Eton Wick C of E First School

Calculation Policy

This policy supports the White Rose maths programme used throughout the school.

Progression within each area of calculation is in line with the programme of study in the 2014 National Curriculum.

This calculation policy should be used to support children to develop a deep understanding of number and calculation. This policy has been designed to teach children through the use of concrete, pictorial and abstract representations.

Concrete representation— a pupil is first introduced to an idea or skill by acting it out with real objects. This is a 'hands on' component using real objects and is a foundation for conceptual understanding.

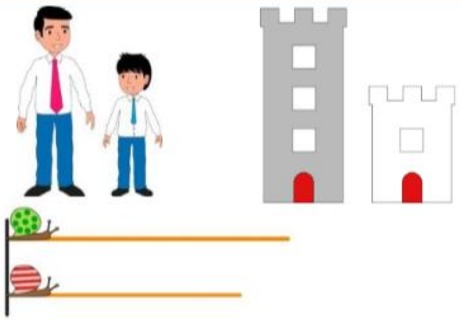
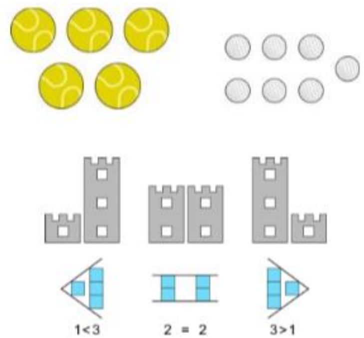
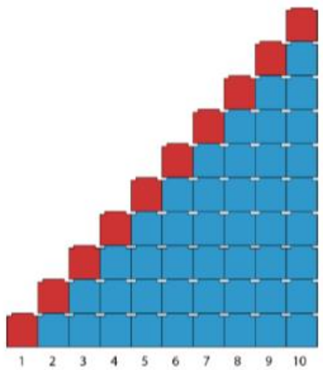
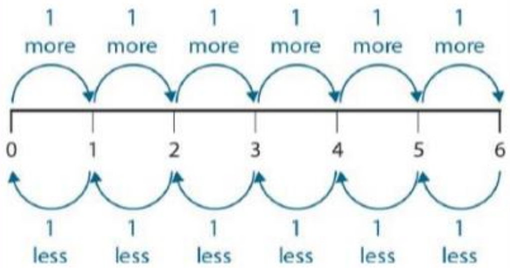
Pictorial representation – a pupil has sufficiently understood the 'hands on' experiences performed and can now relate them to representation, such as a diagram or picture of the problem.

Abstract representation—a pupil is now capable of representing problems by using mathematical notation, for example 12 x 2 = 24.

It is important that conceptual understanding, supported by the use of representation, is secure for all procedures. Reinforcement is achieved by going back and forth between these representations.

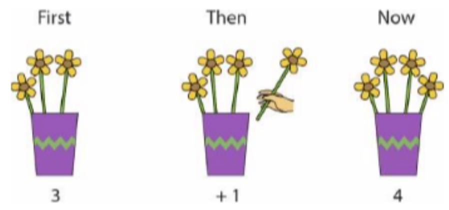
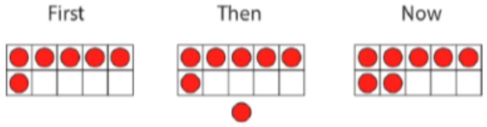
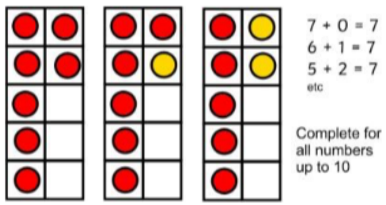
Y1

ADDITION +

Objective, Strategy	Concrete	Pictorial	Abstract
Comparing Objects, groups of objects	People's height, distance, mass. Use of balancing scales using numicon to show equivalence, < > Comparing multiple objects Use of concrete materials eg. Compare bears, jewels, cubes etc to create groups of different sizes to compare		
Using < > and =	Use a multilink staircase in two colours		Use variation with missing boxes and missing symbols. 3 ◯ 4 4 > □ 2 ◯ 2 □ < 6
Finding one more, finding one less			One more/less sentences – example one: 1 more than 3 is □ 1 less than 2 is □ 1 more than □ is 1 1 less than □ is 1

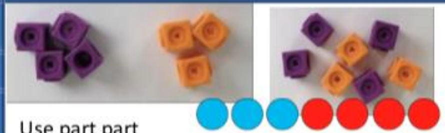
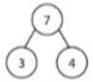
Y1

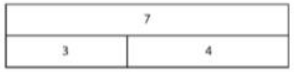
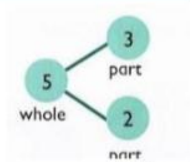
ADDITION +

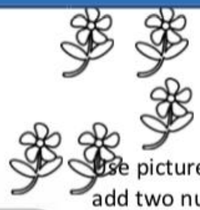
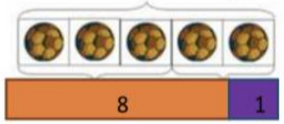
Objective, Strategy	Concrete	Pictorial	Abstract
Adding 1 gives 1 more			6 + 1 7 6 + 1 = 7
Augmentation—increasing an amount	Use FIRST, THEN, NOW and range of practical situations for showing augmentation. E.g. first there were three children on carpet then 2 more came. Now there are 5 children on the carpet.		4 + 3 7 4 + 3 = 7
Stories of numbers within 10	Children should work with doubled sided counters and ten frame. Start with 7 red, turn one over, tell me the 'story'? Turn one more over. What is the 'story'? Continue. Complete this for stories of all numbers up to 10.		7 + 0 = 7 6 + 1 = 7 5 + 2 = 7 4 + 3 = 7 3 + 4 = 7 2 + 5 = 7 1 + 6 = 7 0 + 7 = 7

Y1

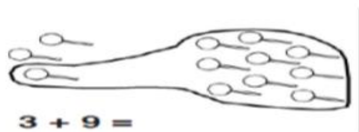
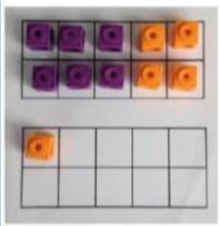
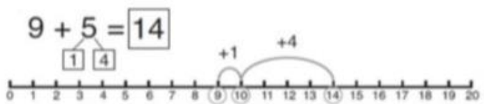
ADDITION +

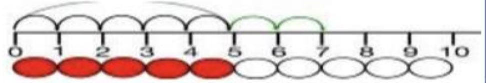
<table>
<tr><th>Objective & Strategy</th><th>Concrete</th><th>Pictorial</th><th>Abstract</th></tr>
<tr>
<td>Combining two parts to make a whole: part- whole model</td>
<td>
Use part part whole model.
Use cubes to add two numbers together as a group or in a bar.


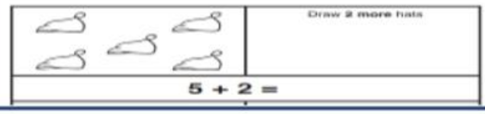

</td>
<td>


Use pictures to add two numbers together as a group or in a bar.

</td>
<td>4 + 3 = 7
10= 6 + 4

Use the part-part whole diagram as shown above to move into the abstract.</td>
</tr>
<tr>
<td>Regrouping to make 10.
This is an essential skill for column addition later.</td>
<td>

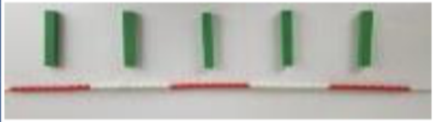
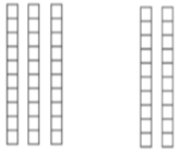
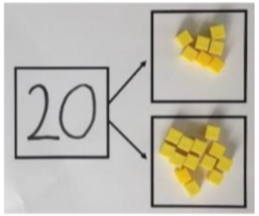
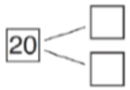
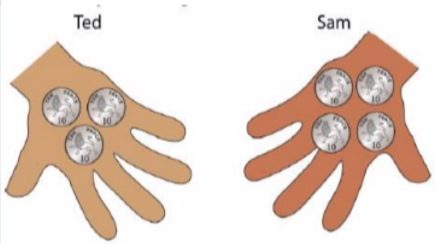
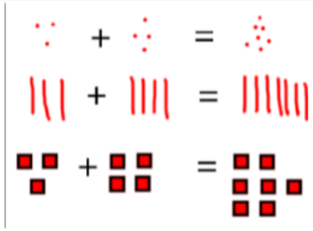
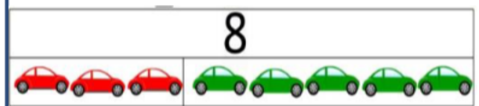
6 + 5 = 11
2 more than 5.</td>
<td>Start at the larger number on the number line and count on in ones or in one jump to find the answer.

