Granby Junior School

Maths Calculation Policy

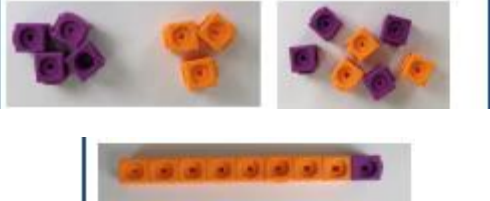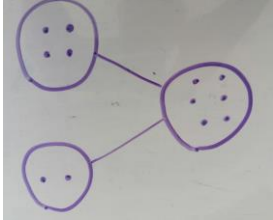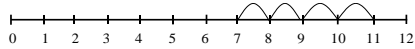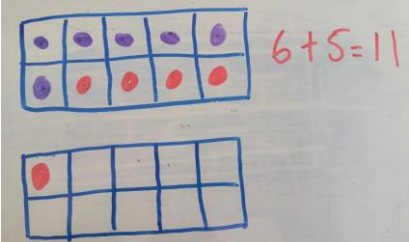| Review Date	Approved by	Governor Minute Reference

Granby Junior School Calculation Policy 2022

At Granby Junior School we believe that learning in mathematics should be underpinned through a concrete, pictorial and abstract approach. Both mental and written methods are important and children will be taught how to choose the most efficient method depending on the calculation given.
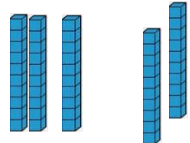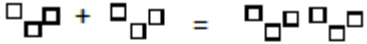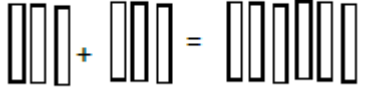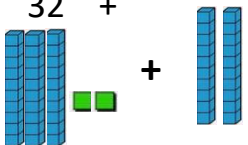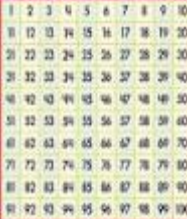
The calculation policy covers year 1 to year 6 to ensure that progression from Infants to KS2 is clear and to support the catch-up curriculum.

Addition Vocabulary: add, addition, total, altogether, sum, more

Year 1

Objective	Concrete	Pictorial	Abstract
Combining two parts to make a whole: part-whole model	Counters, cubes, base 10	Use pictures to add 2 numbers together	4 + 3 = 7 7 = 4 + 3 (understanding the concept of the = sign important here)
Counting on – starting at the biggest number (count on not count all)		Numbertracks and numberlines to count on from larger number (encourages them to not to count all)	? = 4 + 7 7 + 4 = ? Place the larger number in your head and count on
Regrouping to make 10	Use tens frames with cubes/counters	Draw tens frame and counters	7 + 4 = ? 3 1 I know that 7 + 3 = 10, so I need to add 1 more to make 11

Year 2

Objective	Concrete	Pictorial	Abstract
Add multiples of 10	Use base 10 30 + 20	Use representations of base 10 $\|\|\| + \|\|$ +	50 = 20 + 30 30 + 20 = 50
Use known facts	$\square\square + \square\square = \square\square\square\square$ $\|\|\| + \|\|\| = \|\|\|\|\|\|$ 3 + 3 = 6 30 + 30 = 60	Use representations of base 10 ••• + ••• $\|\|\| + \|\|\|$	3 + 2 = 5 So 30 + 20 = 50 Moving to 300 + 200
Add a 2 digit number and ones	Developing an understanding of partitioning and place value, using Base 10, PV counters or numicon.. 41 + 8	Use representations of base 10 and tens frame $\|\|\|\|$ •• + ⋮⋮	41 + 8 = 49 *recall of number facts must be secure by this point 1 + 8 = 9
Add a 2 digit number and tens	Use base 10, place value counters and grids (explore how the 1s don't change) 32 + 20 = 52	Counting on a number square	32 + 10 = 42 32 + 20 = 52 Counting in tens: 32 (hold it in your head), 42, 52

