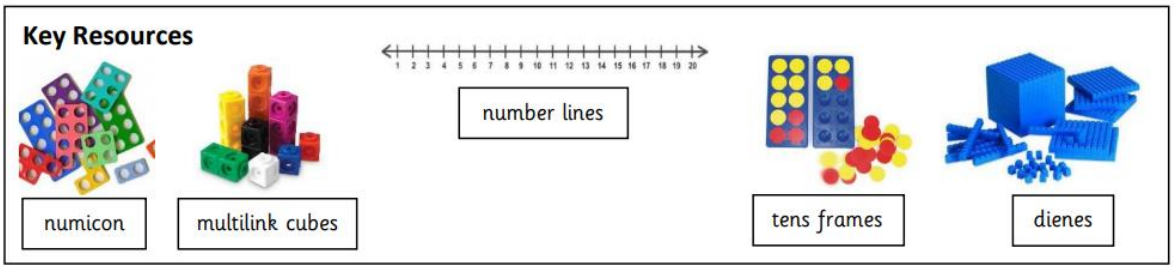
Hareside Primary School

Calculation Policy

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.



At Hareside we recognise the importance of children developing their conceptual understanding. The CPA approach builds on children's existing knowledge by introducing abstract concepts in a concrete and tangible way. It involves moving from concrete materials, to pictorial representations then to abstract symbols and problems.

Concrete Representation: This is the first step in a child's learning. Children should be introduced to a new concept or skill by acting it out using real life objects or maths manipulatives. When children physically handle the resources they are more able to gain mathematical mastery.

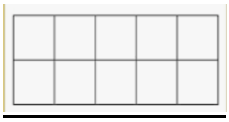
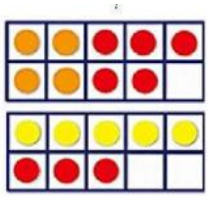
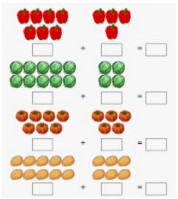
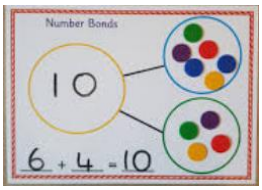
Pictorial Representation: This stage involves the use of images to represent a visual representation of the physical objects. It can be the children's drawings of the resources they are acting on or a representation such as the bar model, number line or part part whole model.

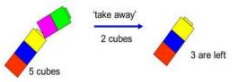
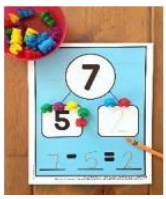
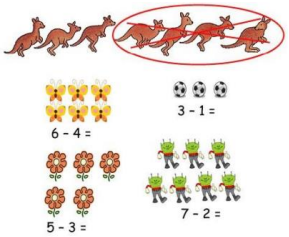
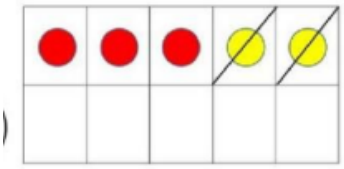
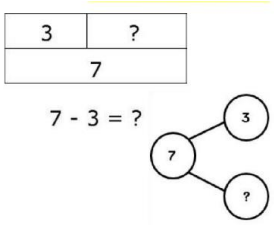
Abstract Representation: The third stage involves using abstract symbols to model problems – usually numerals. To be able to access this stage effectively, children need access to the previous two stages alongside it and have demonstrated a secure understanding of both concrete resources and visual images.

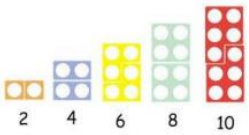
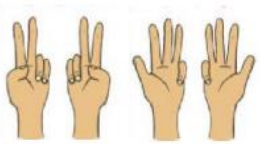
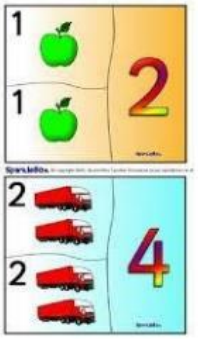
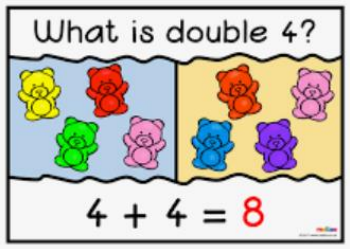
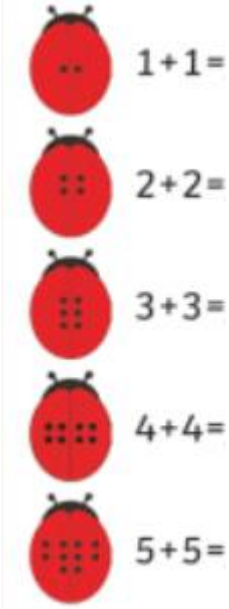
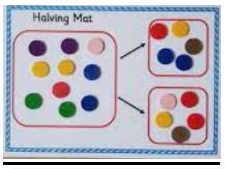
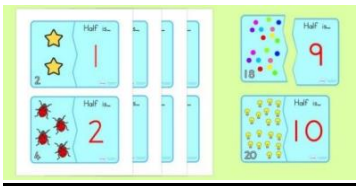
For the most effective learning to take place, children need to constantly go back and forth between each of the stages. This ensures concepts are reinforced and understood.

