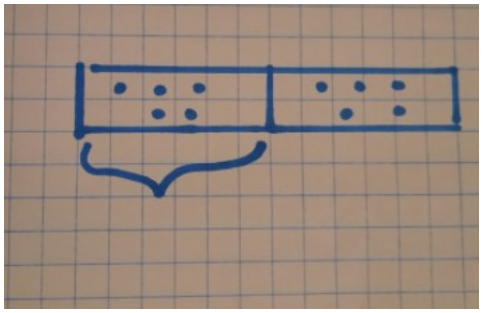
Y6 Multiplication x

Objective / Strategy	Concrete Money, place value chart	Pictorial Money, place value chart	Abstract Written method
Multiplying decimals up to 2 decimal places by a single digit	This could be represented using place value counters using 0.1s, 0.01s, 1s and 10s or 1ps, 10ps and £1s.	This could be represented using place value counters using 0.1s, 0.01s, 1s and 10s or 1ps, 10ps and £1s.	Remind children that the single digit belongs in the ones column. Line up the decimal points in the question and the answer 

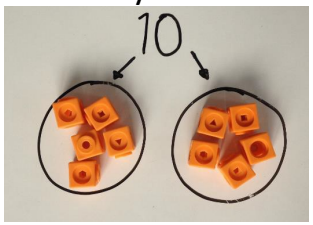
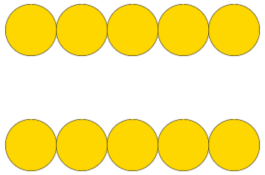
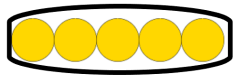
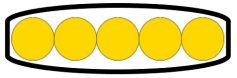
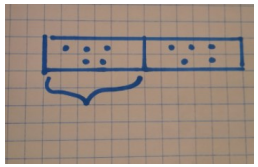
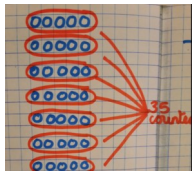
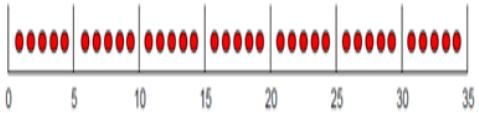
YR Division ÷

Division can be introduced through halving or sharing an equal amount into 2 groups	  
Children begin with mostly pictorial representations linked to real life contexts **Grouping Model** Mum has 6 socks. She grouped them into pairs. How many pairs did she make? Children need to see and hear representations of division as both grouping and sharing	
Children begin with mostly pictorial representations linked to real life contexts **Sharing Model** I have 10 sweets. I want to share them with my friend. How many will we have each? Children need to see and hear representations of division as both grouping and sharing	
Children have a go at recording the calculation that has been carried out e.g. by drawing pictures in groups or by arranging concrete apparatus into groups.	 12 shared equally by 3 is 4

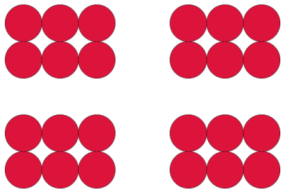
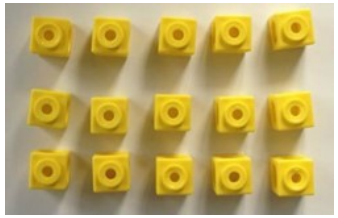
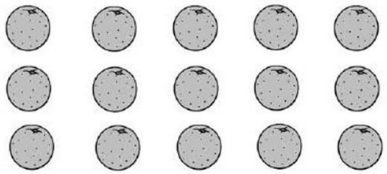
Y1 Division ÷

Objective / Strategy	Concrete Cubes, counters, dienes	Pictorial Base ten	Abstract
Division as sharing	Sharing using a range of objects   I have 10 cubes, can you share them equally between 2?   	Children use pictures or shapes to share quantities 10 shared between 2 is 5     	10 shared between 2 is What happens if I share 10 between 5?

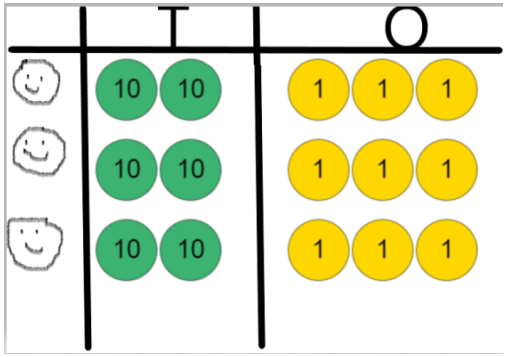
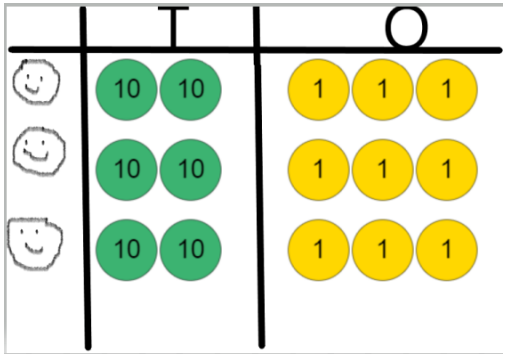
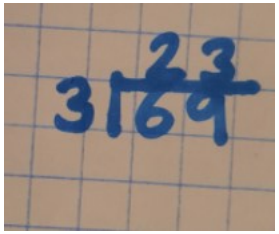
Y2 Division ÷