</td>
<td>7 + 4= 11
If I am at seven, how many more do I need to make 10. How many more do I add on now?</td>
</tr>
<tr>
<td>Represent & use number bonds and related subtraction facts within 20</td>
<td>
Start with the bigger number and use the smaller number to make 10.
Use ten frame
</td>
<td>Use pictures or a number line. Regroup or partition the smaller number using the part part whole model to make 10.





</td>
<td>Emphasis should be on the language '1 more than 5 is equal to 6.'
'2 more than 5 is 7.'
'8 is 3 more than 5.'</td>
</tr>
</table>

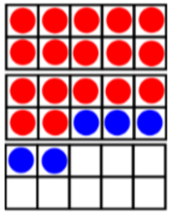
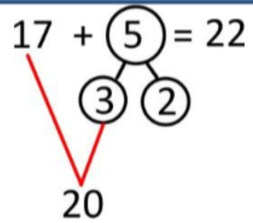
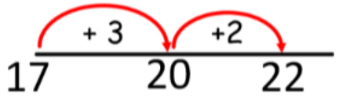
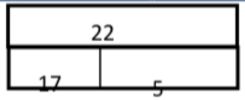
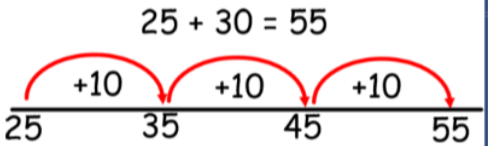
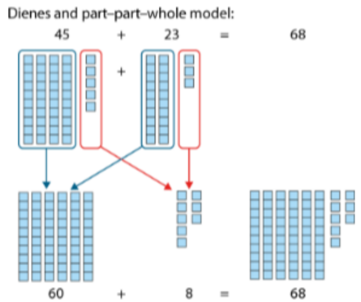
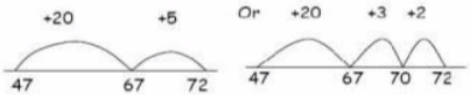
Y2

ADDITION +

Objective & Strategy	Concrete	Pictorial	Abstract
Adding multiples of ten	50= 30 + 20  Model using dienes and bead strings	 ___tens and____tens makes____tens Use representations for base ten.	20 + 30 = 50 70 = 50 + 20 40 + □ = 60 □ + 30 = 50
Use known number facts	 Children explore ways of making numbers within 20	 □ + □ = 20 20 − □ = □ □ + □ = 20 20 − □ = □	□ + 1 = 16 16 - 1 = □ 1 + □ = 16 16 - □ = 1
Using known facts	 	 Children draw representations of H,T and O	3 + 4 = 7 Leads to 30 + 40 = 70 Leads to 300 + 400 + 700 *'3 things and 4 things is always 7 things'*
Bar model	 3 + 4 = 7	 3 + 5 = 8	<table><tr><td colspan="2">30</td></tr><tr><td>14</td><td>16</td></tr></table> 14 + 16 = 30

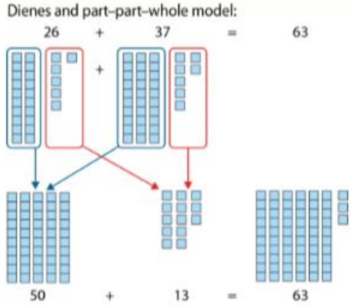
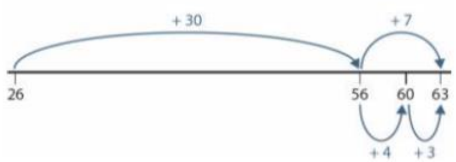
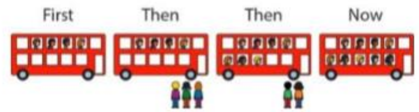
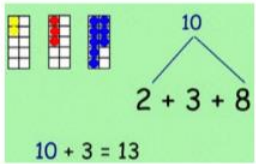
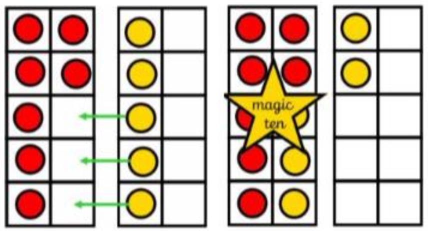
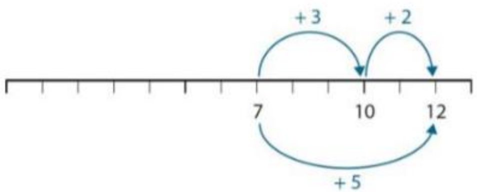
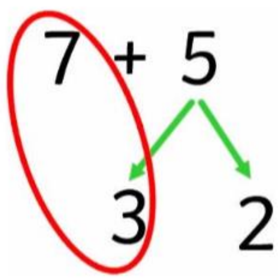
Y2

ADDITION +

Objective & Strategy	Concrete	Pictorial	Abstract
Add a two digit number and ones	 17 + 5 = 22 Use ten frame to make 'magic ten Children explore the pattern. 17 + 5 = 22 27 + 5 = 32	Use part part whole and number line to model.  	17 + 5 = 22  Explore related facts 17 + 5 = 22 22 = 17 + 5 5 + 17 = 22 22 = 5 + 17 22—17 = 5 17 = 22 - 5 22—5 = 17 5 = 22 - 17
Add a 2 digit number and tens	 25 + 10 = 35 Explore that the ones digit does not change	25 + 30 = 55 	27 + 10 = 37 27 + 20 = 47 27 + □ = 57 □ + 30 = 67
Add two 2-digit numbers without bridging.	Model using dienes , place value counters and numicon 	 Use number line and bridge ten using part whole if necessary.	25 + 47 20 + 5 40 + 7 20 + 40 = 60 5+ 7 =12 60 + 12 = 72

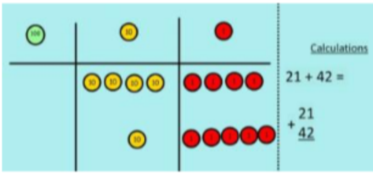
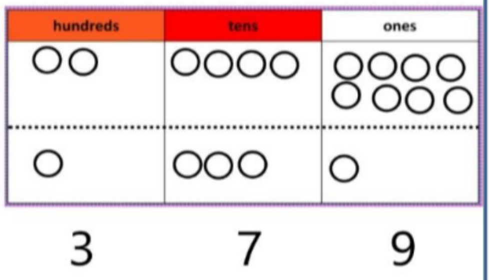
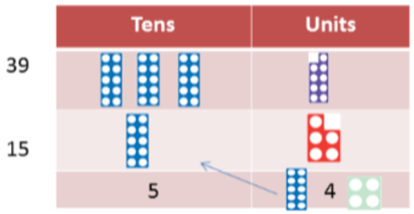
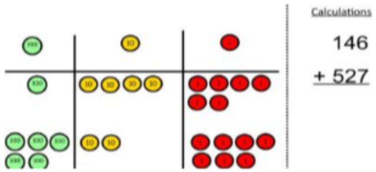
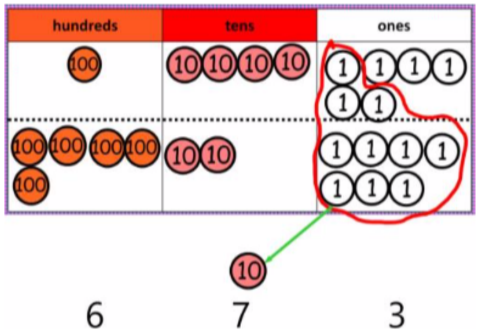
Y2

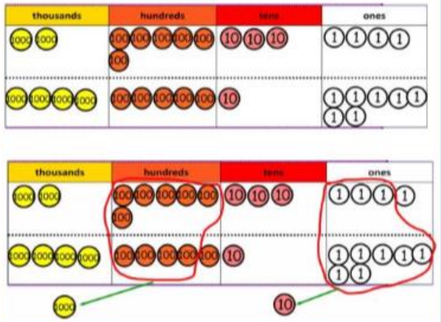
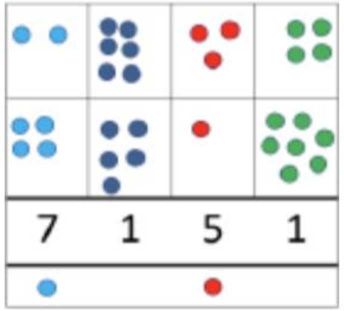
ADDITION +

Objective & Strategy	Concrete	Pictorial	Abstract
Add any two 2-digit numbers	Dienes and part-part-whole model:  	26 + 30 + 7  	$24 + 38 = \square$ $38 + 24 = \square$ $29 + \square = 51$ $\square + 22 = 51$
Add three 1-digit numbers	 Combine to make magic 10 first where relevant, or bridge 10 then add third	Use language of fist, then, then, now Pictorial:  Use part part whole to show magic ten  	4 + 7 + 6 = $\boxed{10}$ + $\boxed{7}$ 10 = $\boxed{17}$ Combine the two numbers that make/ bridge ten then add on the third.
Adding two numbers that bridge 10.	 Use double sided counters and ten frames. Move counters to fill the ten frame and make Magic 10	 Show on a number line how 5 is portioned into adding three, then adding 2.	