Hareside Primary School- Calculation Policy

3 Methods of Calculation Used in Each Year Group:

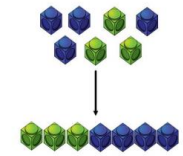
EYFS			
Addition - Knows that a group of things change in quantity when something is added. - Find the total number of items in two groups by counting all of them. - Says the number that is one more than a given number. - Finds one more from a group of up to five objects, then ten objects. - In practical activities and discussion, beginning to use the vocabulary involved in adding. - Using quantities and objects, they add two single digit numbers and count on to find the answer.	Concrete Use toys and general classroom resources for children to physically manipulate groups.  Use resources such as ten frames and part whole model to manipulatives being physically moved. Maths manipulatives 	Pictorial Visual supports such as part whole model and ten frames   Representations that show 2 clear groups so children can find the total by counting. 	Abstract The children will focus on the symbols and numbers to write the calculation  There is no expectation for children to record addition calculations.

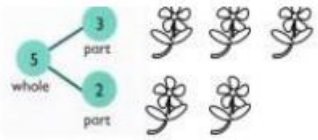
Subtraction - Knows that a group of things change in quantity when something is taken away - Find one less from a group of five objects, then ten objects. - In practical activities and discussion, beginning to use the vocabulary involved in subtracting. - Using quantities and objects, they subtract two single digit numbers and count back to find the answer.	 Use toys and general classroom resources for children to physically manipulate, group/regroup.  	 Children should be given pictures to cross out or cover to practise the concept.  Visual representations are key	Children can practise the symbols but there's no expectation for them to record the number sentence. 

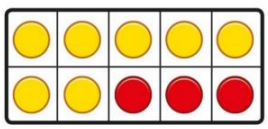
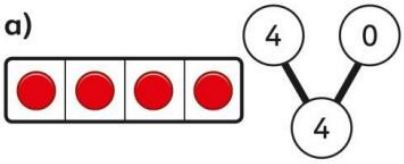
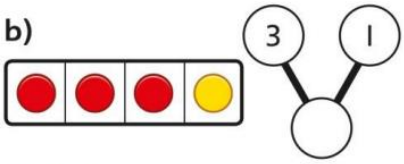
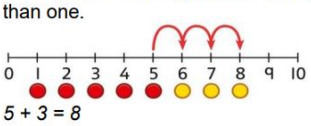
Multiplication - Solve problems including doubling	 Provide children with resources to practise making 2 equal groups.  Encourage children to see doubling as adding 2 equal groups. 	 Pictures to support children understanding that doubling is adding to equal groups.  	 Addition calculations
Division Solve problems including halving and sharing. -Halving a whole, halving a quantity of objects. -Sharing a quantity of objects.	 Children have the opportunity to physically cut objects, food or shapes in half.	 Pictures and icons that encourage children to see concept of halving in relation to subitising, addition and subtraction knowledge 	

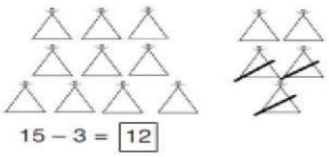
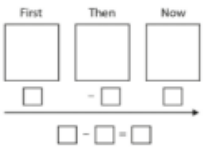
Hareside Primary School- Calculation Policy

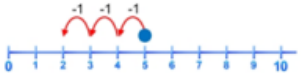
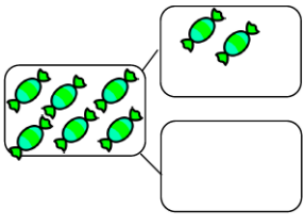
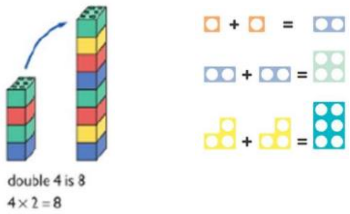
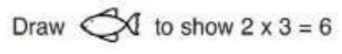
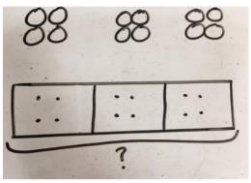
3 Methods of Calculation Used in Each Year Group:

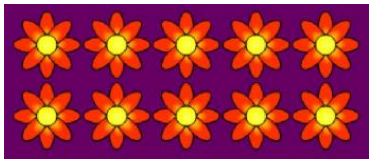
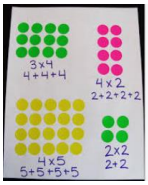
<table>
<tr><th colspan="4">Year 1</th></tr>
<tr><td>Addition</td><th>Concrete</th><th>Pictorial</th><th>Abstract</th></tr>
<tr><td></td><td colspan="3">Key Vocabulary-_addition, add, plus, total, altogether, combine, sum, increase, make</td></tr>
<tr><td></td><td> 
Children will use a range of resources to model the combining of groups

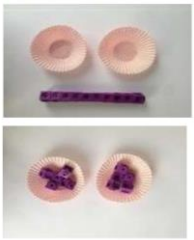
They will be able to say the value of the parts and combine them to find the whole.
 </td><td>Pictures can support children adding in a group
 
The Bar Model supports problem solving, continuing with concrete representations and moving onto using pictorial representations of objects.

