Nursery Hill Primary School, Ansley Common, Nuneaton

Calculation policy

Written September 2018

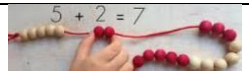
Adopted October 2018

Review September 2019

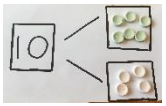
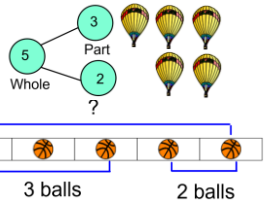
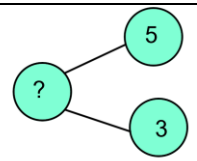
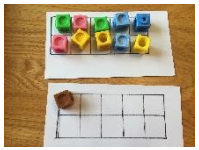
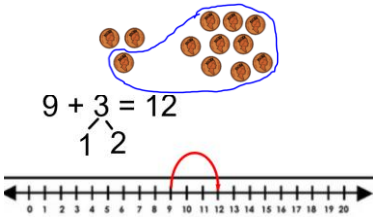
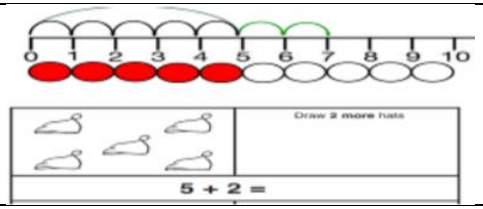
Children are introduced to the processes of calculation through practical, oral and mental activities. As children begin to understand the underlying ideas they develop ways of recording to support their thinking and calculation methods, use particular methods that apply to special cases, and learn to interpret and use the signs and symbols involved. As children's mental methods are strengthened and refined, so too are their informal written methods. These methods become more efficient and succinct and lead to efficient written methods that can be used more generally. By the end of Year 6 children are equipped with mental, written and calculator methods that they understand and can use correctly. When faced with a calculation, children are able to decide which method is most appropriate and have strategies to check its accuracy. At whatever stage in their learning, and whatever method is being used, it must still be underpinned by a secure and appropriate knowledge of number facts, along with those mental skills that are needed to carry out the process and judge if it was successful. In summary, we are aiming for children who;

- ✓ have a secure knowledge of number facts and a good understanding of the four operations;
- ✓ have a secure understanding of place value to support with mental and written calculations;
- ✓ are able to use this knowledge and understanding to carry out calculations mentally and to apply general strategies when using one-digit and two digit numbers and particular strategies to special cases involving bigger numbers;
- ✓ make use of diagrams and informal notes to help record steps and part answers when using mental methods that generate more information than can be kept in their heads;
- ✓ have an efficient, reliable, method of calculation for each operation that children can apply with confidence when undertaking calculations, either written or mental;
- ✓ use a calculator effectively, using their mental skills to monitor the process, check the steps involved and decide if the numbers displayed make sense.

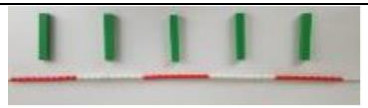
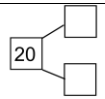
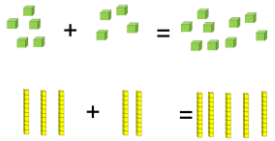
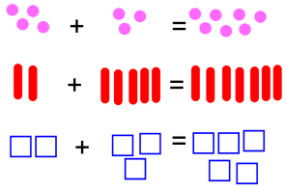
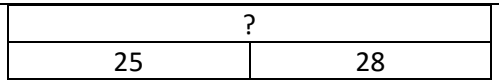
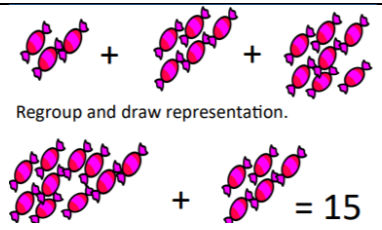
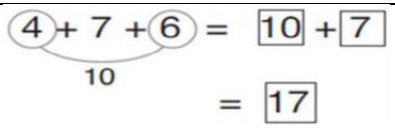
This policy outlines the routes through calculation within each year group to support the development of all 4 operations. Support and guidance for this policy has been taken from the White Rose Maths Calculation Policy as well as additional materials.

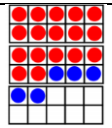
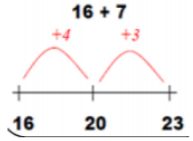
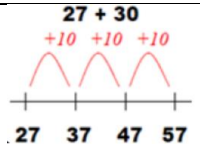
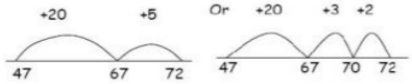
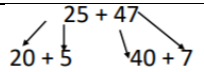
Addition – Foundation Stage			
Objective	**Concrete**	**Pictorial**	**Abstract**
1 more	 Numbers up to 10. Add one to the group or bar.	 Use pictures to add numbers shown in a group or bar.	5 + 1 = 6 4 + 1 = 5 This stage may still be alongside the concrete/pictorial.
Combining 2 groups	 Start with the larger number on the bead string then count on using the smaller number 1 by 1 to find the answer.	 Start with the larger number and count on in ones to find the answer.	4 + 2 = 6 This stage may still be alongside the concrete/pictorial