Objective / Strategy	Concrete Counters, place value counters	Pictorial	Abstract Number sentences
Division as sharing	How can I share 10 cubes equally between you and me?  	Show different representations when sharing.     	10 ÷ 2 = 5 10 sweets shared between 5 people. How many do they get each?
Division as grouping 	Divide quantities into equal groups	Children to use pictures or shapes to group quantities  Use number lines for grouping 	35 ÷ 5 = 7 There are 35 sweets, how many people can have 5 each?

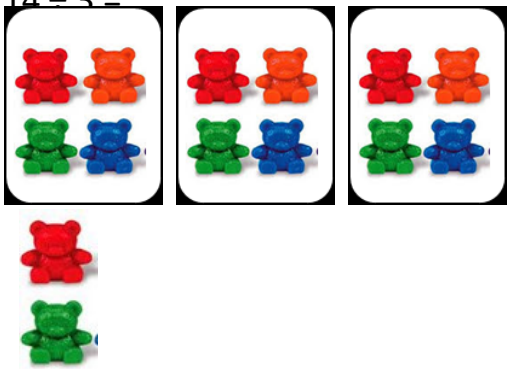
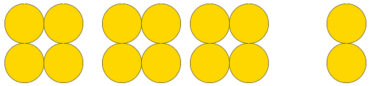
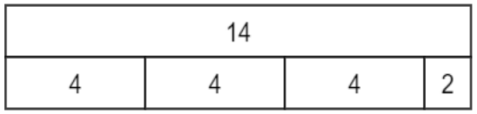
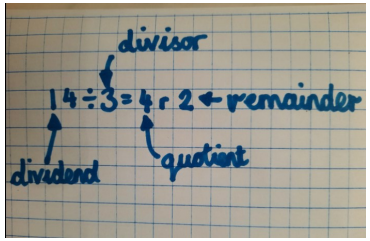
Y3 Division ÷

Objective / Strategy	Concrete Cubes, counters, objects, place value counters	Pictorial	Abstract
Division as grouping	Use cubes, counters, objects or place value counters to aid understanding  24 divided into groups of 6 = 4 	Children to use pictures or shapes to group quantities Relate to real life e.g. cinema seats 	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  5 ÷ 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 3 x 5 = 15 5 ÷ 3 = 5 15 = 3 x 5 3 = 15 ÷ 5

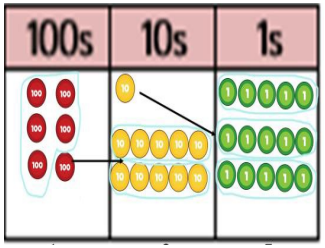
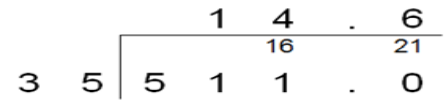
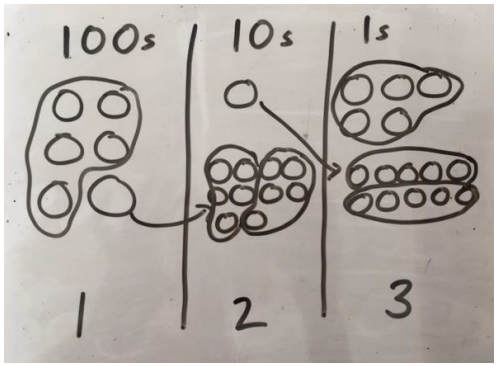
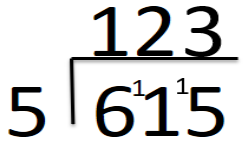
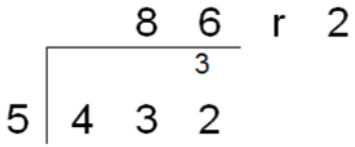
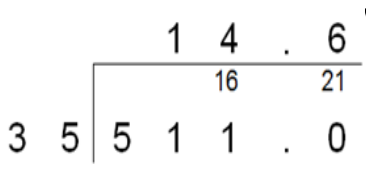
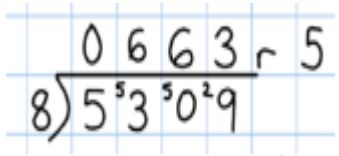
Y3 Division ÷

Objective / Strategy	Concrete Place value counters, dienes	Pictorial Counters, base ten	Abstract Short method
Division without remainders	69 ÷ 3 = 23 When regrouping, move the counter into the next column to show the new digit. 	69 ÷ 3 = 23 Draw the counters/base ten/ objects to share out when dividing. 	Link the short method to the Concrete and pictorial methods to show the link. 