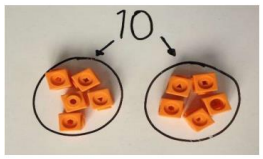
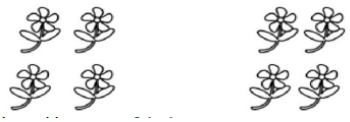
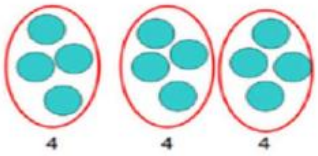
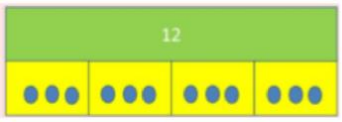
 
10 = 7 + 3</td><td> 
 
4 + 0 = 4
3 + 1 = 4
Learn to link counting on with adding more than one.
 
5 + 3 = 8
Children will demonstrate their understanding by solving abstract equations.</td></tr>
<tr><td>Subtract

ion</td><td colspan="3">Key Vocabulary: subtraction, subtract, minus, difference, take away, leave, decrease</td></tr>
<tr><td></td><td>
Children will begin by using objects that they can physically remove from the group one at a time ‘subtracting them’.</td><td>Cross out objects to show what has been taken away
 
15 – 3 = 12</td><td>__ = 15 – 2
10 – 4 = __
7 - __ = 3
  </td></tr>
</table>

	 8 – 5 = ? Arrange 2 groups to find the difference 	Children can use a number line to demonstrate counting back. Start at the bigger number and count back the smaller number showing the jumps on the number line.  Use pictorial representations to show the parts 	Children will then move on to applying their understanding built from the concrete and pictorial representations to solve abstract equations. Progress to using numbers in the part whole model.
Multiplication	Key Vocabulary: multiplication, multiply, multiplied by, double, equal groups		
	 double 4 is 8 4 × 2 = 8 Use practical activities using manipultives including cubes and Numicon to demonstrate doubling Children should first see multiplication as repeated addition.	Children will then use images to represent multiplication calculations and write calculations from images. Double 4 is 8  Draw and make different representations.  Children to represent the practical resources in a picture and use a bar	Write addition sentences to describe objects and pictures. 2 + 2 + 2 + 2 + 2 = 10 Children should move on to using an array to write a range of calculations. $10 = 2 \times 5$ $5 \times 2 = 10$ $2 + 2 + 2 + 2 + 2 = 10$ $10 = 5 + 5$

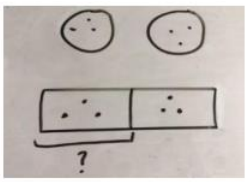
<table>
<tr>
<td></td>
<td> 
Use objects laid out in arrays to find the answers to 2 lots 5, 3 lots of 2 etc.</td>
<td>model.
 
Draw arrays to show understanding</td>
<td>$3 \times 4 = 12$

$4 + 4 + 4 = 12$</td>
</tr>
<tr>
<td>Division</td>
<td colspan="3">Key Vocabulary: divide, divided by, divided into, half, share, share equally, equal groups</td>
</tr>
<tr>
<td></td>
<td> 
Children first see division as grouping and sharing.

 
Eg. 10 have been split into 2 equal groups. Eg. The cubes have been shared into two cases.</td>
<td>Children will then use pictures and shapes to share quantities.
 
 
12 shared between 3 is 4
 
Children can use bar modelling to show and support understanding.</td>
<td>Share 9 buns between three people.

$9 \div 3 = 3$

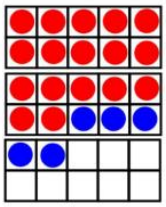
Children continue with pictorial method until fully secure. Children should also be encouraged to use their 2 times tables facts.

 
To progress further children can then be moved on to…

‘6 shared between 2 is 3’</td>
</tr>
</table>

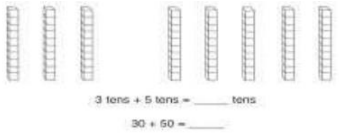
3 Methods of Calculation Used in Each Year Group:

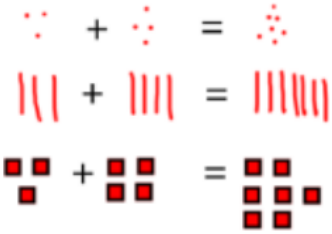
<table>
<tr><th colspan="4">Year 2</th></tr>
<tr><td rowspan="3">Addition</td><th>Concrete</th><th>Pictorial</th><th>Abstract</th></tr>
<tr><td colspan="3">Key Vocabulary-_addition, add, plus, total, altogether, combine, sum, increase, make</td></tr>
<tr>
<td>

Children will begin exploring addition using a range of resources.
 
17 + 5 = 22

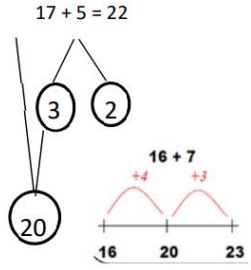
Use ten frame to make 'magic ten'

Children explore the pattern.
17 + 5 = 22
27 + 5 = 32

Initially used when adding two tens numbers, children are asked to count in tens. Then children move on to adding two, two-digit numbers. Using the resources enables children to rearrange putting all the</td>
<td> 

Base 10 can be used to represent the differences between tens and ones.
 
When confident the children should move on to draw or use images of the resources.

Lines and dots can be used to represent the tens and ones.