Addition - Year 1

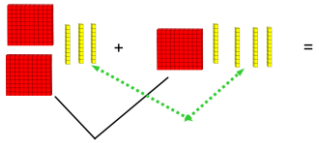
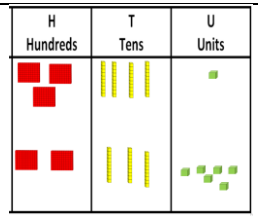
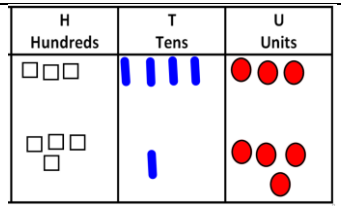
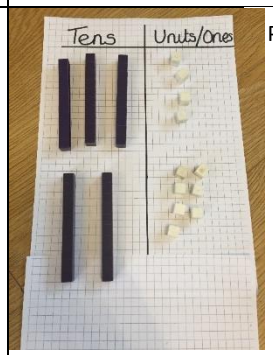
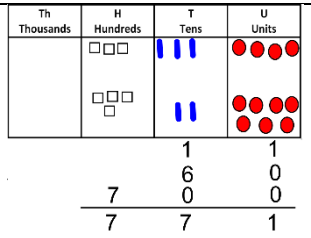
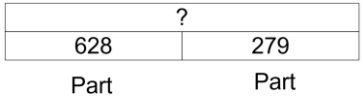
Objective	Concrete	Pictorial	Abstract
Combining two parts to make a whole: part-whole model	  Use part whole models. Use cubes to add 2 numbers together as a group or bar. 	 Use pictures to add numbers shown in a group or bar.	6 + 4 = 10 7 = 4 + 3  Use the part whole diagram to move into the abstract.
Starting at the bigger number and counting on	 Start with the larger number on the bead string then count on to the smaller number 1 by 1 to find the answer.	13 + 5 = 18  Start with the larger number on the number line and count on in ones or one jump to find the answer.	5 + 13 = 18 Place the larger number in your head and count on to the smaller one to find the answer.
Regrouping to make 10 (essential for column addition later on)	 9 + 3 = 12  Start with the bigger number and use the smaller number to make 10 and adjust. Use ten frames too.	 Use pictures or a number line. Regroup or partition the smaller number using the part part whole model to make 10.	7 + 4 = 11 If I am seven, how many more do I add on to get to 10? How many more do I need to add on now?
Represent and use number bonds and related subtraction facts within 20	 2 more than 5 is 7		Focus on understanding the language. “2 more than 5 is equal to 7” “1 more than 8 is 9” “8 is 3 more than 5”

Addition - Year 2

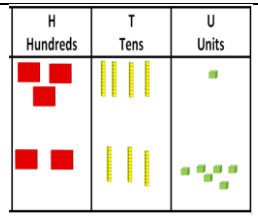
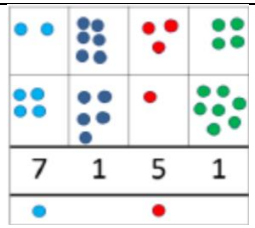
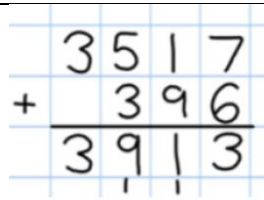
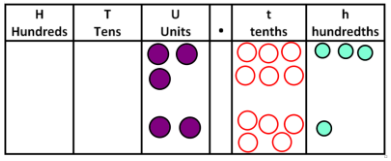
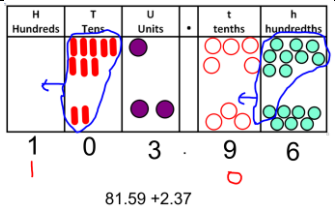
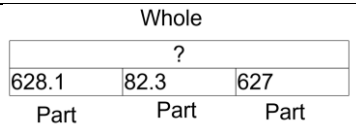
Objective	Concrete	Pictorial	Abstract
Adding multiples of ten	 20 + 30 = 50 Model using dienes or bead strings.	 3 tens + 4 tens = 7 tens 30 + 40 = 70 Use representations for dienes	40 + 50 = 90 60 = 40 + 20 80 = 40 + ?
Use known number facts (part, part, whole)	 Children explore ways to make numbers within 20.	 ? + ? = 20 20 - ? = ? + ? = 20 20 - ? =	□+ 1 = 16 16 - 1 = 1 +□= 16 16 -□= 1
Using known number facts		 Children draw representations for H, T, U	3 + 4 = 7 Leads to 30 + 40 = 70 Leads to 300 + 400 = 700
Bar Model – supporting problem solving	 3 + 4 = 7	 7 + 3 = 10	 25 + 28 = ?
Add 3 one digit numbers	 Combine to make 10 first if possible or bridge 10 and add the third digit.	 Regroup and draw representation. = 15	 Combine two numbers that make 10 if possible then add the third digit.