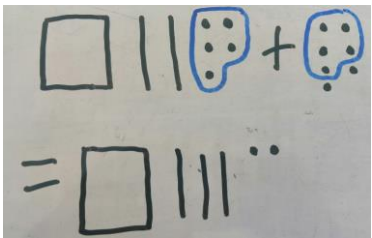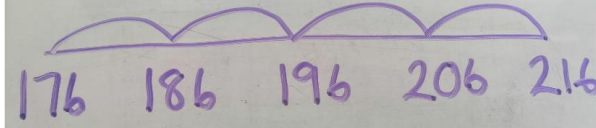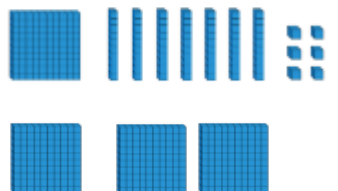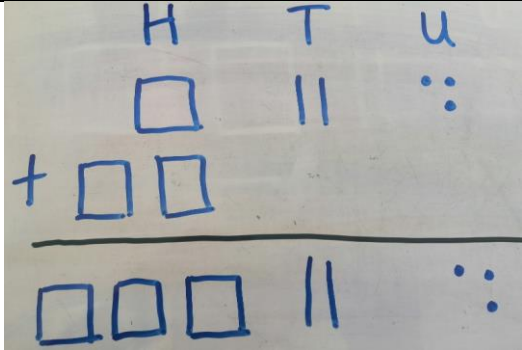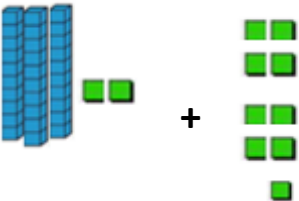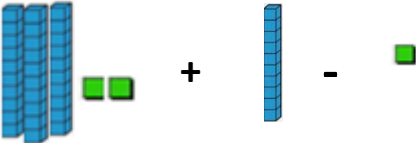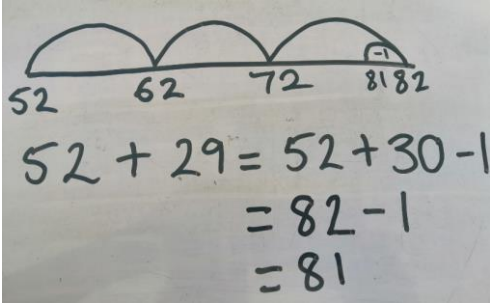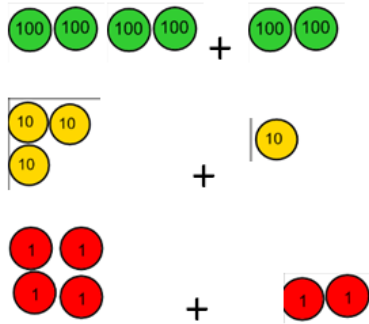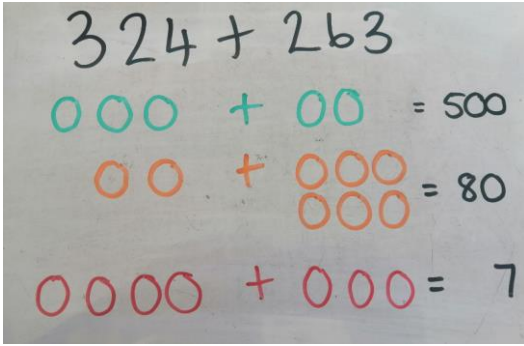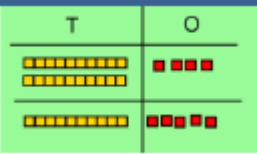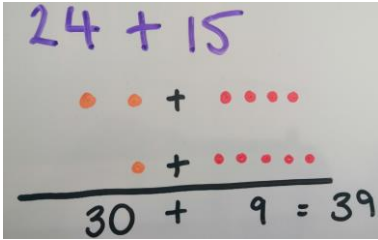|			
Add two 2 digit numbers (units don't cross 10)	Use base 10, place value counters and grids 32 + 25	+	Partitioning 32 + 25 = 57 30 + 20 = 50 2 + 5 = 7 50 + 7 = 57
Add two 2 digit numbers (bridging 10 and exchanging)	Use base ten and place value grids Partitioning into tens and units Leading to exchanging: 72 	Draw representations +	47 +25 Partitioning Add tens 40 + 20 = 60 Add ones 7 + 5 = 12 Recombine 60 + 12
Add 3 one digit numbers	 Combine to make 10 first if possible, or bridge 1o then add third digit	Combine to make 10 or bridge 10, then add the third digit	Draw representations – look for bonds to ten or make 10 	 Combine the two numbers that make/ bridge ten then add on the third.
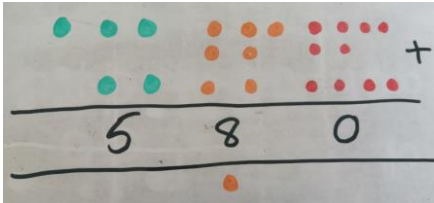
KS2 Addition

Objective	Concrete	Pictorial	Abstract
Add a three-digit number and ones (mental) Year 3	Base 10 Explore which columns will change and discuss why. Look at where there might be an exchange. 	Draw representations 	125 + 7 = Make the next 10 125 + 5 = 130 + 2 = 132
Add a three-digit number and tens (mental) Year 3	Use base 10, place value counters and grids Explore which columns will change and why 	Draw representation Number squares Bar models Number lines 	Count on in 10s 176 + 40 176 (held in head), 186, 196, 206, 2016
Add a three-digit number and hundreds (mental) Year 3	Use base 10, place value counters and Grids Explore which columns will change and why 		Count on in 100s 176 + 300 176 (held in head), 276, 376, 476

| Adjusting - add near multiples of 10, then adjust (mental)

Year 3 – TU + U and TU

Year 4 with appropriate numbers

Year 5 – add near multiples of 10 and 100, then adjust

Year 6 - add near multiples of 10, 100 and 1000, then adjust | Number lines
100 squares

32 + 9 =

Add one to make 9 into 10 and exchange for a ten stick

Increasingly large numbers
53 + 19
53 + 99 | Numberline or 100 squares to count on then adjust

 | First we add 52 + 30 = 82 then subtract 1 or 52 + 29 is equal to 52 + 30 – 1 = 81 |

Partition to add increasingly large numbers Year 4 – HTU + HTU up to 4 digits Year 5 up to 5 digits and decimals Year 6 increasingly larger numbers	Partition into HTO then add and recombine 	Draw PV counters OR base 10 equipment 	Jottings to add Either partition both numbers and recombine or partition the second number only e.g. 358 + 73 = 358 + 70 + 3 **or** 300 + (50+70) + (8+3) Decimals: 35.8 + 7.3 35 + 7 = 42 0.8 + 0.3 = 1.1 then recombine 42 + 1.1 = 43.1
Written methods			
Add numbers with up to three digits, using a formal written of columnar addition Expanded form first leading to formal column method	Use Base 10, place value counters and place value grids Model adding ones first – always start on the right	Expanded form 24 + 15 = Draw representation – place value counters 	Expanded form 20 + 4 10 + 5 30 + 9 = 39 Leading to formal written method 34 + 15 39