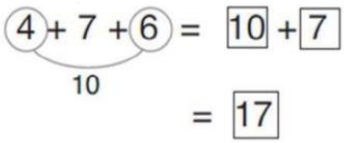
 

Children can use part whole model and a number line to represent 'bridging</td>
<td>20 + 30 = 50

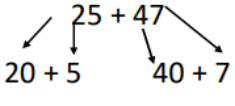
70 = 50 + 20

40 + ___ = 60

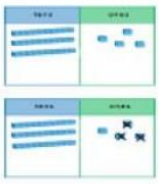
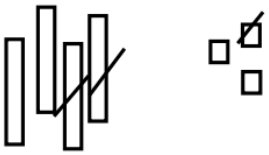
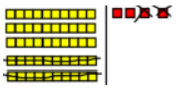
Once secure children will move on to abstract methods always focussing on the 'magic ten'.

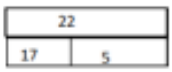
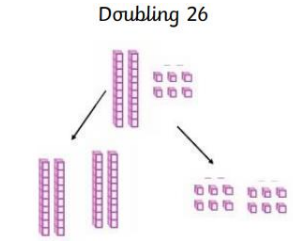
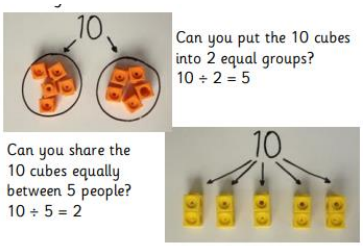
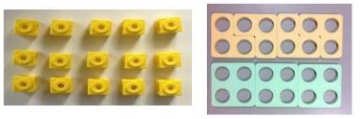
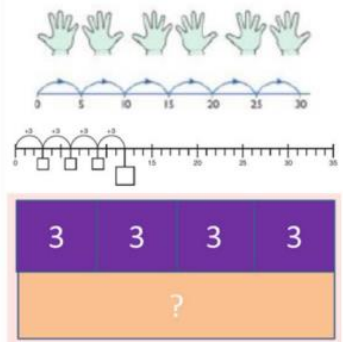
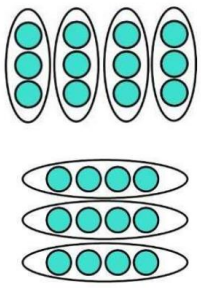
 

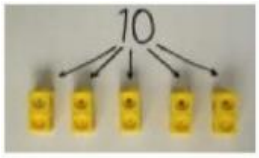
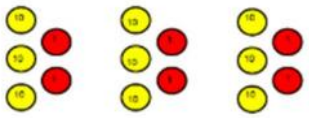
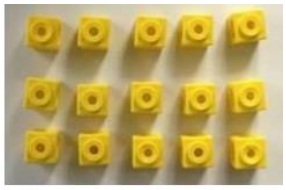
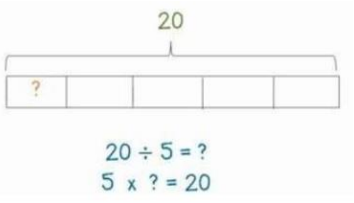
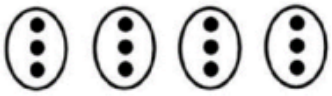
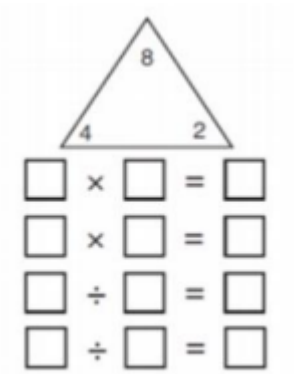
Lead into recording in column format, to reinforce place value and prepare children for formal written methods with larger values.

20 + 40 = 60
5+ 7 =12
60 + 12 = 72</td>
</tr>
</table>

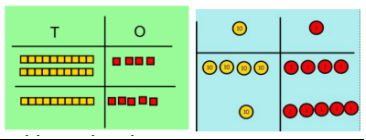
	tens together, then all the ones making it easier to count the total. Children are taught that when they have 10 ones, this can be exchanged for one 10 stick. Model using 'Base 10' place value counters and Numicon.	the ten.'	
Subtract ion	Key Vocabulary: subtraction, subtract, minus, difference, take away, leave, decrease		
	 Children can use ten frames and base 10 to support the understanding of subtraction.  34—13 = 21 Use Base 10 to show how to partition the number when subtracting without regrouping.	Children can draw representations of base 10 to cross out. 43 – 21 = 22  43—21 = 22  Eg. 54 – 22 = 32 It is important that children do not just see subtraction as a 'take-away'. Bar models are used to help understand the concept of difference.	Once secure children should move on to solving subtraction problems including missing numbers. 17 - _____ = 12 _____ - 7 = 4 _____ = 15 – 5 To solve 2-digit subtract 2-digit calculations children will initially partition both digits, adding the tens and then adding the ones together. 60 - 20 = 40 5 - 4 = 1 40 + 1 = 41 Therefore 65 + 24 = 41 Children will begin to see this in a formal column subtraction.

		Explore related facts 17 + 5 = 22 5 + 17 = 22 22 − 17 = 5 22 − 5 = 17 	
Multiplication	Key Vocabulary: multiplication, multiply, multiplied by, double, equal groups		
	 Children can model doubling using base 10.  Children can use concrete resources to create arrays.  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.	Children will then use images; real life, number lines and arrays to represent, write and solve multiplication calculations.  Number lines, counting sticks and bar models should be used to show representations of counting in multiples.  Use representations of arrays to show different calculations and explore commutativity.	0, 2, 4, 6, 8, 10 0, 3, 6, 9, 12, 15 0, 5, 10, 15, 20, 25 , 30 $4 \times 3 = \square$ Children should count in multiples out loud. Write sequences with multiples of numbers.