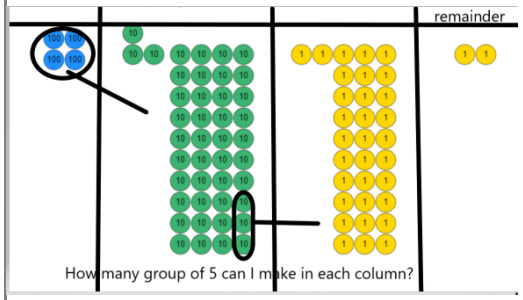
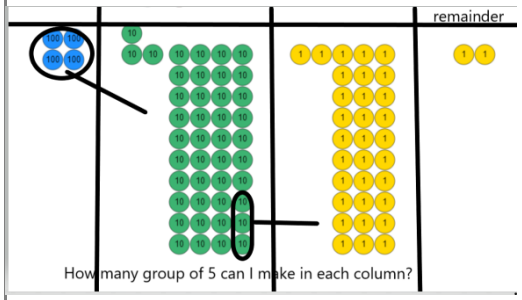
Y3 Division ÷

Objective / Strategy	Concrete Place value counters, dienes, other objects	Pictorial Counters, base ten	Abstract Short method
Division with remainders	Divide objects between groups and see how much is left over 14 ÷ 3 = 	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   	Complete written divisions and show the remainder using r  Use the bus stop method for numbers over the multiple of 10. e.g. 34 ÷ 3 = 34 is larger than the first multiple of 10.