Add a 2 digit number and ones	 Use ten frames to make 'magic ten' then explore patterns e.g 17+5=22, 27+5=32	 Make links to jumps to the magic ten rather than counting in ones.	18 + 6 = 24 Explore related facts 18 + 6 = 24 6 + 18 = 24 24 – 6 = 18 24 – 18 = 6 
Add a 2 digit number and tens	 Explore that the ones do not change when adding multiples of ten.		47 + 10 = 57 47 + 30 = 77 38 + ? = 58
Add 2 digit numbers to 2 digit numbers	 Model using dienes or place value counters. Add the units first and then the tens.	 Use a number line to add the tens and then ones separately.	 20 + 40 = 60 5+ 7 =12 60 + 12 = 72

Addition - Year 3

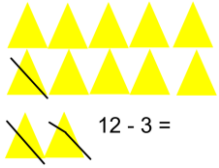
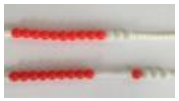
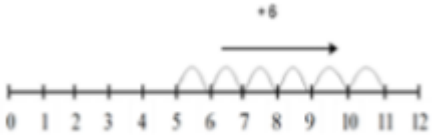
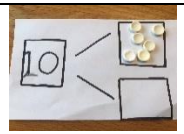
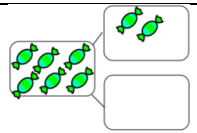
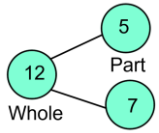
Objective	Concrete	Pictorial	Abstract
Add mentally 3 digit – 3 digit 3 digit – 2 digit 3 digit – 1 digit	 300 + 70 = Children to begin counting tens first. Progress to being over hundred boundary when adding tens.	Use drawings to represent each digit. – PV chart may be used as below.	320 + 480 = 700 + 100 = 800
Column addition – no regrouping 2 and 3 digits	 Begin by using dienes to add using place value charts. Start with no exchanging such as 31 + 26 = 57. Begin adding the units. This could be done with place value counters too.	 Children move to drawing counters.	Children to complete the formal expanded method for addition. Showing their understanding of place value 223 + 114 7 30 300 337 Note: If children are secure with their place value knowledge, they may progress onto the compact method for addition as shown in year 4-6.
Column addition – with regrouping 2 and 3 digits	 Progress to exchanging where there are more than 10 ones in the units column and they need to be exchanged for a ten. This could also be done with place value counters.	 1 1 6 0 7 0 0 7 7 1 Children move to drawing counters.	Children to complete the formal expanded method for addition. Showing their understanding of place value. 568 + 261 9 120 700 829 Note: If children are secure with their place value knowledge, they may progress onto the compact method for addition as shown in year 4-6.
Bar model to support problem solving	 The bar model for addition needs to work alongside all problem solving to help children visualise what the problem is asking them to do.		

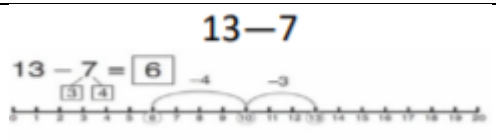
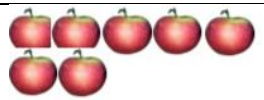
Addition - Year 4-6

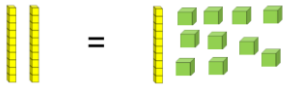
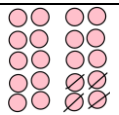
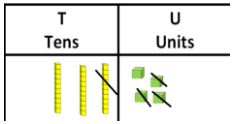
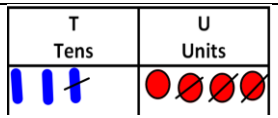
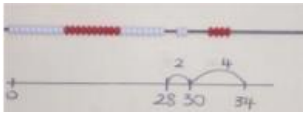
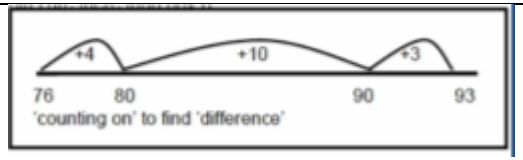
Objective	Concrete	Pictorial	Abstract
Mental Methods	Use mental methods as shown in year 3 for increasingly larger numbers.		
Year 4 - add numbers up to 4 digits	 Children continue to use dienes or place value counters to exchange ten ones for a ten, ten tens for a hundred and ten hundreds for a thousand.	 Children move to drawing counters.	 Continue from previous work to carry hundreds as well as tens. Relate to money and measures.
Year 5 – add numbers with more than 4 digits Add decimals with 2 decimal places including money	As year 4. Introduce decimal place value counters and model exchange 	 Children move to drawing counters.	£10.38 + £2.85 1 0 . 3 8 + 2 . 8 5 1 3 . 2 3 1 1 1.25m + 12 ½ m + 37.5cm 1 . 2 5 + 1 2 . 5 0 0 . 3 7 5 1 4 . 1 2 5 m 1 1
Year 6 – Add several numbers of increasing complexity Adding money, measure and decimals with different numbers of decimal places	As Year 5	As Year 5	3 0 2 4 3 2 + 1 1 0 7 0 9 4 1 3 1 4 1 1 1 1 0 6 . 0 3 5 2 . 8 2 3 . 3 8 + 2 1 0 . 1 2 4 3 4 2 . 3 3 9 1 1 1 Note: Children could insert zeros for place holders.
Bar model to support problem solving	 The bar model for addition needs to work alongside all problem solving to help children visualise what the problem is asking them to do.		