Y3

ADDITION +

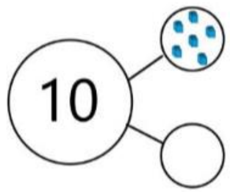
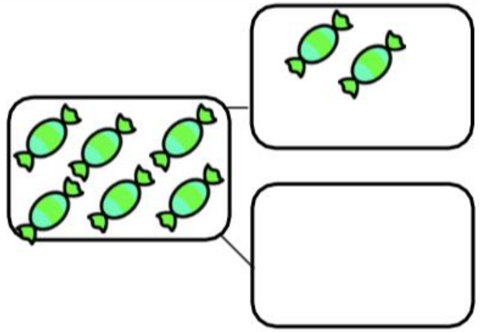
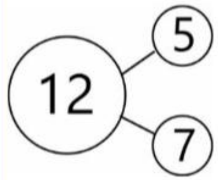
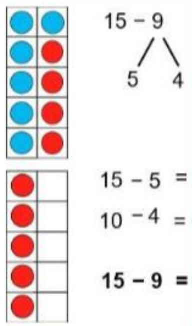
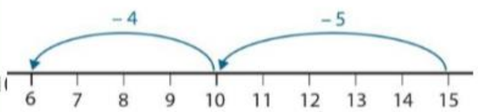
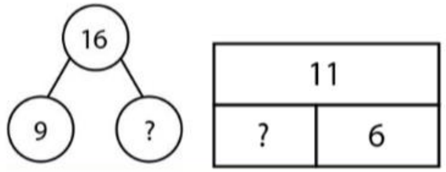
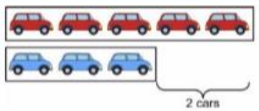
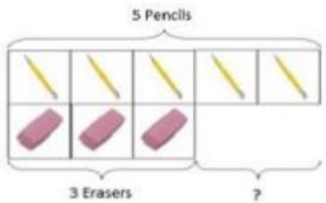
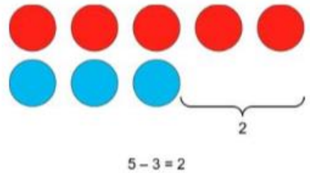
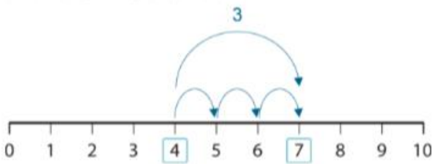
Objective &Strategy	Concrete	Pictorial	Abstract
Column Addition—no regrouping 3-digit numbers	 Model using Dienes or numicon Add together the ones first, then the tens.   Move to using place value counters	Children move to drawing the counters using a tens and one frame. 	$$\begin{array}{r} 248 \\ +\ 131 \\ \hline 379 \\ \hline \end{array}$$ Add the ones first, then the tens, then the hundreds.
Column Addition with regrouping. Use language of exchange or regroup to describe carrying	 Exchange ten ones for a ten. Model using numicon and pv counters. 	Children can draw a representation of the grid to further support their understanding, carrying the ten **underneath** the line 	Use expanded method ONLYWHEN NEEDED $$\begin{array}{rcrl} 20 & + & 5 & \\ 40 & + & 8 & \\ \hline 60 & + & 13 & = 73 \end{array}$$ Start by partitioning the numbers before formal column to show the exchange. $$\begin{array}{r} 536 \\ +\ 85 \\ \hline 621 \\ \hline 1\ 1 \end{array}$$

Objective & Strategy	Concrete	Pictorial	Abstract
Add numbers with up to 4 digits	Children continue to use dienes or pv counters to add, exchanging ten ones for a ten and ten tens for a hundred and ten hundreds for a thousand.  	 Draw representations using pv grid.	$\begin{array}{r} 2634 \\ +\ 4517 \\ \hline 7141 \\ \hline {}_{1\ \ \ 1\ \ } \end{array}$ Continue from previous work to carry ones, tens and hundreds. Relate to money and measures.

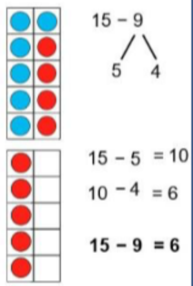
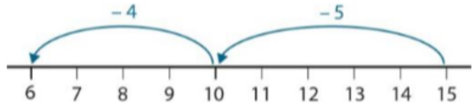
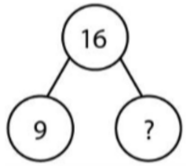
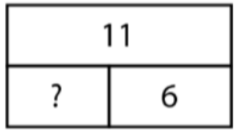
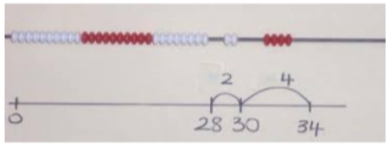
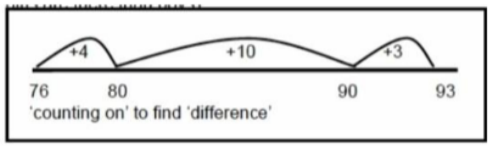
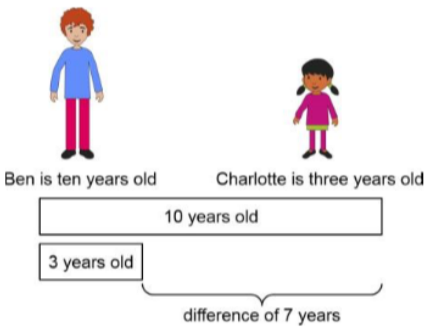
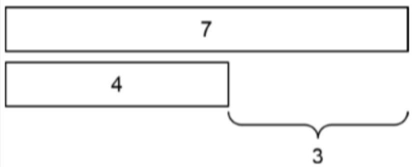
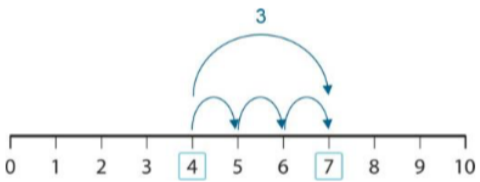
Y4

ADDITION +

Y1 SUBTRACTION -

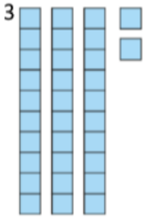
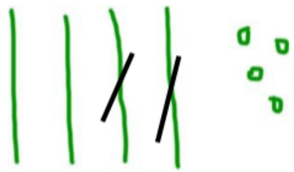
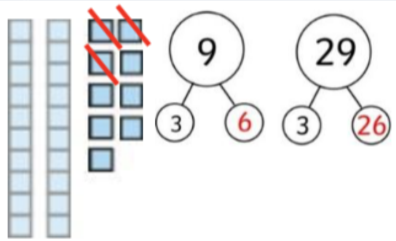
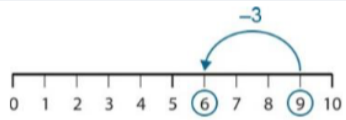
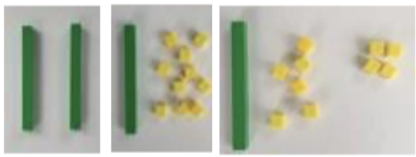
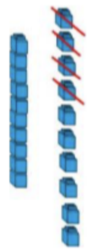
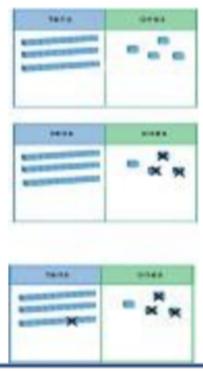
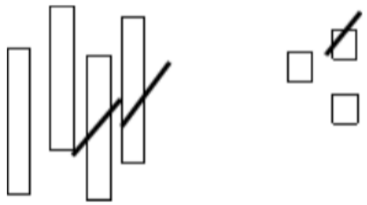
Objective & Strategy	Concrete	Pictorial	Abstract
Represent and use number bonds and related subtraction facts within 20 Part-Part-Whole model	 Link to addition. If 10 is the whole and 6 is one of the parts, what's the other part? 10—6 = 4	 Use pictorial representations to show the part.	Move to using numbers within the part whole model.  12 - 5 = 7 12 - 7 = 5 7 = 12 - 5 5 = 12 - 7
Subtract by making ten	15—9 Make 15 on the ten frame. Take 5 away to make ten, then take 4 more away so that you have taken 9.  15 − 5 = 10 10 − 4 = 6 **15 − 9 = 6**	15 – 9  Jump back 5 first, then another 4. Use ten as the stopping point.	16—9 How many do we take off first to get to 10? How many left to take off? 
Compare numbers by finding the difference.	 There are 2 more red cars than blue cars.  There are 2 more pencils than erasers.	 Use a number line to count on.. 	Hannah has12 sweets and her sister has 5. How many more does Hannah have than her sister?