Division	Key Vocabulary: divide, divided by, divided into, half, share, share equally, equal groups		
	 Children will be exposed to questions which relate to division as grouping as well as sharing. 96 ÷ 3 = 32  Link division to multiplication by creating an array and thinking about the number sentences that can be created. Eg 15 ÷ 3 = 5 5 x 3 = 15 15 ÷ 5 = 3 3 x 5 = 15 	 Children should continue to use bar modelling to aid solving division problems.  Children will use dots to represent objects in a problem. Eg. Sam has 12 sweets. He shares them with his 4 friends. How many sweets does each person get? 12 ÷ 4 = 3	How many groups of 6 in 24? 24 ÷ 6 = 4 Children will be asked to recall the division facts for the 2, 5 and 10 times tables as well as using these to solve problems. 

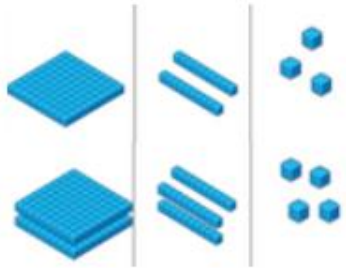
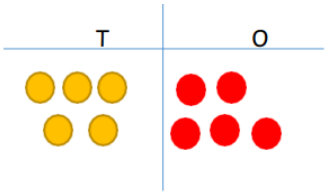
Hareside Primary School- Calculation Policy

3 Methods of Calculation Used in Each Year Group:

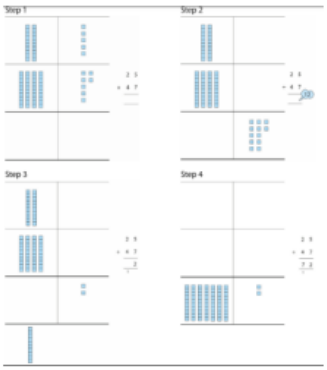
<table>
<tr><td colspan="4">Year 3</td></tr>
<tr><td rowspan="3">Addition</td><td>Concrete</td><td>Pictorial</td><td>Abstract</td></tr>
<tr><td colspan="3">Key Vocabulary-_addition, add, plus, total, altogether, combine, sum, increase, make</td></tr>
<tr>
<td> 

Using manipulatives (dienes, numicon, counters), children are to line up hundreds, tens and ones.

Add together the ones first then add the tens. Use the Base 10 blocks first before moving onto place value counters.

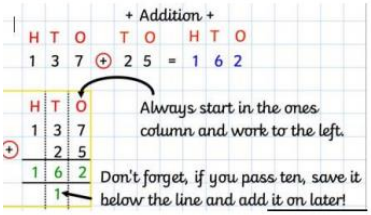
 
Children will use base 10 to represent 3-digit and 3-digit addition. Counting how many hundreds, tens and ones there are by grouping them together.</td>
<td> 

After practically using the base 10 blocks and place value counters, children can draw the counters to help them to solve additions.

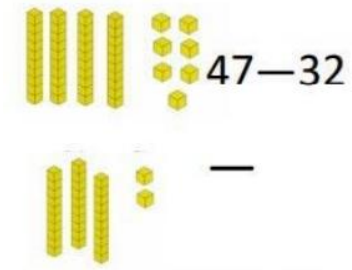
 
Children will use pictorial images of the calculations to help understand how the abstract methods work.</td>
<td>2 2 3
+ 1 1 4
3 3 7

Children will move on to recording more formally.

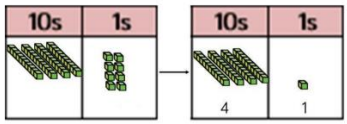
Add the ones first, then the tens then the hundreds.

 
</td>
</tr>
<tr><td></td><td colspan="3">Key Vocabulary: subtraction, subtract, minus, difference, take away, leave,</td></tr>
</table>

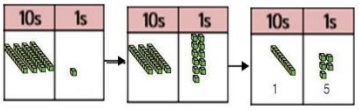
<table>
<tr><td>Subtract

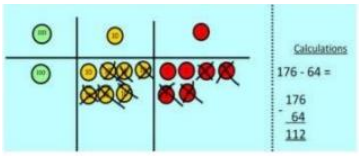
ion</td><td colspan="3">decrease</td></tr>
<tr><td></td><td> 

Children can use base 10 and numicon to support understanding.

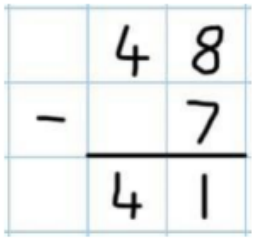
Column method using base 10.
 

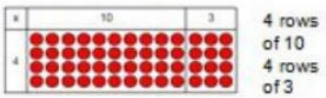
Column method using base 10 and having to exchange.

41 – 26 =
 
</td><td>Children will use pictorial images of the calculations to help understand how the abstract methods work.