Subtraction – Foundation Stage			
Objective	**Concrete**	**Pictorial**	**Abstract**
1 less	 Numbers up to 10. Take one off the group or bar.	 Use pictures to take away numbers shown in a group or bar.	5 – 1 = 4 4 - 1 = 3 This stage may still be alongside the concrete/pictorial
Taking away more than one	 Start with the bigger number and take away the desired amount. Re count the new total.	 Start with the larger number and cross out to take away.	4 - 2 = 2 This stage may still be alongside the concrete/pictorial.

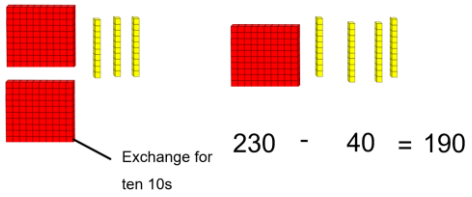
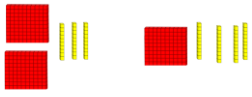
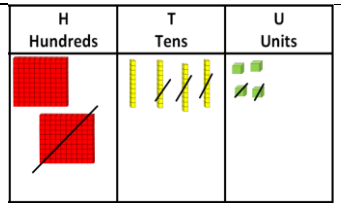
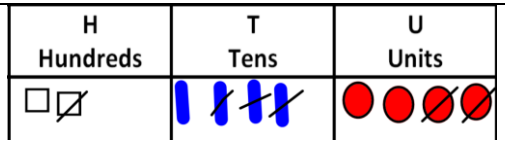
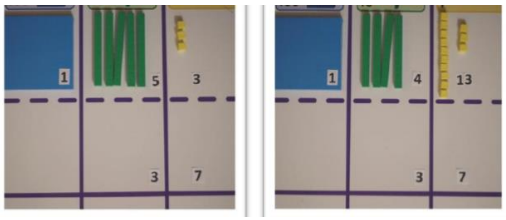
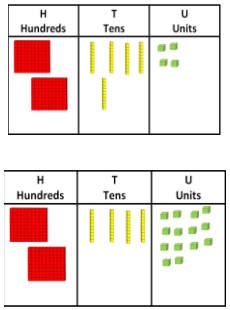
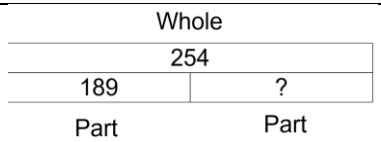
Subtraction - Year 1

Objective	Concrete	Pictorial	Abstract
Take away ones	 Use physical objects, counters or cubes to show how objects can be taken away.	 Cross out drawn pictures to show what has been taken away.	7 – 4 = 3 16 – 9 = 7
Counting back	 Move objects away from the group, counting backwards.  Move the beads along the string to count backwards.	 Count back in ones using a number line.	Put 13 in your head, count back 4. What number are you at?
Find the difference	Compare objects and amounts. 7 is 3 more than 4.  5  Lay objects to represent the bar model.	 Count on using a number line to find the difference.	Hannah has 12 sweets and Kate has 5. How many more sweets does Hannah have?
Represent and use number bonds and related subtraction facts within 20 Part, part whole model	 Link to addition – use the part, part whole model to encourage the inverse. If 10 is the whole and 6 is one of the parts, what is the other part? 10 – 6 = 4	 Use pictorial representations to show the part.	 Move to using numbers within the part whole model.

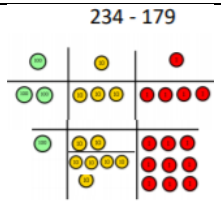
Make 10	 14 – 5 = 9 Make 14 on a ten frame. Take away 4 to make ten, then take 1 more away so that you have taken 5 away in total.	 Jump back 3 first then 4. Use ten as the stopping point.	16 – 8 How many do we take off first to get to 10? How many are left to take off?
Bar model	 5 – 2 = 3	? 	8 | 2 10 = 8 + 2 10 = 2 + 8 10 – 8 = 2 10 – 2 = 8

Subtraction - Year 2			
Objective	**Concrete**	**Pictorial**	**Abstract**
Regroup a ten into ten ones	 Use dienes to show how to change a ten into ones. 'Take and make'	 20 – 4 = 16 Children to represent numbers using jottings.	20 – 4 = 16
Partitioning to subtract without regrouping	34 – 13 = 21  Use dienes to show how to represent a number.	 34 – 13 = 21 Count back in ones using a number line.	43 – 12 = 31
Make ten strategy Progression should be crossing one ten, crossing more than one ten then crossing the hundreds	Use bead strings to count to the next ten and then 'jump' the rest'.  	 Use a number line to count onto the next ten and then the rest.	93 – 76 = 17