| Add numbers with up to three digits, using a formal written of columnar addition
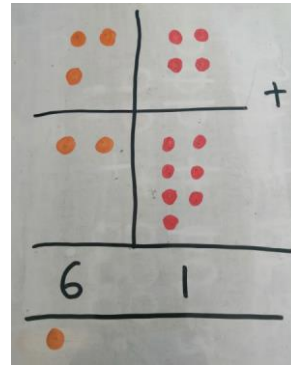
Method used for Year 4 – up to 4 digits Year 5 – up to 5 digits and decimals up to 2dp including money Year 6 – adding several numbers with different digits and decimals with different numbers of dp |
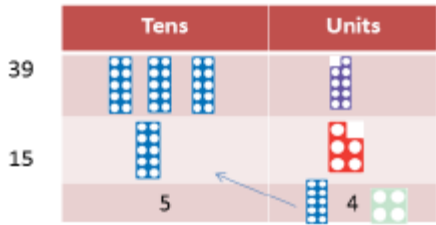
Exchange ten ones for a ten. Model using numicon and pv counters.
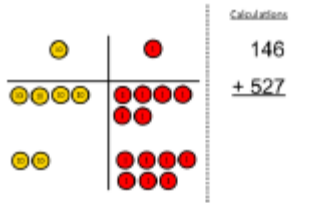
 | Draw representations using PV counters OR Base 10 and exchanging the ones for tens and placing underneath tens column | | Start with expanded form (partitioned) so they understand the exchange
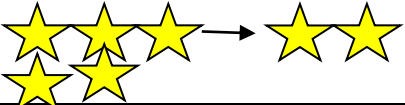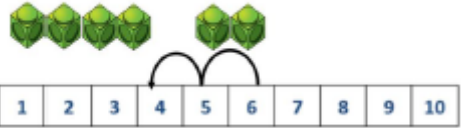
40 + 8
20 + 3
60 + 11 = 71

Moving to
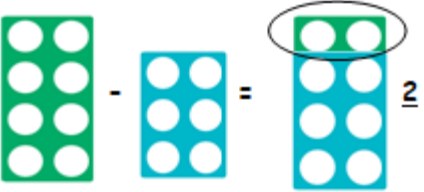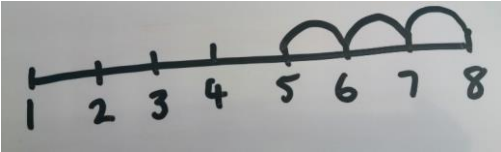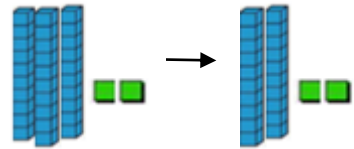
48 +
23
71
1 |

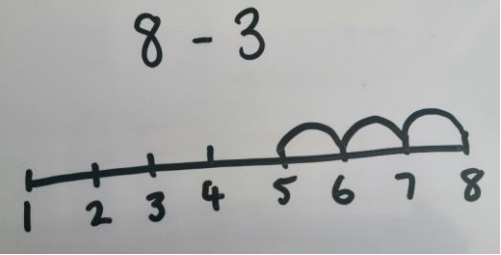# Subtraction – take away, subtract, less than, the difference, minus, fewer, decrease,

Year 1

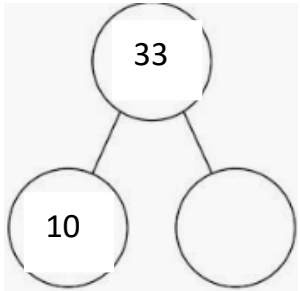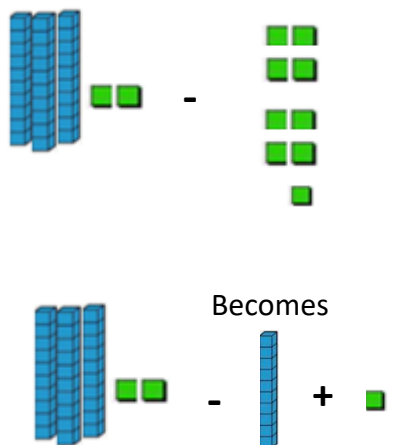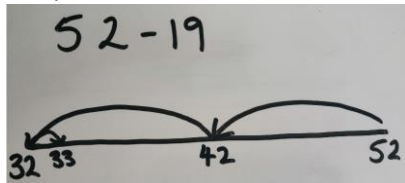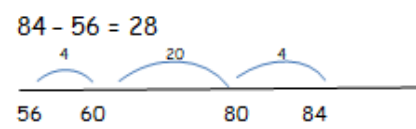| Objective/strategy	Concrete	Pictorial	Abstract
Subtract ones	Removing objects 5 - 3 	Crossing out 	5 – 3 = 2
Counting back	Numberlines/tracks with cubes/counters to visualise – take the cubes away as you count back 6 - 2 = 4 	Numberlines/100 square (pre-drawn numberlines) 	Count back in head/use fingers 6-2 = 4 Put the big number in your head then count back 2
Finding the difference	Asking how many more? What is the difference between 8 and 6? Use cubes or counters in a lines parallel or numicon stacked	Draw amounts and calculate the difference (numberlines may be useful – counting on) Difference between 5 and 8 	Jack has 6 sweets and Bethany has 8. How many more does Bethany have?
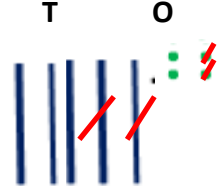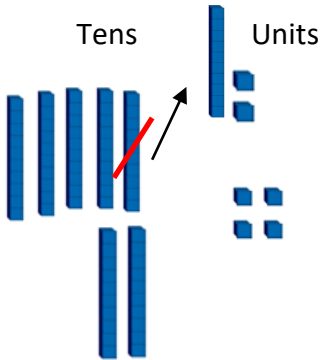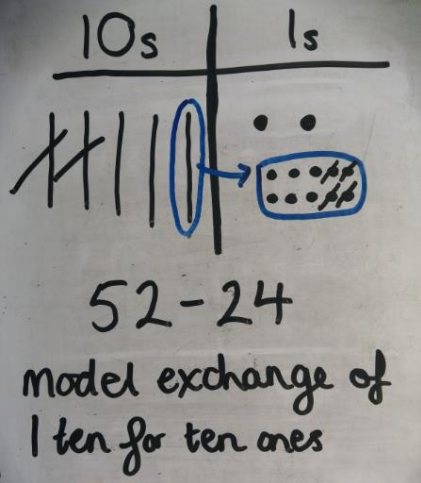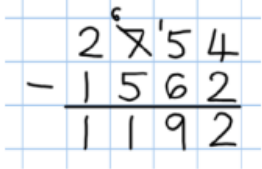
Year 2