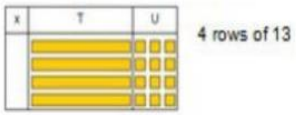
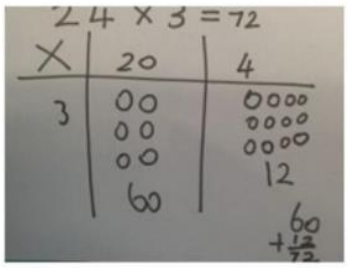
Children can cross out those which are being subtracted.
Eg. 234 – 23 = 211
 

Children are to be secure with use of PV counters before moving onto abstract.</td><td>Children should begin with the expanded form. Moving onto a more formal way as below.

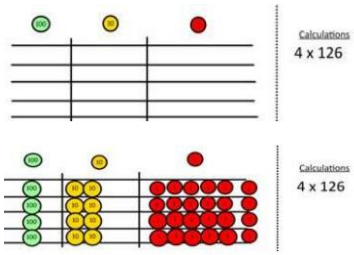
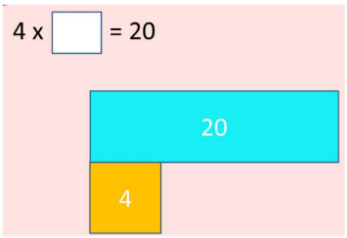
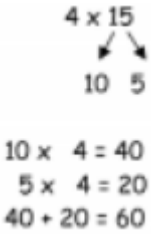
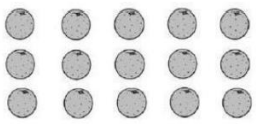
Use column method
 

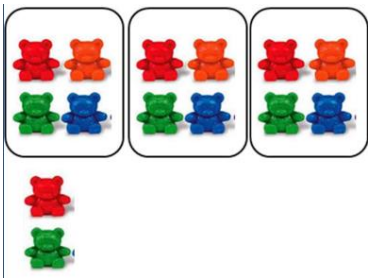
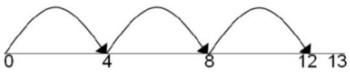
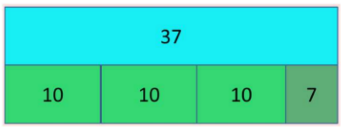
Compact Column Method:
457 – 234 = 223
457
234
223</td></tr>
<tr><td>Multiplic
ation</td><td colspan="3">Key Vocabulary: multiplication, multiply, multiplied by, double, equal groups</td></tr>
<tr><td></td><td> 

Show the links with arrays to first introduce grid method

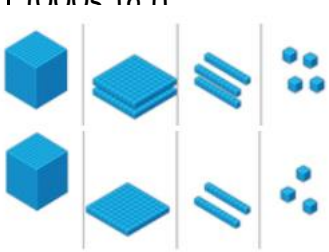
 
</td><td> 

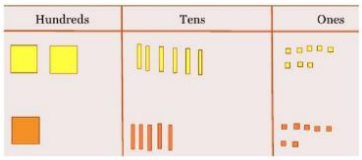
Children can represent their work with place value counters in a way that they understand. They can draw the</td><td>Children will be able to fluently recall the multiplication facts for the 3, 4 and 8 times tables. Once children are confident partitioning the two digit numbers and multiplying them they will move onto formal written methods, initially alongside the partition method.</td></tr>
</table>

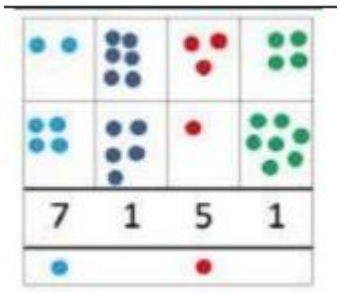
	Move onto base ten to move towards a more compact method.  Move onto place value counters to show how we are finding groups of a number. We are multiplying by 4 so we need 4 rows. Add each column starting with the ones making any exchanges needed.	counters using colours to show different amounts or just use the circles in the different columns to show their thinking as shown below.  Bar model can be used to explore missing numbers.	 Expanded Column Multiplication Method 35 x 7 = **×** | **30** | **5** **7** | **210** | **35** **210 + 35 = 245** 35 x 7 35 (5 x 7) 210 (30 x 7) 245
Division	Key Vocabulary: divide, divided by, divided into, half, share, share equally, equal groups		
	 Link division to multiplication by creating an array and thinking about the number sentences that can be created: 15 ÷ 3 = 5 5 x 3 = 15 15 ÷ 5 = 3 3 x 5 = 15	Children can draw an array and use lines to split the array into groups to make multiplication and division sentences:  15 ÷ 3 = 5 5 x 3 = 15 15 ÷ 5 = 3 3 x 5 = 15 Children can jump forward in equal jumps on	Children will become fluent with their division facts for the 3,4 and 8 times tables and use them to solve a series of problems including missing box problems. Eg. __ ÷ 4 = 8 16 ÷ _____ = 4 _____ = 24 ÷ 8

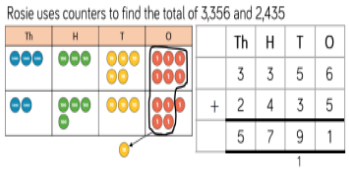
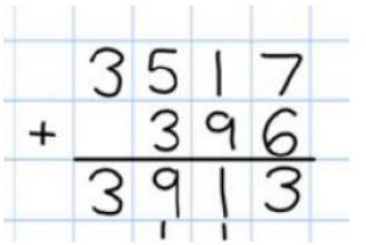
	 14 ÷ 3 = Divide objects between groups and see how many are left over.	a number line then see how many more you need to jump to find a remainder.  Use bar model to show remainders.  	How many groups of 6 in 24? 24 ÷ 6 = 4 Children should find the inverse of multiplication and division sentences by creating 8 linking number sentences. 7 x 4 = 28 4 x 7 = 28 28 ÷ 7 = 4 28 ÷ 4 = 7 28 = 7 x 4 28 = 4 x 7 4 = 28 ÷ 7 7 = 28 ÷ 4