Subtraction - Year 3

Objective	Concrete	Pictorial	Abstract
Subtract mentally 3 digit – 3 digit 3 digit – 2 digit 3 digit – 1 digit	 230 - 40 = 190 190 - 100 = 90	 230 - 40 = 190 190 - 100 = 90	230 – 140 = 90 230 - 40 = 190 190 - 100 = 90
Column subtraction without regrouping 2 and 3 digit numbers	 244 – 132 = 112	 244 – 132 = 112 Children represent numbers using drawings.	Children to complete the formal expanded method for subtraction. Showing their understanding of place value. 244 - 132 2 10 100 112 Note: If children are secure with their place value knowledge, they may progress onto the compact method for addition as shown in year 4-6
Column subtraction with regrouping 2 and 3 digit numbers	 153 – 37 = 116 Use dienes to model how to exchange a ten for ten ones to enable the subtraction to happen.	 254 – 138 = Children represent numbers using drawings.	Children to complete the formal expanded method for subtraction. Showing their understanding of place value. 4 1 254 - 138 6 10 100 116 Note: If children are secure with their place value knowledge, they may progress onto the compact method for addition as shown in year 4-6
Bar model – supporting problem solving	 The bar model for addition needs to work alongside all problem solving to help children visualise what the problem is asking them to do.		

<table>
<tr><th colspan="4">Subtraction - Year 4-6</th></tr>
<tr><th>Objective</th><th>Concrete</th><th>Pictorial</th><th>Abstract</th></tr>
<tr><td>Mental Methods</td><td colspan="3">Use mental methods as shown in year 3 for increasingly larger numbers.</td></tr>
<tr><td>Year 4 – subtract with up to 4 digits

Include decimals through a money context</td><td> 

Model the process of exchanging again.</td><td>See year 3 – Children to draw a visual representation of the calculation.</td><td>£4.45 - £2.27
4 . 4 5
- 2 . 2 7
2 . 1 8

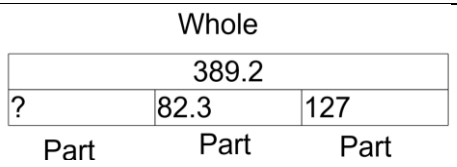
4 3 2 5
- 7 0 8
3 6 1 5</td></tr>
<tr><td>Year 5 – with at least 4 digits using money and measure

Include decimals that have difference decimal places</td><td>As year 4</td><td>See year 3 – Children to draw a visual representation of the calculation.</td><td>Use zeros for place holders.
14 . 8 0
- 15 . 8 6
08 . 4 4 m

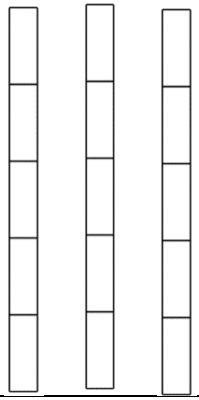
£42.38 - £14.85
42 . 3 8
- 14 . 8 5
27 . 5 3</td></tr>
<tr><td>Year 6</td><td></td><td></td><td>20142 - 11079 = 19123

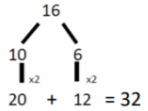
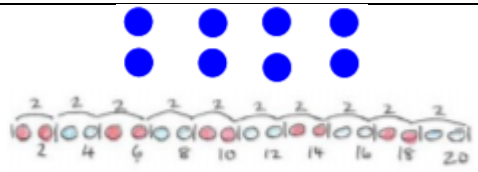
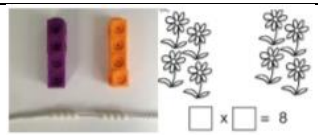
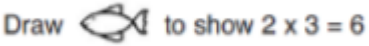
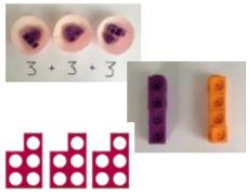
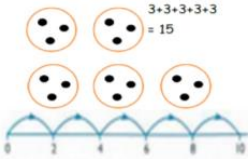
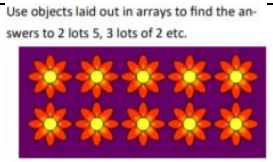
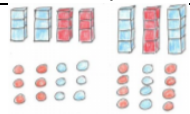
12 6 . 0 3 5
- 52 . 8 0 3
073 . 2 3 2