Objective/strategy	Concrete	Pictorial	Abstract
Take 10	Take away equipment		33-10
Partitioning to subtract (two 2 digit numbers)	Taking away equipment – take 1 ten and 1 unit - using PV grids to help 32 – 11	Draw and crossing out base 10	Can take away mentally using partitioning where decomposition is not needed. 48 – 21=27 40-20=20 8-1=7

Year 3/KS2

Objective/strategy	Concrete	Pictorial	Abstract
Mental strategies			
Counting back/make ten HTU – U	Using a numberline to count back 123 – 6 Using number facts (make 10)	Draw a numberline	Counting back in head

Yr 3			
Counting up HTU – TU/HTU - HTU Year 3	Using a numberline to count on		
Subtract near multiples of 10, then adjust Year 4 with appropriate numbers Year 5 – subtract near multiples of 10 and 100, then adjust Year 6 - subtract near multiples of 10, 100 and 1000, then adjust	Becomes	Count back in tens on a numberline or number square then adjust (add 1, 10, 100)	Count back then adjust 32 - 9 = 32 – 10 = 22 + 1 = 23
Written methods (in order of teaching)			
Numberline to subtract (year 3) (key skill used for subtraction inc. money throughout KS2)		Empty numberline – counting on	

Column method - begin in year 3	Using place value grids and Base 10 – start on left and subtract ones, then tens (7 – 4, 30 – 20)	Draw representations	Move to expanded form first to reinforce place value
Year 3 – start with small numbers up to 1000 Year 4 – up to 4 digits Year 5 – more than 4 digits and decimals Year 6 increasing large numbers		54 - 22 **T O** 	T O 30 + 7 _ 20 + 4 10 + 3 Move to Formal column TO 37 _ 24 13
Column method with exchange Year 4 – up to 4 digits Year 5 – more than 4 digits and decimals Year 6 increasing large numbers Contexts varied	Base ten or numicon 52 – 24 Model exchange of 1 ten for 10 ones Move to using PV counters Tens Units 	Pictorial representation showing the exchange 	Expanded form (partitioned numbers) 352 - 124 H T O 300 ^{40}50 ^{1}2 - 100 20 4 200 20 8 Moving to formal column with exchanging H T O Year 4 3 ^{4}5 ^{1}2- 1 2 4 2 2 8
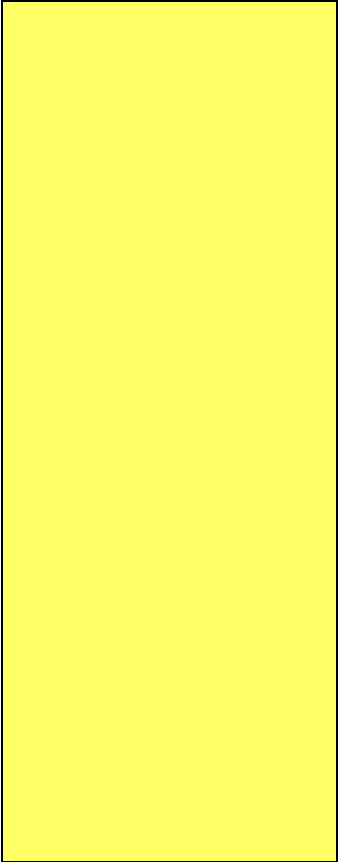
Year 5

$$
\begin{array}{r}
\cancel{7}\;\cancel{8}\;0,\;6\;9\;9 \\
-\quad 8\;9,\;9\;4\;9 \\
\hline
6\;0,\;7\;5\;0
\end{array}
$$

$$
\begin{array}{r}
\cancel{1}\;\cancel{0}\;5\;.\;\cancel{4}\;1\;9 \text{ kg} \\
-\quad 3\;6\;.\;0\;8\;0 \text{ kg} \\
\hline
6\;9\;.\;3\;3\;9 \text{ kg}
\end{array}
$$