Y2 SUBTRACTION -

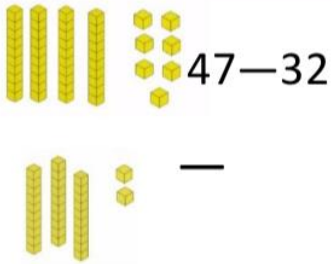
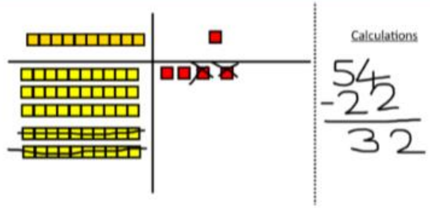
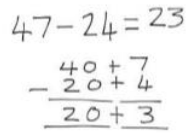
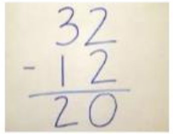
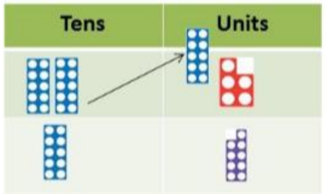
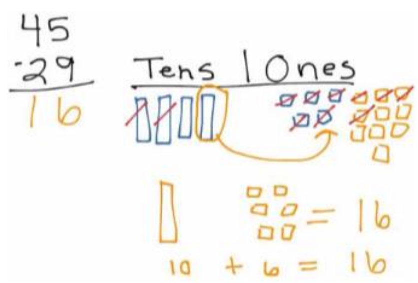
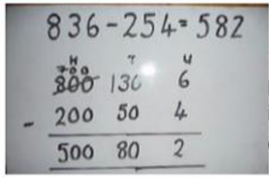
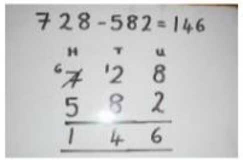
Objective & Strategy	Concrete	Pictorial	Abstract
Subtracting by making 10	Make 15 on the ten frame. Take 5 away to make ten, then take 4 more away so that you have taken 9. 15 - 9 = 	15 - 9 =  Jump back 5 first, then another 4. Use ten as the stopping point.	16 - 9 = How many do we take off first to get to 10? How many left to take off?  
Counting on to next ten *Progression should be crossing one ten, crossing more than one ten, crossing the hundreds.*	34 - 28 =  34—28 Use a bead bar or bead strings to model counting to next ten and the rest. 28 to 30 is 2, 30 to 34 is 4. So, 34 - 28 = 6	 Use a number line to count on to next ten and then the rest. Begin with bead line, move to landmarked line then to ENL.	93—76 = 17 76 ⟶ 80 = 4 80 ⟶ 93 = 13 13 + 4 = 17
Subtractions as difference		 	The difference between 24 and 16 is 8.

Y2

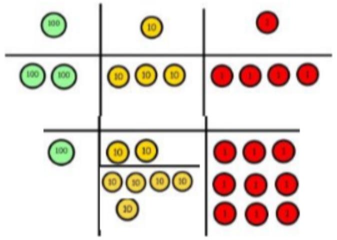
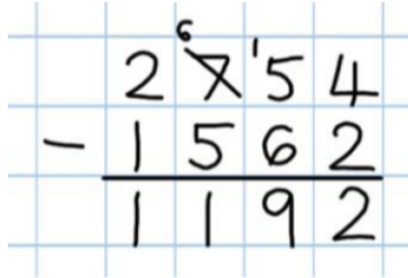
SUBTRACTION -

Objective & Strategy	Concrete	Pictorial	Abstract
Subtracting a multiple of 10	 32 - 10 = 22 Children use dienes, PV counters or Numicon. They remove the correct number of tens	 Children draw rods and cubes and cross off multiples of ten.	64 - 10 = ☐ 64 - 20 = ☐ 64 - 30 = ☐ 64 - ☐ = 24 ☐ - 50 = 14
Subtract a single digit from a two digit number No regrouping	 Explore that 9 - 3 = 6 so 29 - 3 = 26 etc	 9 – 3 = 6  19 – 3 = 16	9 - 3 = 6 19 - 6 = 13 29 - 6 = 23 etc
Regroup a ten into ten ones	 Use a PV chart to show how to change a ten into ten ones, use the term 'take and make'.	20 - 4 = 16 	20—4 = 16
Partitioning to subtract without regrouping.	34—13 = 21 Use Dienes to show how to partition the number when subtracting without regrouping. 	43—21 = 22 Children draw representations of Dienes and cross off. 	43—21 = 22

Y3 SUBTRACTION -

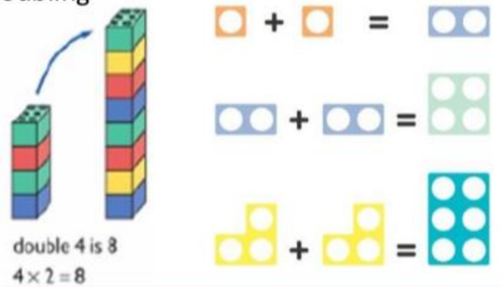
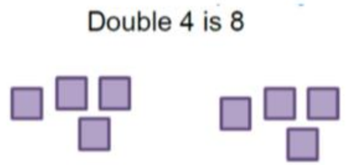
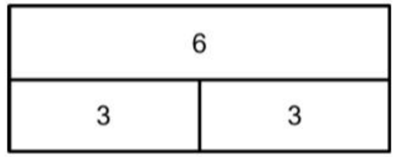
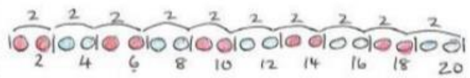
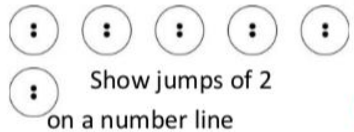
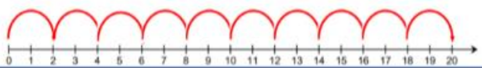
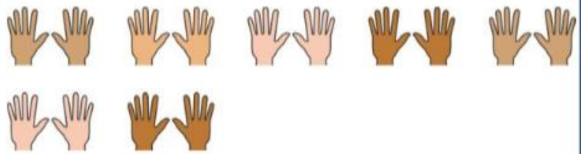
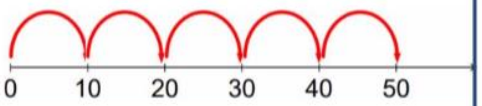
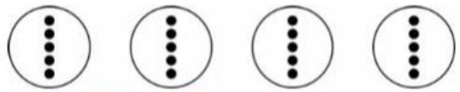
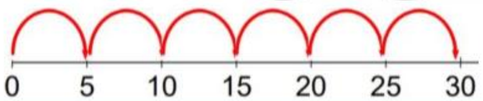
Objective & Strategy	Concrete	Pictorial	Abstract
Column subtraction without regrouping (friendly numbers)	 Use base 10 or Numicon to model	 Draw representations to support understanding	 Intermediate step may be needed to lead to clear subtraction understanding. 
Column subtraction with regrouping	 Begin with base 10 or Numicon. Move to pv counters, modelling the exchange of a ten into ten ones.		 Begin by partitioning into pv columns  Then move to formal method.