3 Methods of Calculation Used in Each Year Group:

<table>
<tr><th colspan="4">Year 4</th></tr>
<tr><td rowspan="3">Addition</td><td>Concrete</td><td>Pictorial</td><td>Abstract</td></tr>
<tr><td colspan="3">Key Vocabulary-_addition, add, plus, total, altogether, combine, sum, increase, make</td></tr>
<tr>
<td>Children will use base 10 to explore what happens to a 4-digit number when you add 1s, 10s, 100 or 1000s to it.
 
Children will use dienes to represent 4-digit and 4-digit addition. Counting how many hundreds, tens and ones there are by grouping them together.

Eg. 1234 + 1123 = 2357
 

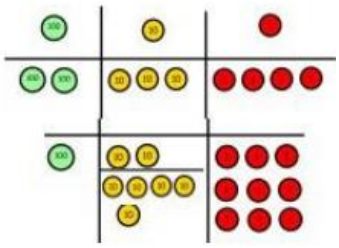
Children continue to use place value counters to add, exchanging ten ones for a ten and ten tens for a hundred and ten hundreds for a thousand.</td>
<td> 

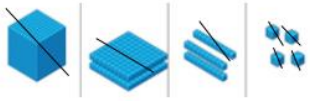
Children can draw a pictorial representation of the columns and place value counters to further support their learning and understanding.
 
</td>
<td> 

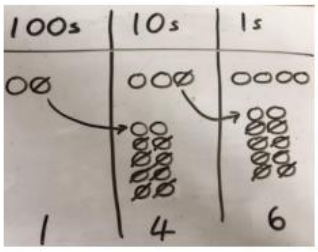
Record carrying hundreds as well as tens.

Relate to money and measures.</td>
</tr>
<tr><td></td><td colspan="3">Key Vocabulary: subtraction, subtract, minus, difference, take away, leave,</td></tr>
</table>

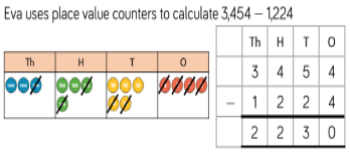
<table>
<tr><td>Subtract

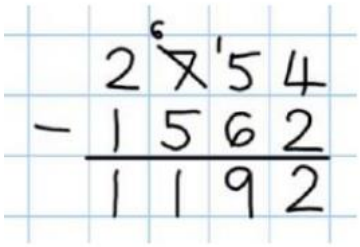
ion</td><td colspan="3">decrease</td></tr>
<tr><td></td><td>234 – 179 =
 
Model process of exchange using numicon, base ten and then move to place value counters.

 
Eg. 1234 – 1114 = 220

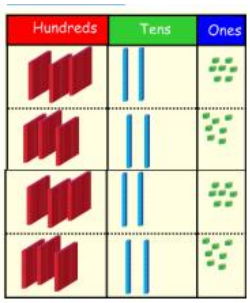
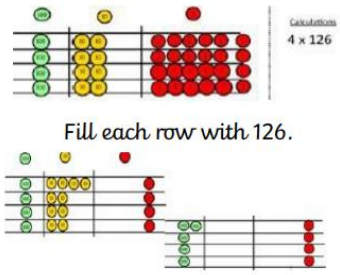
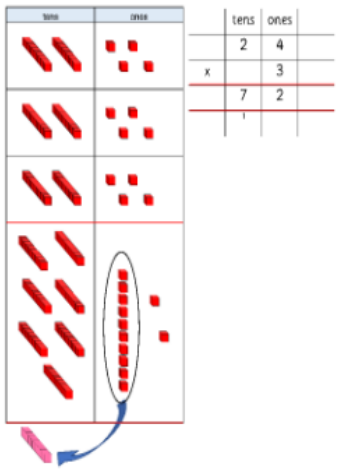
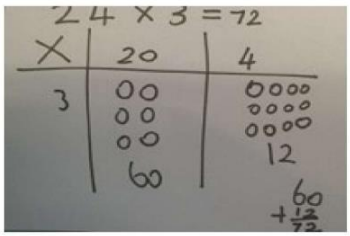
Children will use dienes to represent 4-digit and 4-digit subtraction. Counting how many thousands, hundreds, tens and ones there are left when some have been removed.</td><td> 

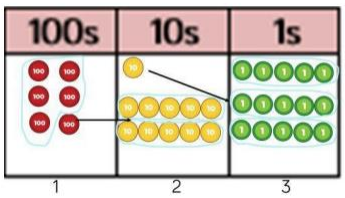
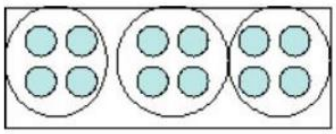
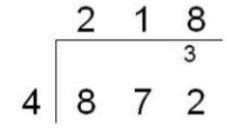
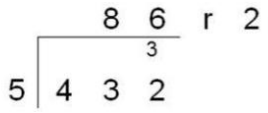
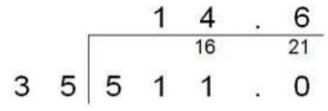
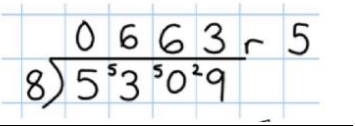
Represent the place value counters pictorially; remembering to show what has been exchanged.