Year 6
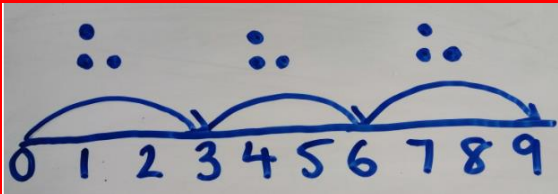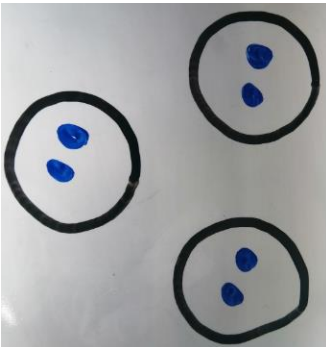
$$
\begin{array}{r}
\cancel{3}\;\cancel{1}\;0\;\cancel{5}\;6 \\
-\quad 2\;1\;2\;8 \\
\hline
2\;8,\;9\;2\;8
\end{array}
$$
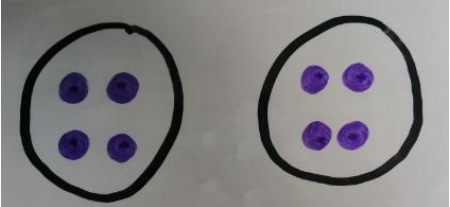
Use zeros for place-holders.

$$
\begin{array}{r}
\cancel{7}\;\cancel{1}\;6\;\cancel{9}\;.\;0 \\
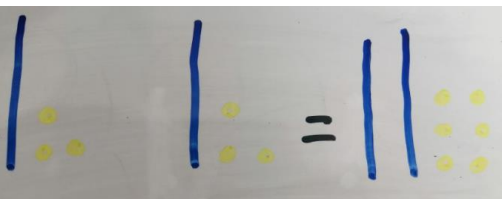-\quad 3\;7\;2\;.\;5 \\
\hline
6\;7\;9\;6\;.\;5
\end{array}
$$
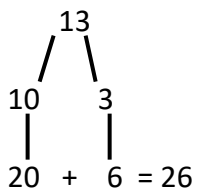
Multiplication: times, double, lots of, multiply, groups of, product, equal groups
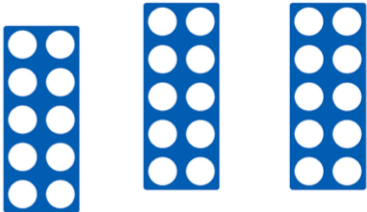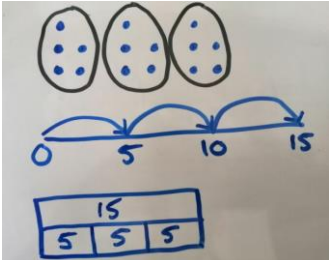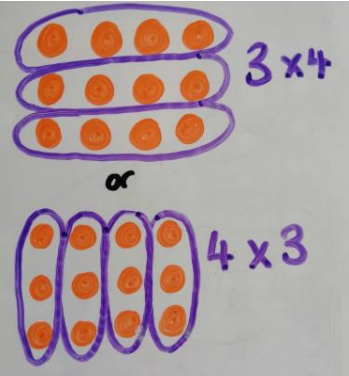
Year 1
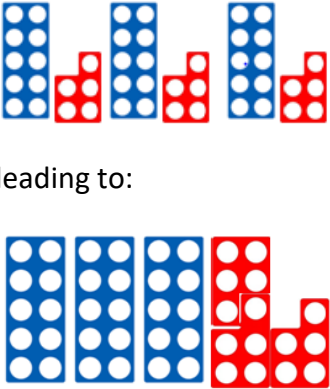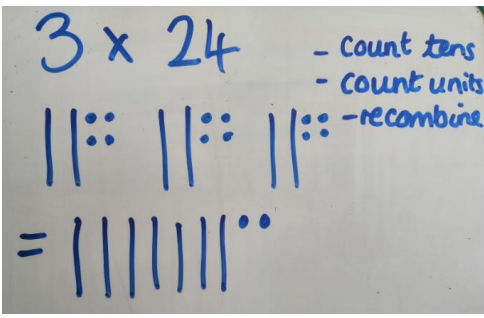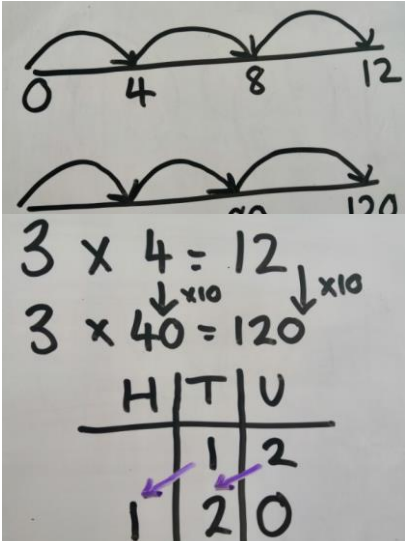
Objective/strategy	Concrete	Pictorial	Abstract
Repeated groups/repeated addition	Numicon used to add 2+2+2	Draw groups of the same amount	Count in groups on fingers 2, 4, 6
Counting in groups (multiples)	Skip counting objects – moving them	Counting on numberlines (pre-drawn) with equipment too	Counting on fingers/counting stick
Understand and make equal groups	Equipment cubes/dinosaurs to make groups the same. Noah's ark animals went in 2 by 2 etc	Draw equal amounts in each group	Count in groups on fingers/counting stick 3 groups of 2 = 6 or 3 x 2 = 6
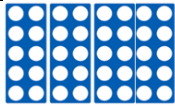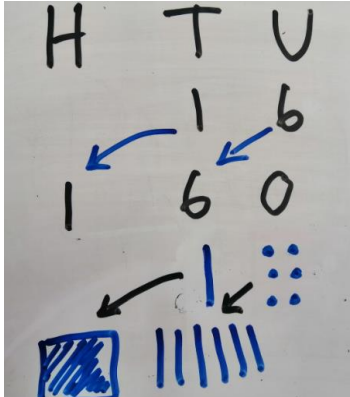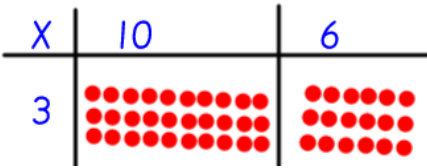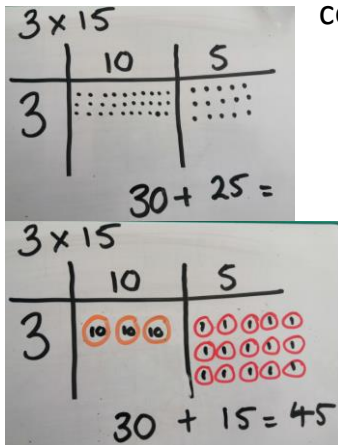
Doubling	Use manipulatives to demonstrate e.g. find the same numicon shape, count out the same amount of cubes. Find the total	Draw the picture needed the show the amount twice	Count on using fingers. Start on six and add six more. Double 6 = 12
Arrays ?	Simple arrays used to show groups of objects	Children draw equal groups (as above)	Verbal use of language ' I have 2 groups of 3'
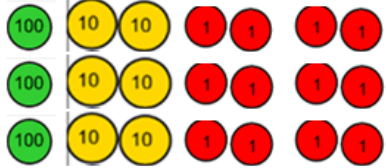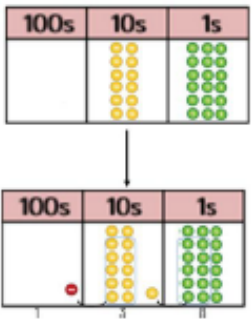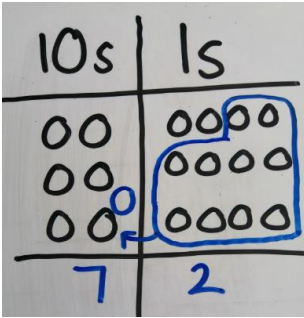
Year 2