Y4 SUBTRACTION -

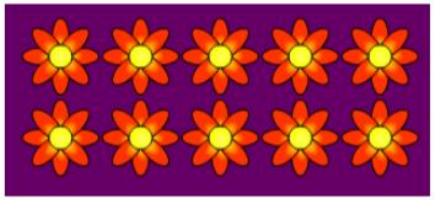
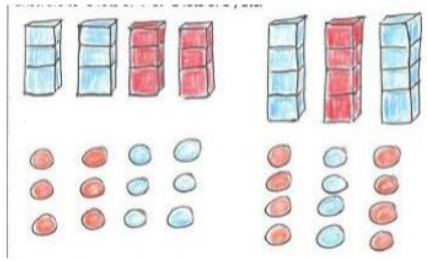
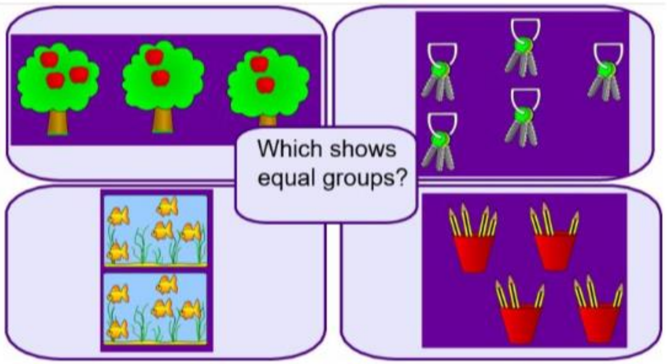
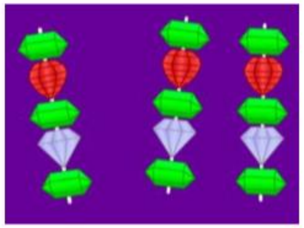
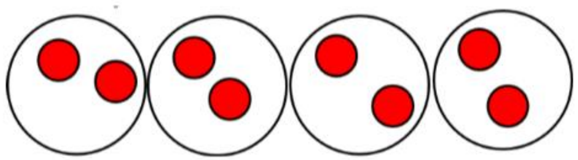
Objective & Strategy	Concrete	Pictorial	Abstract
Subtracting tens and ones Subtract with up to 4 digits. *Introduce decimal subtraction through context of money*	234 - 179  Model process of exchange using Numicon, base ten and then move to PV counters.	Children to draw pv counters and show their exchange—see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

Y1

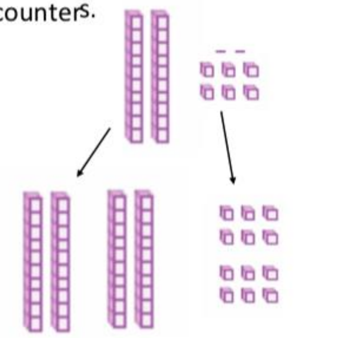
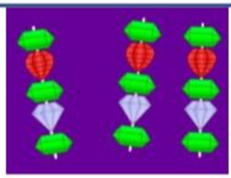
MULTIPLICATION X

Objective & Strategy	Concrete	Pictorial
Double numbers to 10	Use practical activities using manipulatives including cubes and Numicon to demonstrate doubling 	Draw pictures and bar models to show how to double numbers  
Counting in groups of 2	Count in 2s using real life objects and contexts. 	Children make representations to show counting in multiples of 2. Count in multiples of a number aloud.   Show jumps of 2 on a number line 
Counting in groups of 10	Use real life objects and contexts to count in groups of 10 	Use and draw representations for counting in multiples of 10. Count in multiples of 10 aloud  Show jumps of 10 on a number line 
Counting in groups of 5	Use real life objects and contexts to count in groups of 5 	Use and draw representations for counting in multiples of 5. Count in 5s aloud.  

Y1 MULTIPLICATION X

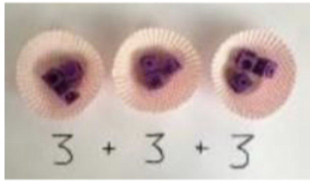
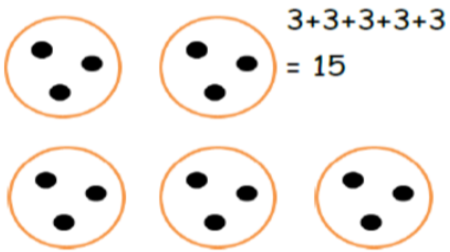
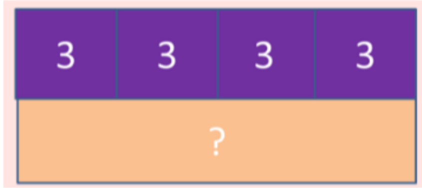
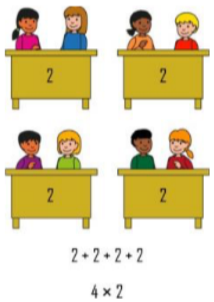
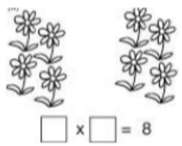
Objective & Strategy	Concrete	Pictorial
Understand and use arrays	Use objects laid out in arrays to find the answers to 2 lots of 5, 3 lots of 2 etc. 	Make and draw representations of arrays to show understanding 
Equal/non equal groups	Use real life objects and contexts to examine equal and non-equal groups.   There are 3 equal groups. There are 5 in each group.	Children make/match representations of real life problems to show equal groups and find the total.  There are 4 equal groups. There are 2 in each group. There are 8 altogether.

Y2 MULTIPLICATION X

Objective & Strategy	Concrete	Pictorial	Abstract
Double a 2-digit number	Model doubling using dienes and PV counters.  40 + 12 = 52	Draw pictures and representations to show how to double numbers	Partition a number and then double each part before recombining it back together 16 10 6 x2 x2 20 + 12 = 32
Understand equal and non-equal groups	Equal groups   Not equal groups  There are 5 equal groups. Each group has 3 cakes.	Make representations and drawings of equal groups   I have 4 groups of 3.	

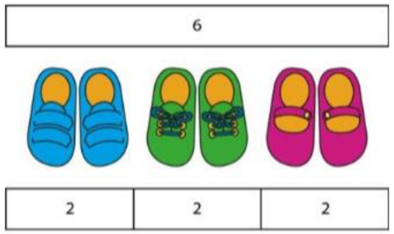
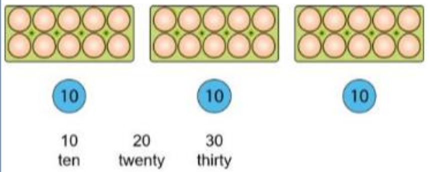
Y2

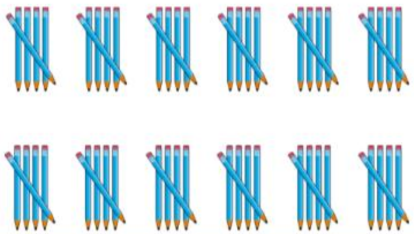
MULTIPLICATION X

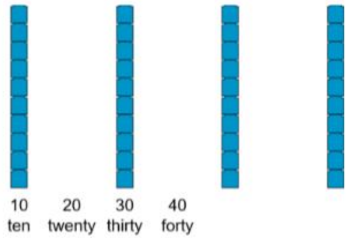
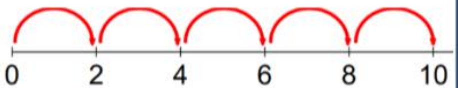
Objective & Strategy	Concrete	Pictorial	Abstract
Use repeated addition for multiplications	Use objects and real life contexts.  There are 5 groups of 2. There are 10 socks altogether.  There are 3 groups of 3. There are 9 altogether.	Make and draw representations to show repeated addition There are 3 sweets in one bag. How many sweets are in 5 bags altogether?  Use bar models for representations of repeated additions.	Create number sentences using repeated addition to match representations.  3 + 3 + 3 + 3 = 12
Relate repeated addition to multiplication using the x sign.	Write multiplication sentences to match repeated addition.  	Children make and draw representations and record both an addition sentence and a multiplication sentence.  1 + 1 + 1 + 1 + 1 + 1 = 6 6 x 1 + 6  	Write multiplication sentences to match repeated addition, without the support of representations. 2 + 2 + 2 + 2 + 2 = 10 5 x 2 = 10

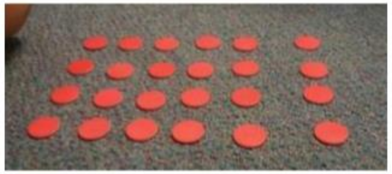
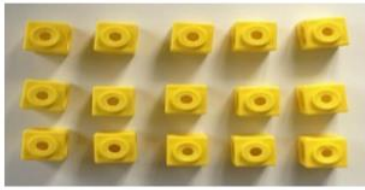
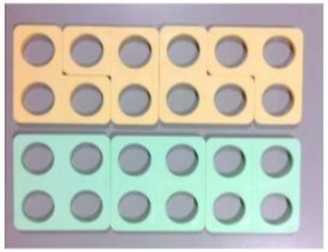
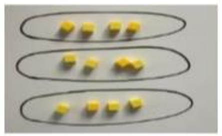
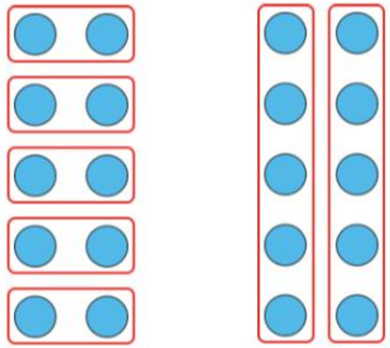
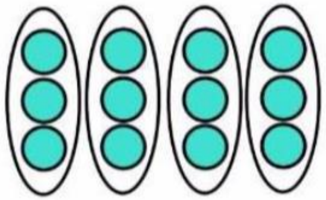
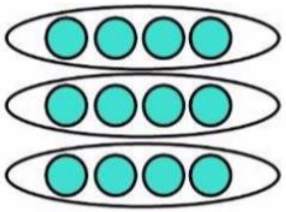
Y2

MULTIPLICATION X

<table>
<tr><th>Objective & Strategy</th><th>Concrete</th><th>Pictorial</th><th>Abstract</th></tr>
<tr>
<td>Understand the 2, 5 and 10 times table</td>
<td>Use objects and real life contexts for multiples of 2, 5 and 10

$3 \times 2 = 6$
$6 = 3 \times 2$

$3 \times 10 = 30$

</td>
<td>Make and draw representations for 2, 5 and 10 times tables

$12 = 6 \times 2$

$4 \times 10 = 40$
Number lines, bead strings, counting sticks and bar models should be used to show representation of counting in multiples.