4 . 7 2 1 8
- ? . ? ? ? ?
1 . 5 8 0 3

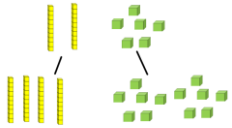
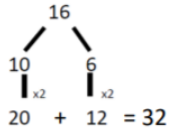
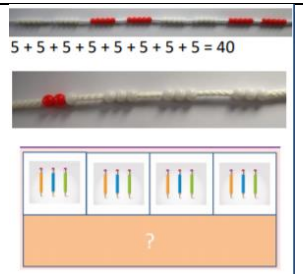
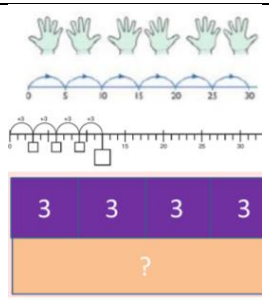
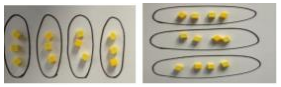
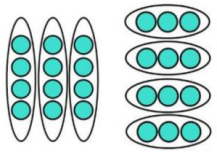
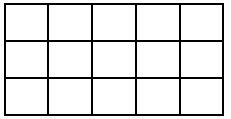
4 . 7 2 1 8
- 1 . 5 8 0 3
3 . 1 4 1 5</td></tr>
<tr><td>Bar model to support problem solving</td><td colspan="3"> 

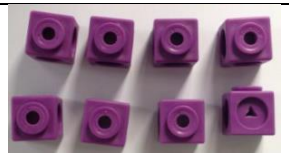
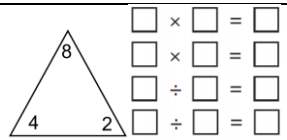
The bar model for subtraction needs to work alongside all problem solving to help children visualise what the problem is asking them to do.</td></tr>
</table>

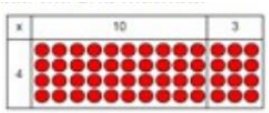
Multiplication – Foundation Stage			
Objective	**Concrete**	**Pictorial**	**Abstract**
Grouping to count	 Group cubes into 2, 5 and 10 to count. . Relate multiplication to having more than one group of objects.	Use pictures to show more than one group of numbers. Link to repeated addition. 	4 lots of 2 is 8. 4 x 2 = 8 This stage will still be alongside the concrete and pictorial

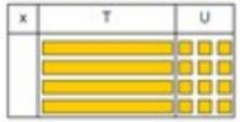
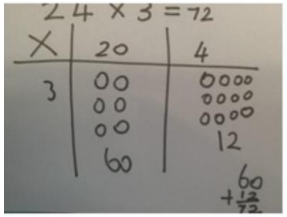
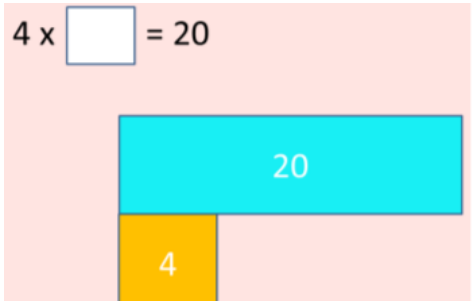
Multiplication - Year 1			
Objective	**Concrete**	**Pictorial**	**Abstract**
Doubling	 Use equipment like cubes to explain doubling. Double 2 is 4 2 x 2 = 4	 Draw pictures to show how to double numbers.	 Partition each digit and double each. Recombine the answers.
Counting in multiples	 Count the groups 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 aloud. Write sentences with multiples of numbers 2, 4, 6, 8, 10 5, 10, 15, 20, 25,
Making equal groups and counting the total	 Use equipment that can be manipulated (cubes) to make equal groups.		2 x 4 = 8
Repeated addition	 Use different objects to add equal groups.	 Use pictures and number lines to visualise problems/questions.	 Write repeated addition number sentences to describe patterns.
Understanding arrays		 Draw representations of arrays to show understanding.	3 x 2 = 6 2 x 5 = 10

Multiplication - Year 2

Objective	Concrete	Pictorial	Abstract
Doubling	 40 + 12 = 52 Model doubling using dienes.	Draw pictures to show how to double numbers.  21 doubled equals 42	 16 10 6 x2 x2 20 + 12 = 32 Partition each digit and double each. Recombine the answers.
Counting in multiples of 2, 3, 4, 5, 10 from 0 (repeated addition)	 5 + 5 + 5 + 5 + 5 + 5 + 5 + 5 = 40 Count the groups as children are skip counting. Children may use their fingers as they are skip counting. Use bar models.	 3 3 3 3 ? Number lines, counting sticks and bar models should be used to show representation of counting in multiples.	Count in multiples aloud. Write sequences with multiples of numbers 2, 4, 6, 8, 10 3, 6, 9, 12, 15 5, 10, 15, 20, 25, 4 x 3 = ?
Multiplication is commutative	 Create arrays using counters. Pupils should understand that an array can represent different equations and that multiplication is commutative - the order doesn't affect the answer 	 Use representations of arrays to show different calculations and explore commutativity.	12 = 3 x 4 12 = 4 x 3  Use the array to write multiplication sentences. 5 + 5 + 5 = 15 3 + 3 + 3 + 3 + 3 = 15 5 x 3 = 15 3 x 5 = 15