Objective/strategy	Concrete	Pictorial	Abstract
Doubling (larger numbers)	Doubling equipment (base 10, numicon, cubes)	Draw the same number again	Partition mentally 13 10 3 20 + 6 = 26

Counting in multiples 2, 5, 10 (count in steps of 2,3 and 5 from 0)	Repeated equipment	Visuals of repeating groups – numberlines, drawings, bar models	Count groups on fingers complete missing numbers
Arrays to show Commutativity	Counters/cubes/equipment 2 x 5 5 x 2 3 x 4 or 4 x 3	Draw arrays and circle groups in 2 ways to show Commutativity	Instant recall or using arrays to write the equation 3 x 4 = 12

Objective/strategy	Concrete	Pictorial	Abstract
Mental methods and strategies			
Partitioning year 3	leading to:		15 x 3 10 x 3 = 30 5 x 3 = 15 Recombine = 30 + 15 = 45
Use known facts to multiply larger numbers (year 4 and 5)	3 x 4 = 12 3 x 40 = 120 Stacking numicon to show that the second number has become ten times bigger so the answer will be ten times bigger. Extend to larger numbers 	Number lines, place value grids 	Skip counting multiples, using place value grids 3 x 4 = 12 3 x 40 = 120

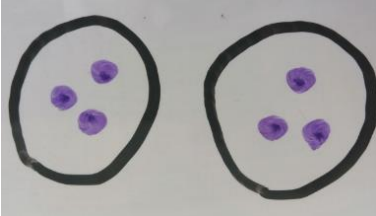|			
Multiply by 10, 100 and 100 Whole numbers and decimals Year 45	***children must understand the value of each column in a place value grid as you move to the right each column gets 10x bigger – time must be given to this first** Cubes, counters, base 10 and place value grids Cube sticks important for this as can represent ones and tenths 10 x 0.4 What does this mean? 10 lots of 0.4 model making groups and skip counting	Place value grids – draw equipment (Base 10 or PV counters and model digits moving 	mental visualisation 10 x 0.4 = 4 100 x 0.4 = 40 1000 x 0.4 = 400
Grid method to multiply Year 3 TU x U Year 4 – HTU x TU Year 5 TU x TU	Use counters to make the link between grid method and arrays, moving onto Base 10 and Place Value counters Place value counter help explicitly show we are finding groups of a number e.g. 3 x 124	Draw calculation as arrays or counters 	Grid method written | x	30	2
---	---	---
3	90	6 | Moving to TU x TU 17 x 26 | x	10	7
---	---	---
20	200	140
6	60	42	 200 140 60 42 442

			HTU x HTU
	  300 + 60 + 12 = 372 Add up each column and model any exchanges e.g. 12 ones = 1 ten and 2 ones		
Column method - short Year 4 numbers up to 2 and 3 digit x 1 digit Year 5 4 digits multiplied by 1 digit Year 6 multi-digit numbers multiplied by 1 digit	6 x 23 Model exchanging	Draw column and show exchange 3 x 24 	**Year 3** **Short method (below) TU x U with multiplication tables 2/5/10/3/4/8** **Year 4** 467 x 3 x by one digit 467 x 3 1401 2 2 **Year 5** 2726 X 5 13680 3 1 3 And decimals £6.76 x 4 £27.04 3 2
Long multiplication Year 5 up to 4 digits multiplied by 2 digits	PV counters to show TU x TU in grid Grid method to show 2 digit by 2 digit – good precursor		Careful teaching of procedure as well as understanding 1. Draw layout carefully 2. Put in any place holders before starting 3. Always start with the units of the multiplier