$5 \times 2 = 10$
</td>
<td>Understand the terms factor and product
<table><tr><td>3</td><td>×</td><td>2</td><td>=</td><td>6</td></tr><tr><td>factor</td><td>×</td><td>factor</td><td>=</td><td>product</td></tr></table>
<table><tr><td>6</td><td>=</td><td>3</td><td>×</td><td>2</td></tr><tr><td>product</td><td>=</td><td>factor</td><td>×</td><td>factor</td></tr></table>
Count in multiples of a number aloud.</td>
</tr>
</table>

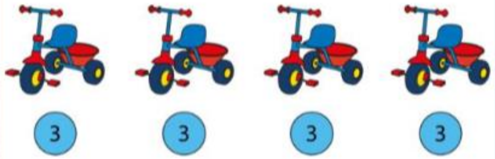
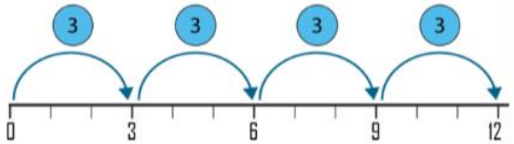
Objective & Strategy	Concrete	Pictorial	Abstract
Multiplication is commutative	Create arrays using counters and cubes and Numicon.    Pupils should understand that an array can represent different equations and that, as multiplication is commutative, the order of the multiplication does not affect the answer.  	Use representations of arrays to show different calculations and explore commutativity.  $5 \times 2 = 10$ $5 \times 2 = 10$ 5 groups of 2 2 groups of 5 2, five times 5, two times  	$12 = 3 \times 4$ $12 = 4 \times 3$ Use an array to write multiplication sentences and reinforce repeated addition.  $5 + 5 + 5 = 15$ $3 + 3 + 3 + 3 + 3 = 15$ $5 \times 3 = 15$ $3 \times 5 = 15$

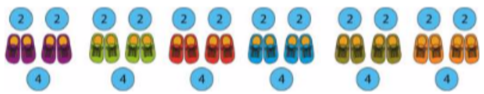
Y2

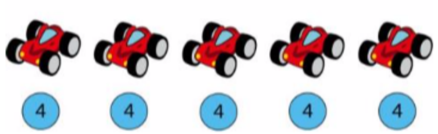
MULTIPLICATION X

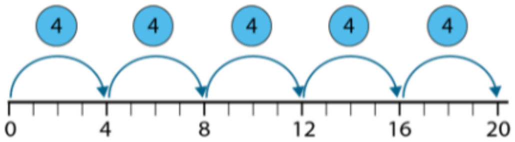
Y3

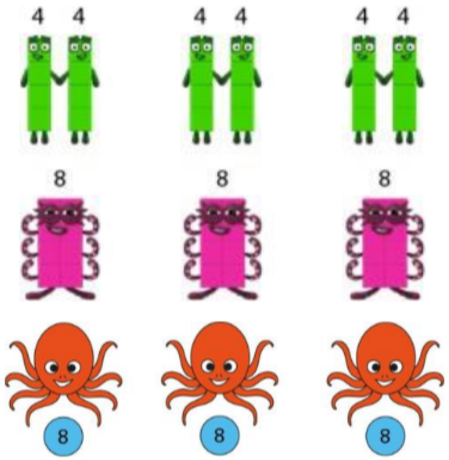
MULTIPLICATION X

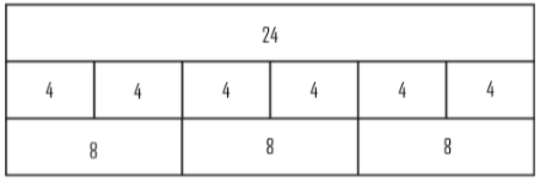
Objective & Strategy	Concrete	Pictorial	Abstract
Understand the 3 times table	Count in three using objects and representations of multiples of 3. 		There are 12 wheels. $4 \times 3 = 12$ $3 \times 4 = 12$

<table>
<tr><th>Objective & Strategy</th><th>Concrete</th><th>Pictorial</th><th>Abstract</th></tr>
<tr>
<td>Understand the 4 times table</td>
<td>We can double our 2 times table to get the 4 times table


Pupils revise 2 times table from year 2 and make link that this can be doubled to obtain 4 times table.
How many wheels? Count in groups of 4.

</td>
<td>


</td>
<td>12 x 2 = 24
6 x 2 = 24

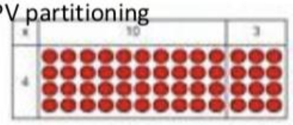
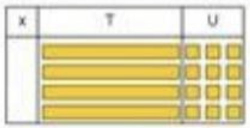
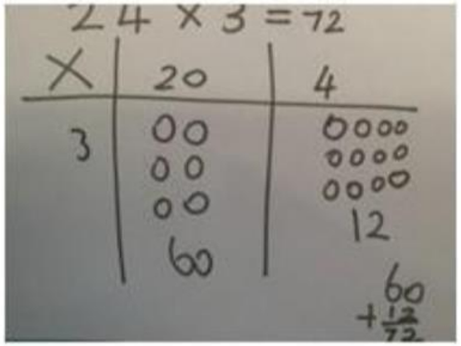
There are 20 wheels.
5 × 4 = 20
4 × 5 = 20</td>
</tr>
<tr>
<td>Understand the 8 times table</td>
<td>We can double our 4 times table to get the 8 times table

</td>
<td>


</td>
<td>6 x 4 = 24
3 x 8 = 24</td>
</tr>
</table>

Y3

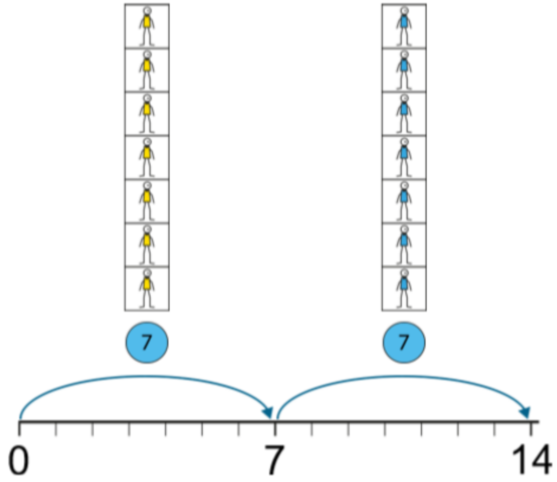
MULTIPLICATION X

Y3 MULTIPLICATION X

Objective & Strategy	Concrete	Pictorial	Abstract
Multiplying 2-digit by 1 digit using partitioning (distributive law)	Show the links with arrays to illustrate the PV partitioning  4 rows of 10 4 rows of 3 Move onto base ten to move towards a more compact method.  4 rows of 13 Move on to place value counters to show how we are finding groups of a number. We are multiplying by 4 so we need 4 rows	Children can represent their work with place value counters in a way that they understand. They can draw the counters using colours to show different amounts or just use the circles in the different columns to show their thinking as shown below.  	$13 \times 4 = 52$ $4 \times 10 = 40$ $4 \times 3 = 12$ $40 + 12 = 52$ Grid Method – as pictorial but without the place value counters

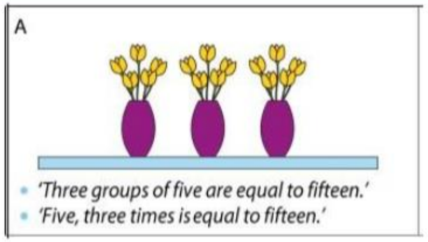
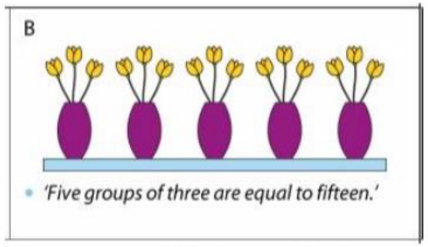
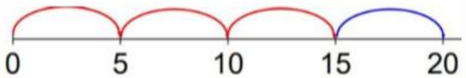
Y4