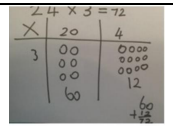
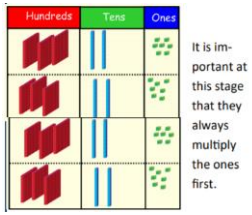
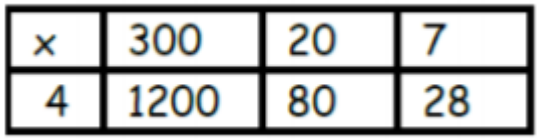
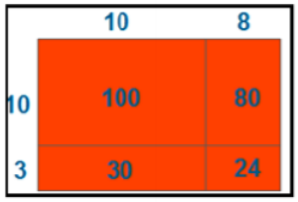
Using the inverse (taught alongside division so children can see the link)	 Use cubes to visualise the numbers.	 Use triangles to support understanding	2 x 4 = 8 4 x 2 = 8 8 ÷ 2 = 4 8 ÷ 4 = 2 8 = 4 x 2 8 = 2 x 4 Etc.

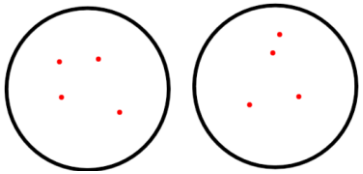
<table>
<tr><th colspan="4"><u>Multiplication - Year 3</u></th></tr>
<tr><th>Objective</th><th>Concrete</th><th>Pictorial</th><th>Abstract</th></tr>
<tr><td>Grid method</td><td>Show the links with arrays first before starting the grid method.
 
4 rows of 10
4 rows of 3

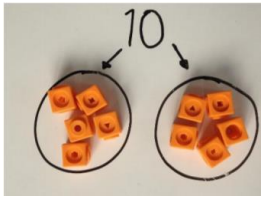
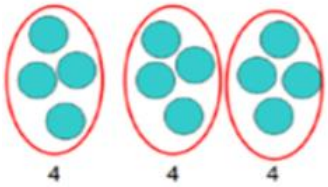
Move swiftly onto using dienes resources. This could also be done with place value counters if place value is secure.
  </td><td>Draw pictures to show how the counters in each column.
 
</td><td><table><tr><td>×</td><td>30</td><td>5</td></tr><tr><td>7</td><td>210</td><td>35</td></tr></table>
210 + 35 = 245</td></tr>
<tr><td>Bar model to support problems and missing numbers</td><td colspan="3"> 

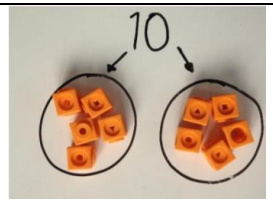
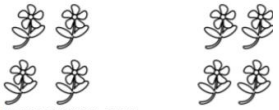
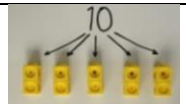
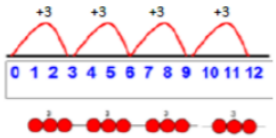
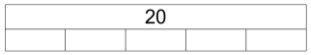
Use bar models throughout the unit to help children visualise what they have to do.</td></tr>
</table>

Multiplication - Year 4-6

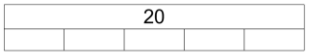
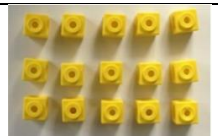
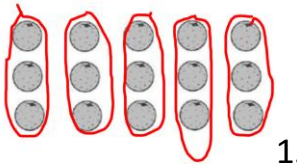
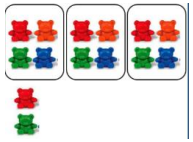
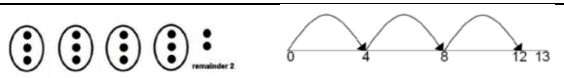
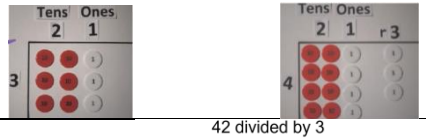
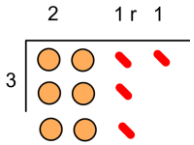
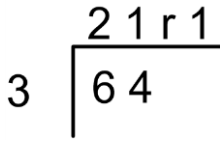
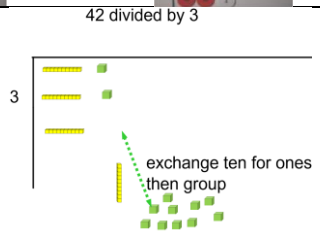
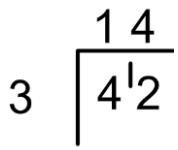
Objective	Concrete	Pictorial	Abstract
Year 4 Column multiplication 3 digit by 1 digit	 Show the links with grid method first before starting the column method.  It is important at this stage that they always multiply the ones first. Initially look at calculations with no regrouping. Show the long multiplication calculation alongside.		36 x 7 = 42, 210, 252 143 x 6 = 18, 240, 600, 858
Year 5 Column multiplication 3 and 4 digits by 1 and 2 digits	As year 4		2741 x 6 = 16446 142 x 31 = 142, 4260 16 x 13 = 18, 30, 160, 208 4276 x 34 = 17104, 128280, 145384 Introduce 2 digits by using the expanded method first.
Year 6 Column multiplication introducing decimals up to 2 dp	As year 4	As year 5	142 x 31 = 142, 4260 3.19 x 8 = 25.52

Division – Foundation Stage			
Objective	**Concrete**	**Pictorial**	**Abstract**
Sharing objects	Split cubes equally. Numbers up to 10.  	 Sharing dots/drawings	8 shared between 2 is 4 This stage will be completed alongside the concrete and abstract stages.