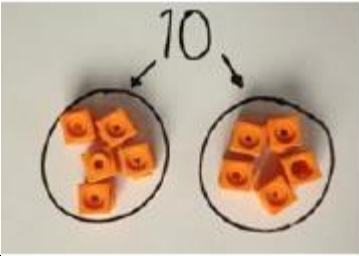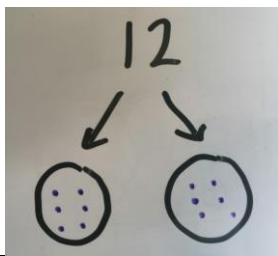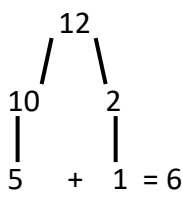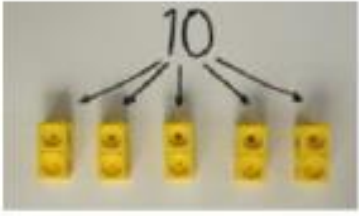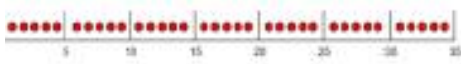| Year 6 – multi-digit numbers multiplied by 2 digits		$457 \times 16 = 7316$
		$\begin{array}{r} 457 \\ \times 16 \\ \hline 2742 \\ 4570 \\ \hline 7316 \\ \tiny{1\ 1} \end{array}$ *Multiply by the unit first*
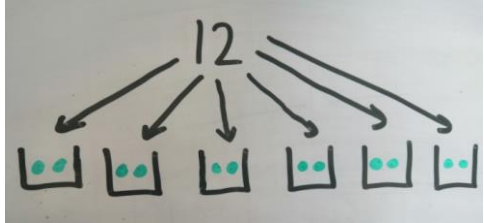
Division – share, group, divide, divided by, half

Year 1
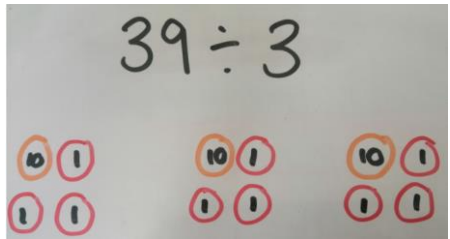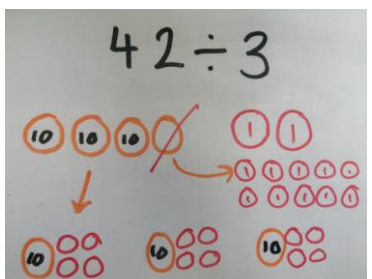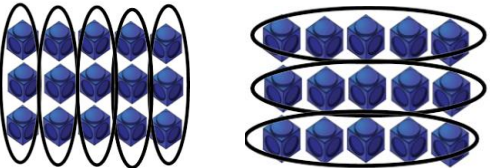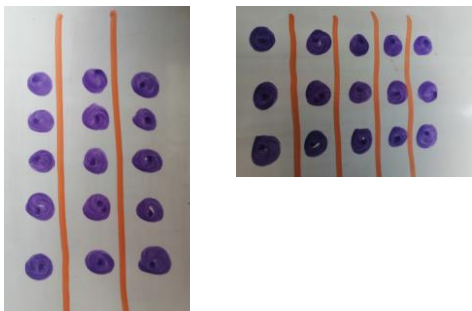
Objective/strategy	Concrete	Pictorial	Abstract
Division as sharing	Share equipment into pots equally one for you, one for me, one for her	Draw the amounts into circles	Know half of a U number mentally. Half 6=3 Half 8=4
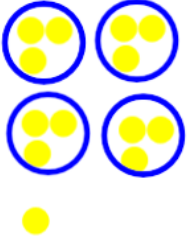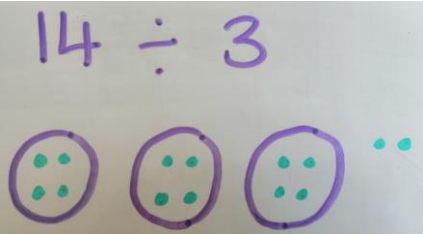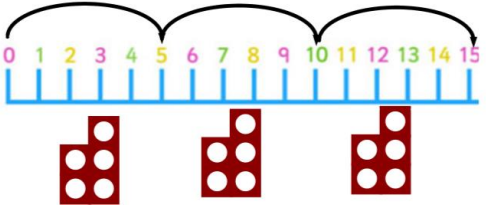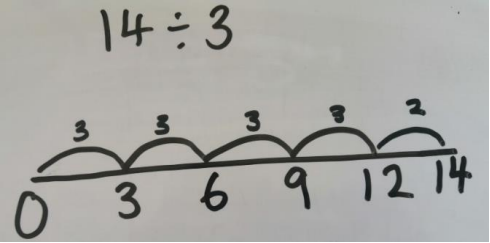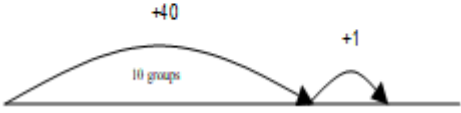
Year 2

Objective/strategy	Concrete	Pictorial	Abstract
Division as sharing	Share equipment equally between groups.	Draw pots and share amounts using carefully drawn dots set out in rows and	Know half of a number by partitioning in head.

		columns	
			12 / \\ 10 2 | | 5 + 1 = 6
Equal grouping	Share equipment equally between groups. 	Draw pots and share amounts using carefully drawn dots set out in rows and columns 	Know half of a number by partitioning in head. 24 = 12 Half of 20=10 half of 4= 2