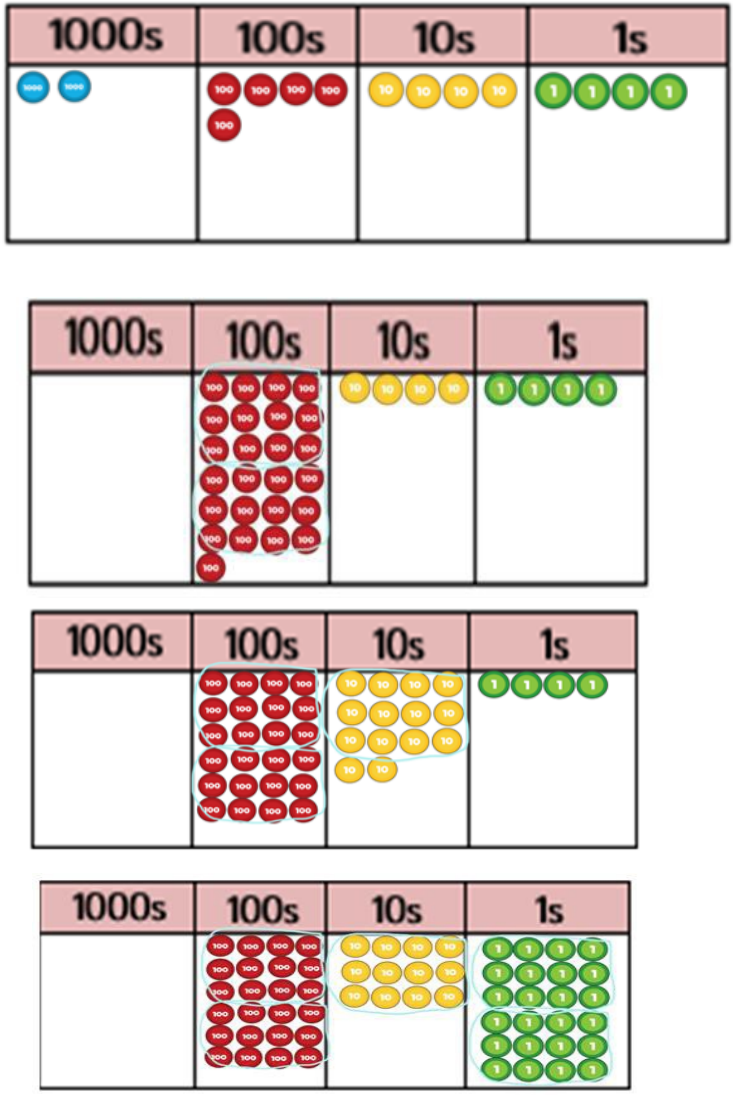
Y4,5,6 Division ÷

Objective / Strategy	Concrete Place value counters, dienes	Pictorial Counters, base ten	Abstract Short method
Divide at least 3 digit numbers by 1 digit Short Division	Short division using place value counters to group 615 ÷ 5   1. Make 615 with place value counters. 2. How many groups of 5 hundreds can you make with 6 hundred counters? 3. Exchange 1 hundred for 10 tens. 4. How many groups of 5 tens can you make with 11 ten counters? 5. Exchange 1 ten for 10 ones. 6. How many groups of 5 ones can you make with 15 ones?	Represent the place value counters pictorially  Additive decomposition	Children to the calculation using the short division scaffold. Begin with no remainders  Move onto divisions with a Remainder  Finally move into decimal places to c  

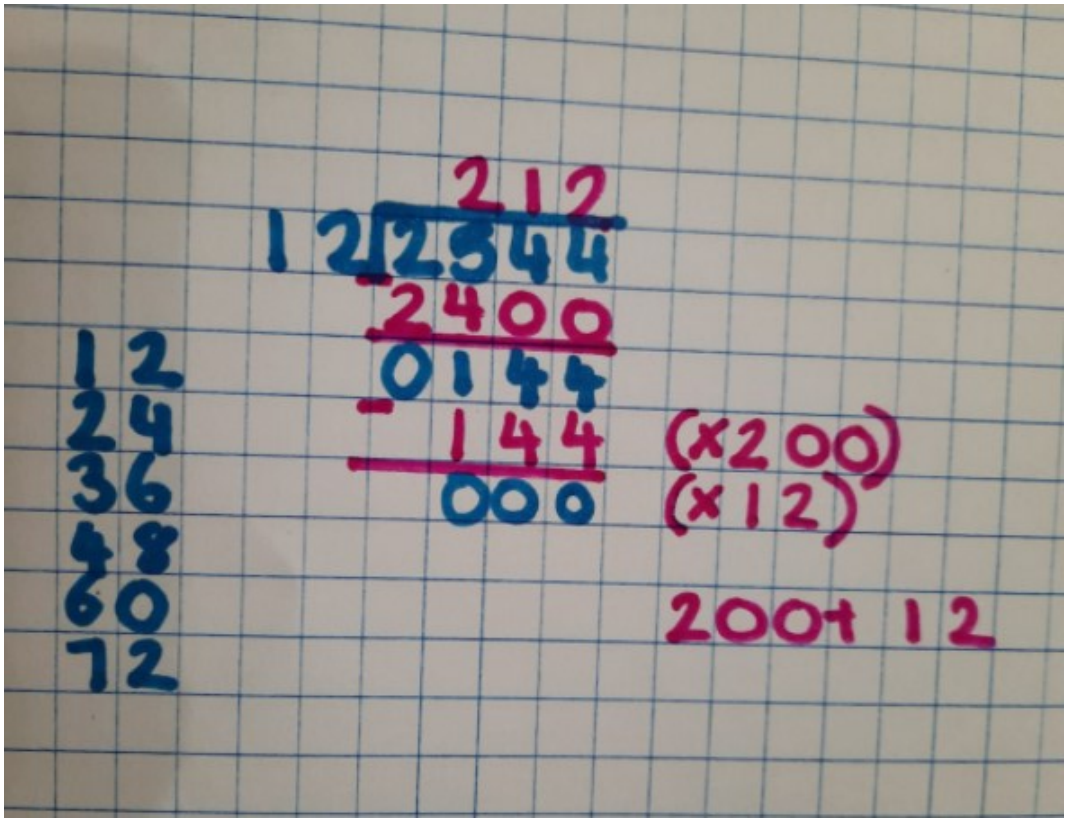
Y4,5,6 Division ÷

Objective / Strategy	Concrete Place value counters, dienes	Pictorial Counters, base ten	Abstract Short method
Divide at least 3 digit numbers by 1 digit Short Division	 432 ÷ 5 Group the place value chart according to the divisor, children should make links using their multiplication facts.		Move onto divisions with a Remainder 8 6 r 2 5 | 4 3 2 3 Finally move into decimal places to divide the total accurately Move on to larger numbers with decimal remainders. 1 4 . 6 3 5 | 5 1 1 . 0 16 21

Y6 Division ÷

Objective / Strategy	Concrete and Pictorial Place value counters, dienes
Long division 2544 ÷ 12	

Y6 Division ÷

Objective / Strategy	Abstract
Long division	

Encourage children to use multiplication facts to find efficient ways of finding the answer.

E.g. I know 12 x 2 = 24, so 12 x 200 = 2400