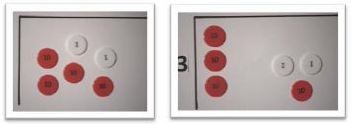
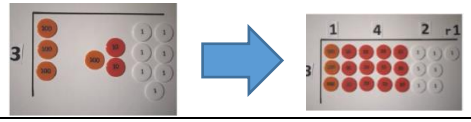
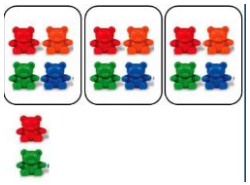
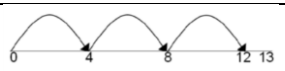
Division - Year 1			
Objective	**Concrete**	**Pictorial**	**Abstract**
Division as sharing	   I have 10 cubes. Can you split them into 2 equal groups?	 12 shared between 3 is 4 Children use pictures to show quantities.  8 shared between 2 is 4	12 shared between 3 is 4.

Division - Year 2			
Objective	**Concrete**	**Pictorial**	**Abstract**
Division as sharing	 I have 10 cubes. Can you split them into 2 equal groups?	8 ÷ 2 = 4  8 shared between 2 is 4  Children use bar modelling to show and support understanding. E.g 12 ÷ 4 = 3	12 ÷ 3 = 4
Division as grouping	 Divide quantities into groups. 	 Use number lines for grouping. Use the bar model to support. 12 is the whole and split the bar into the number needed.  20 ÷ 5 = ? 5 x ? = 20	28 ÷ 7 = 4 Divide 28 into groups of 7. How many are in each group?

Division - Year 3

Objective	Concrete	Pictorial	Abstract
Division as grouping	96 ÷ 3 = 32  Use place value counters to group into the given amounts.	 20 ÷ 5 = ? 5 x ? = 20 Continue to use bar modelling to show and support understanding. E.g 12 ÷ 4 = 3	28 ÷ 7 = 4 Divide 28 into groups of 7. How many are in each group?
Division with arrays	 Link division to creating arrays and think about the number sentence that can be created. 15 ÷ 3 = 5, 15 ÷ 5 = 3, 3 x 5 = 15, 5 x 3 = 15	Draw representations and split into groups to make division sentences.  15 ÷ 5 = 3	28 ÷ 7 = 4 28 ÷ 4 = 7 7 x 4 = 28 4 x 7 = 28 Find the inverse of multiplication and division sentences
Division with remainders	14 ÷ 3 = 4 r 2 	 Jump in equal steps to see the remainder. Draw dots and circle the full groups.	32 ÷ 7 = 4 r 4
Formal division – larger numbers. No exchanging	63 ÷ 3 = 21 87 ÷ 4 = 21 r 3 		
Formal division – larger numbers. Exchanging		As above but using exchanging.	

Division - Year 4-6

Objective	Concrete	Pictorial	Abstract
Year 4 Formal written method – 2 and 3 digit numbers	E.g. 42 ÷ 3  As year 3. Introduce 3rd digit. 	Use drawings to represent the concrete. Encourage them to move towards counting in multiples rather than drawing circles to group.	1 4 2 r.1 3 | 4 2 7
Year 5 Formal written method – 2, 3 and 4 digit numbers Remainders in context	As Year 4	As Year 4	E.g. £1389 ÷ 4 1389 ÷ 4 = 347 remainder 1 0 3 4 7 r.1 4 | 1 3 8 9 1389 ÷ 4 = 347 1/4 The remainder of 1 needs to be shred between 4, resulting in an extra 1/4 each. Alternatively the remainder of 1 is 1 out of the next group of 4, so only 1/4 of the next group can be made. 0 3 4 7 1/4 4 | 1 3 8 9 £1389 ÷ 4 = £347.25 Familiar fractions such as 1/4 can be converted to decimal remainders to fit the money context. 0 3 4 7 . 2 5 4 | 1 3 8 9
Year 6 – Formal written method above 4 digits. Including decimals and interpreting	14 ÷ 3 = 4 r 2 	 Jump in equal steps to see the remainder. Draw dots and circle the full groups. 	0 4 5 r.1 11 | 4 9 6 OR (depending on context) 0 4 5 1/11 11 | 4 9 6 0 2 8 15 | 4 2 0

remainders as a decimal.			Encourage children to use known facts when dividing by 2 digit numbers e.g 15 x 10 = 150, 15 x 5 = 75 15 x 20 = 300. Annotate these around the calculation for support. The below method can bring about mistakes due to many steps. Assess the understanding of the class for this method.