Year 3/KS2

Objective/strategy	Concrete	Pictorial	Abstract
sharing equally (year 3)	Using counters to start with low numbers then using place value counters for TU numbers e.g. 66 ÷ 3 Moving to numbers such as 96 ÷ 4 with an exchange	Draw counters and share equally – where necessary showing exchanges for ones 	Know division facts for associated times tables appropriate to year group and use these to solve calculations which go further than 12x e.g. 42 ÷ 3
Division with arrays (year 3)	Creating arrays and writing associated number facts and inverse 15 ÷ 5 = 3 3 x 5 = 15 15 ÷ 3 = 5 5 x 3 = 15 	Draw an array 	Write the number sentence and all associated facts 15 ÷ 5 = 3 3 x 5 = 15 15 ÷ 3 = 5 5 x 3 = 15 3 = 15 ÷ 5 15 = 3 x 5 5 = 15 ÷ 3 15 = 5 x 3

Remainders (year 3)	Using cubes, counters, equipment and sharing into equal groups – how many don't make an equal group 13 ÷ 4 = 3 r 1 Teaching point – look at how the remainder cannot be greater than the divisor	Use drawings and numberlines 14 ÷ 3 	Mentally calculate remainders from near times table facts e.g. 33 ÷ 4 = 8 r 1
Written methods			
Numberline (inc. Remainders) Year 3 Secure this before moving to bus stop	Division as groups of a number Starting with low friendly numbers Skip counting in multiples of the divisor using visual aids to show Without remainders: ? = 15 ÷ 5 	Draw empty numberlines and skip count 14 ÷ 3 	Larger jumps 41 ÷ 4 = 10 r1 Reduce steps as table knowledge grows. +40 +1 10 groups
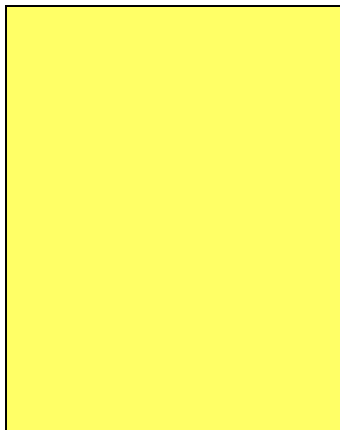
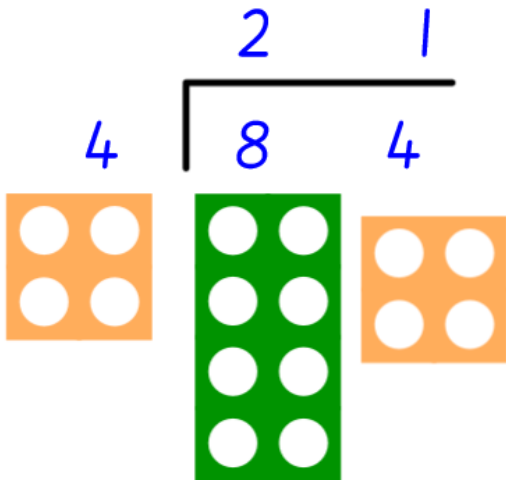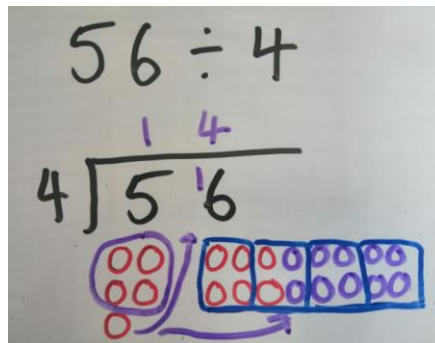|	With remainders:		
	$17 \div 3 = ?$ With number line showing jumps of +3, +3, +3, +3, +3, +2 from 0 to 18, and Numicon pieces below		
Bus stop division – **larger numbers** Year 3 TU ÷ U using only times table facts from NC (2/5/10/3/4/8) (when ready) Moving to: Year 4 up to HTU ÷ U Year 5 up to 4 digits ÷ 1 digit Year 6 – 4 digits ÷ 2 digits (where appropriate)	Use numicon to help teach understanding – stack on top $84 \div 4$ 2 1 4 ⟌ 8 4 (Numicon blocks shown)	Drawing equipment or counters underneath $56 \div 4$ with bus stop division and counters drawn	**Year 3** **Year 4** $1\,9\,r\,1$ $1\,3\,0\,r\,3$ $5\,\overline{)\,9\,{}^{4}6}$ $4\,\overline{)\,5\,{}^{1}2\,3}$ **Year 5** $9\,5\,4\,r\,4$ or $954\tfrac{1}{2}$ $8\,\overline{)\,7\,6\,5\,2}$ *Including decimals* $1\,8\,9\,.\,2$ $5\,\overline{)\,9\,{}^{4}4\,{}^{4}6\,.\,{}^{1}0}$ **Year 6** $0\,2\,1\,r\,10$ $0\,2\,1\,0\,r\,21$ $15\,\overline{)\,3\,{}^{3}2\,{}^{2}5}$ $24\,\overline{)\,5\,{}^{5}0\,{}^{2}6\,{}^{2}1}$ Remainders also given as decimals
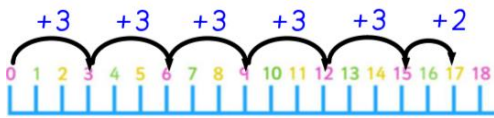
For 4 digit numbers divided by TU, chunking is used with a coin card

Partition the divisor to aid
1 x 24 = 20 + 4 = 24
2 x 24 = 40 + 8 = 48
3 x 24 = 60 + 12 = 72
4 x 24 = 80 + 16 = 96
5 x 24 = 100 + 20 = 120