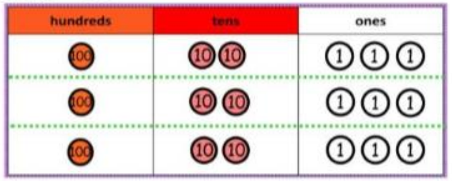
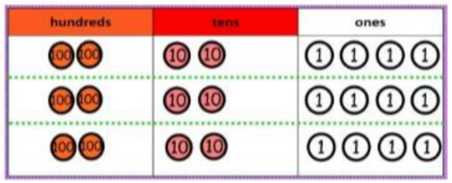
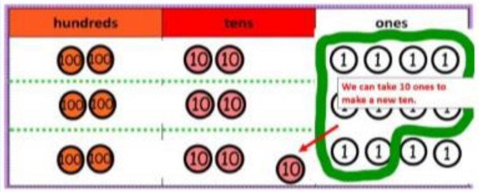
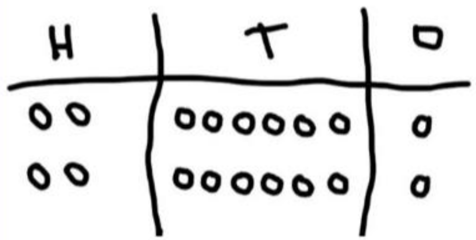
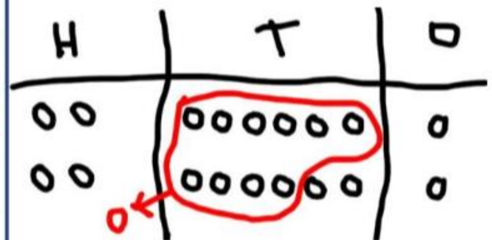
MULTIPLICATION X

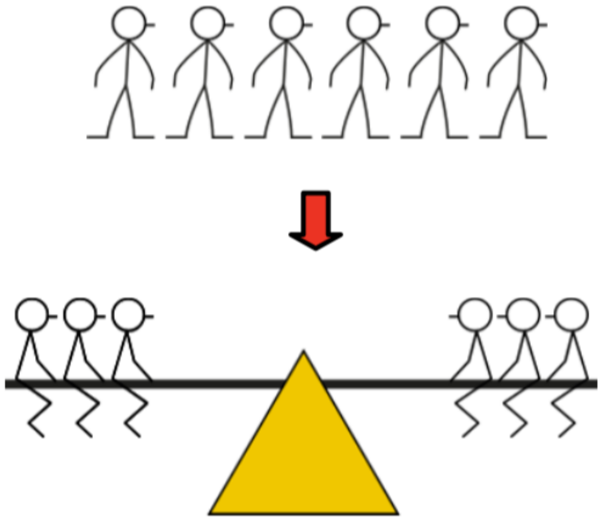
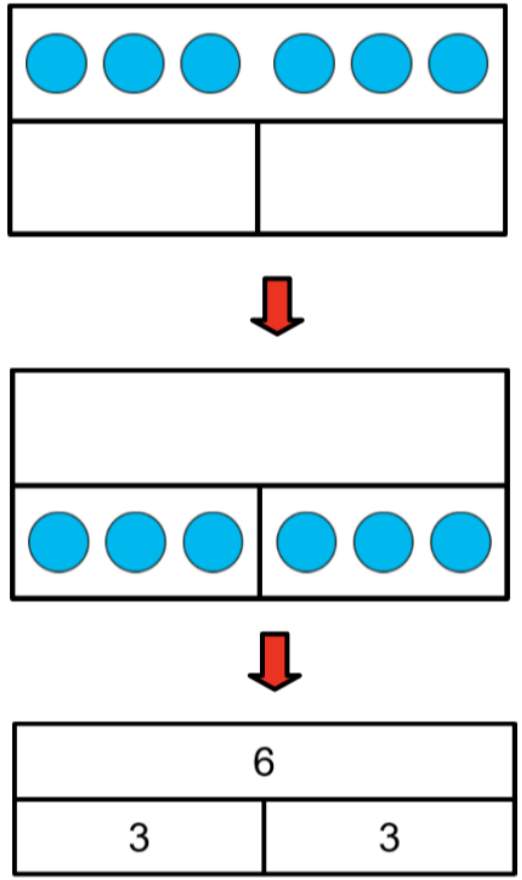
Objective & Strategy	Concrete	Pictorial	Abstract
Understand the 6, 7, 9, 11 and 12 times table *Examples given for the 7 x are applicable for all*	Children use representations which show groups of 7 including real life contexts.	Linear models show jumps of 7. 	There are 14 players. 2 × 7 = 14 7 × 2 = 14

Y4

MULTIPLICATION X

Objective & Strategy	Concrete	Pictorial	Abstract
Understanding the commutative law.	  "Three groups of five is equal to five groups of three."	 	3 x 5 = 15 5 x 3 = 15 5 x 3 = 3 x 5 = 15 15 ÷ 3 = 5 15 ÷ 5 = 3
Understanding the distributive law	 	 	4 x 5 = 3 x 5 + 5 = 20 4 x 5 = 5 x 5 – 5 = 20

Objective & Strategy	Concrete	Pictorial	Abstract
Multiply 3 digit numbers by 1 digit. (no exchange)	Use place value counters to show how we are finding groups of a number. We are multiplying by 3 so we need 3 rows 123 x3 = 369  300 + 60 + 9 Add up each column, starting with the ones.	Children can represent their work with place value counters by drawing place value counters or Dienes.	Grid method or Short division using pv counters
Multiply 3 digit numbers by 1 digit. (with exchange)	224 x 3  Regroup ten ones to make a new ten.  600 + 70 + 2 +672	261 x 2   500 + 20 + 2 +522	Grid method or Short division using pv counters

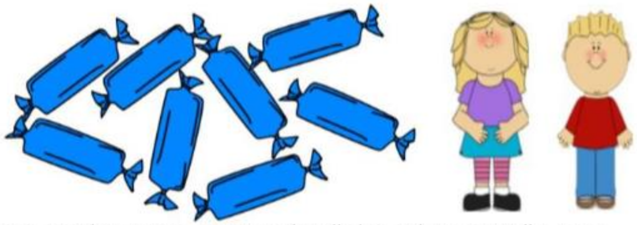
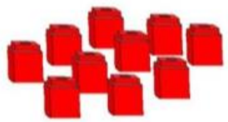
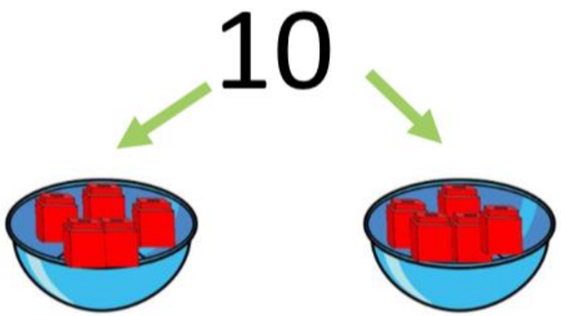
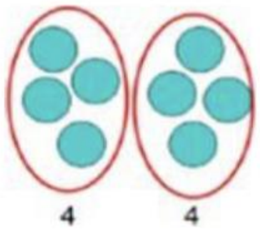
Objective & Strategy	Concrete	Pictorial
Find half of numbers to 20.	Real ife and practical contexts are used to find half of numbers up to 20. 	Children use manipulatives to represent real life problems.  half of 6 = 3 double 3 = 6

Y1

DIVISION ÷

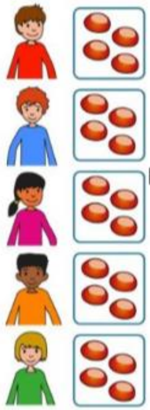
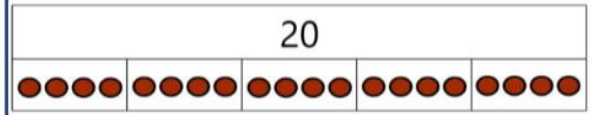
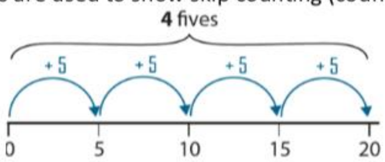
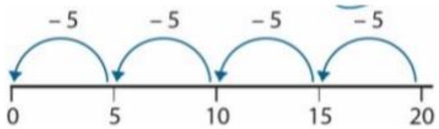
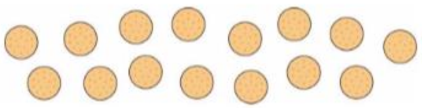
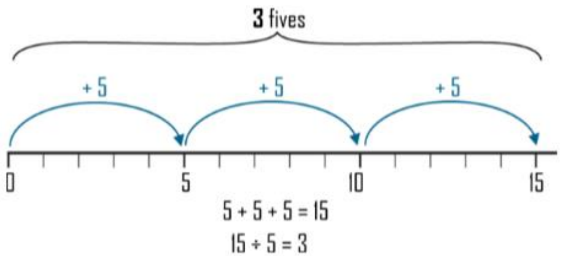
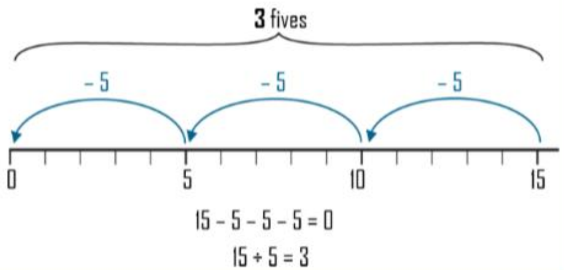
Y1

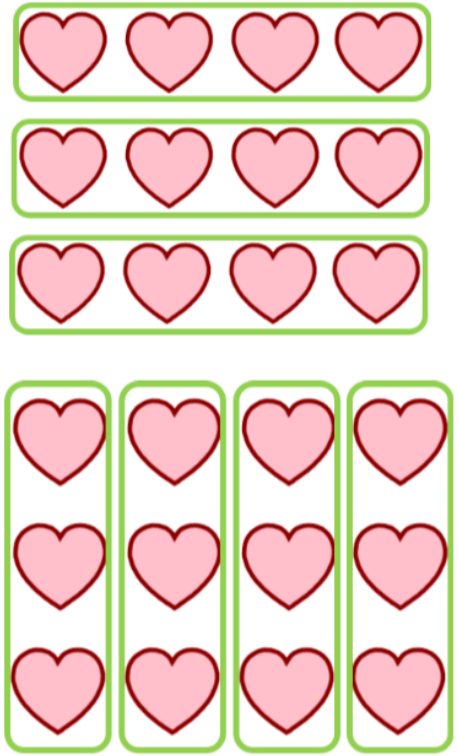
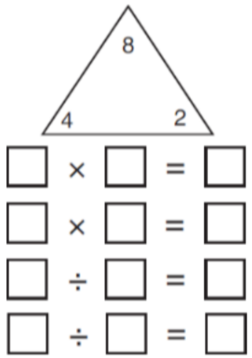
DIVISION ÷

Objective & Strategy	Concrete	Pictorial
Understand division as sharing into equal groups	Children solve real life problems using real objects.  There are eight sweets. Daisy and Will share these equally. How many do they get each? I have 10 cubes, can you share them equally in 2 groups?   There are 2 equal groups. Each group has 5.  	Children use pictures or shapes to share quantities.  8 shared between 2 is 4 10 shared between 2 is 5

Y2

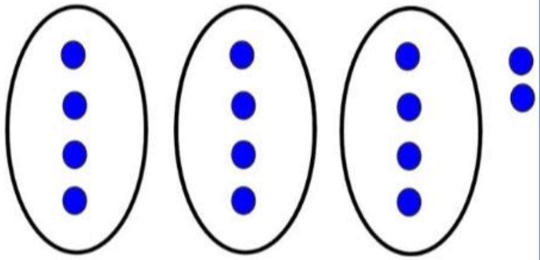
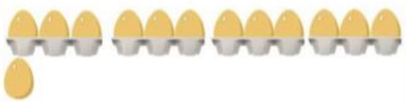
DIVISION ÷

Objective & Strategy	Concrete	Pictorial	Abstract
Division as sharing (partitive)	There are 20 conkers shared equally be-tween 5 children.  h child gets 4 conkers.	Children use pictures or shapes to share quantities. They may use bar modelling to show and support understanding.  Number lines are used to show skip counting (counting forwards)  and repeated subtraction (counting backwards). 	20 ÷ 5 = 4
Division as grouping (quotitive)	Use cubes, counters or real objects or to aid understanding. There are 15 biscuits, there are 5 in each bag. How many bags?  	 	15 divided into groups of 5 is 3 15 ÷ 5 = 3

Objective & Strategy	Concrete	Pictorial	Abstract
Understanding the Inverse			3 x 4 = 12 12 ÷ 4 = 3 4 x 3 = 12 12 ÷ 3 = 4 2 x 4 = 8 4 x 2 = 8 8 ÷ 2 = 4 8 ÷ 4 = 2 8 = 2 x 4 8 = 4 x 2 2 = 8 ÷ 4 4 = 8÷ 2 Show all 8 related fact family sentences.

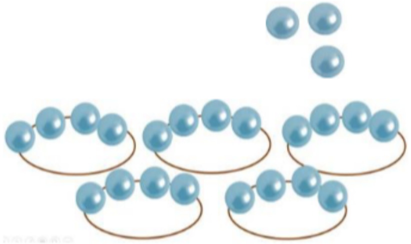
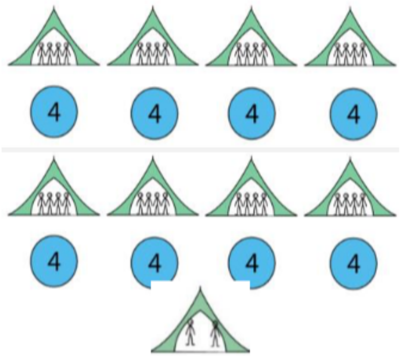
Y3

DIVISION ÷

Objective & Strategy	Concrete	Pictorial	Abstract
Division with remainders. (partitive)	I divide 14 cakes between 3 plates. How are the cakes shared? 	Draw dots and group them to divide an amount and clearly show a remainder. 	Complete written divisions and show the remainder using r. 14 ÷ 3 = 4 r 2 dividend divisor quotient remainder
Division with re- mainders. (quotitive)	13 eggs are put into boxes. Each box holds 3 eggs. How are the eggs boxed? 	Children may draw representations to show their under- standing.  Use bar models to show division with remainders. 13 3 | 3 | 3 | 3 | 1	13 ÷ 3 = 4 r 1

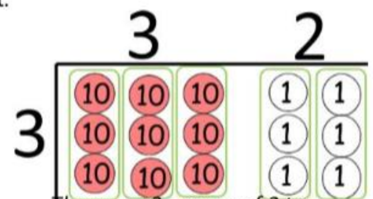
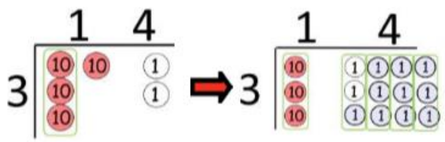
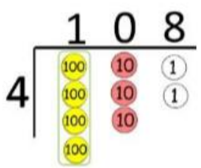
Y4

DIVISION ÷

Objective & Strategy	Concrete	Pictorial	Abstract
Interpreting division with remainders.	Bracelets are made using 4 beads. There are 23 beads. How many bracelets can be made? How many beads left over? 	Bar model representations may be used. 23 4 | 4 | 4 | 4 | 4 | 3	$23 \div 4 = 5$ r 3
Interpreting division with remainders.	4 scouts can fit in each tent. How many tents needed for 30 scouts?  	30 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2	$30 \div 4 = 7$ r 2 8 tents are needed. Discuss with pupils the need to round up in this context.

Y4

DIVISION ÷

Objective & Strategy	Concrete	Pictorial	Abstract
Divide 2 and 3 digit numbers by 1 digit. Short Division	96 ÷ 3 Use place value counters to makes groups of the divisor, starting with the largest value digit.  *There are 3 groups of 3 tens.* *There are 2 groups of 3 ones.* 42 ÷ 3  *There is 1 group of 3 tens. There is a ten left over. We exchange this for 10 ones. 12 ones divided by 3 is 4* *432 ÷ 4*  *There is 1 group of 4 hundreds. There are no groups of 4 tens and three tens left over. There are 8 groups of 4 ones.*	Students use drawn diagrams with dots or circles to show their understanding.	Begin with divisions that divide equally with no remainder. $\begin{array}{r} 1\;2\;4 \\ 3\overline{)\;3\;7\;{}^{1}2} \end{array}$ Move onto divisions with a remainder. Return to concrete if necessary. $\begin{array}{r} 1\;3\;8\ \text{r}\,3 \\ 4\overline{)\;5\;{}^{1}2\;7} \end{array}$