Children will use pictorial images of the calculations to help understand how the abstract methods work.</td><td> 

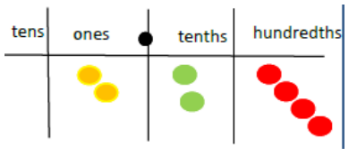
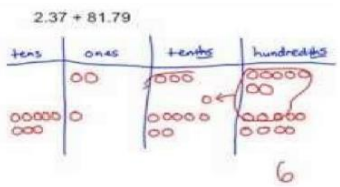
Formal column method. Children must understand what has happened when they have crossed out digits.</td></tr>
<tr><td>Multiplic ation</td><td colspan="3">Key Vocabulary: multiplication, multiply, multiplied by, double, equal groups</td></tr>
<tr><td></td><td>Children will build on their learning from Year 3 to become confident using formal written methods for 2-digit multiplied by 1-digit and 3-digit multiplied by 1-digit calculations.</td><td>Children will then use images and drawings to represent the equipment used, beginning to see the connection between the resources and the abstract representations.</td><td>Children will be able to fluently recall the multiplication facts for all tables up to 12 x 12. Once children are secure with the expanded column multiplication method they will move to the compact column multiplication method.</td></tr>
</table>

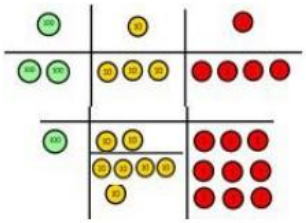
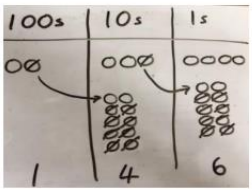
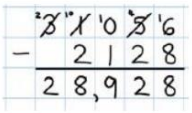
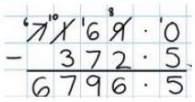
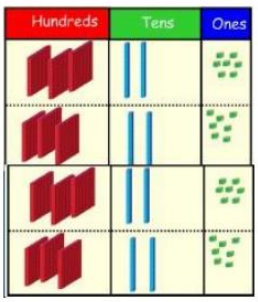
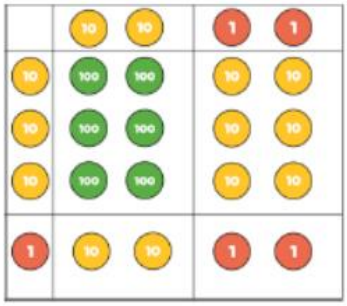
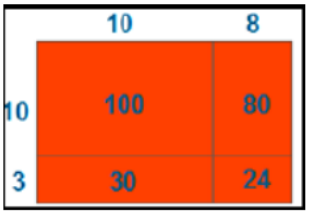
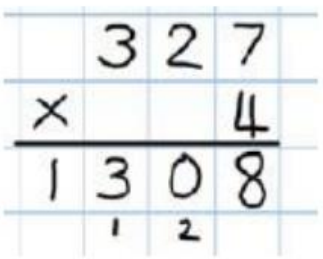
	 AIt is important at this stage that they always multiply the ones first.  Use place value counters to show how we are finding groups of a number. We are multiplying by 4 so we need 4 rows. Add up each column, starting with the ones making any exchanges needed.	 Children can represent their work with place value counters in a way that they understand. They can draw the counters using colour to show different amounts or just use the circles in the different columns to show their thinking. 	6 5 3 x 7 3 x 7 = 2 1 5 0 x 7 = 3 5 0 + 6 0 0 x 7 = 4 2 0 0 4 5 7 1 Compact column multiplication method: 653 x 7 = 653 x 7 4571 3 2
Division	Key Vocabulary: divide, divided by, divided into, half, share, share equally, equal groups		

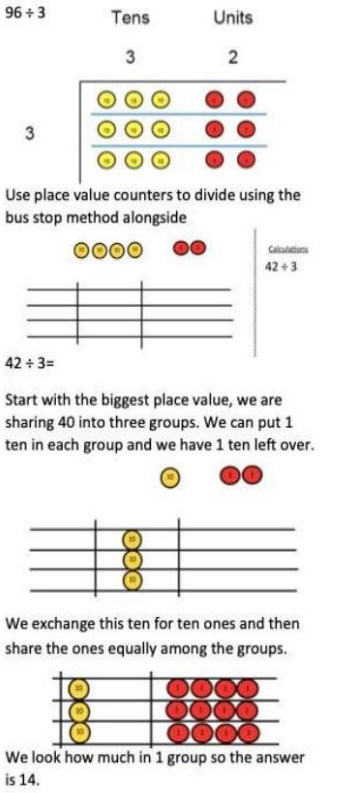
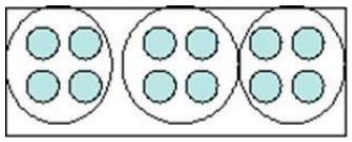
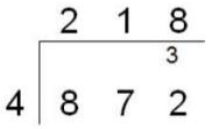
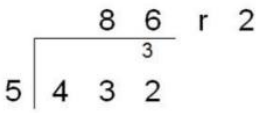
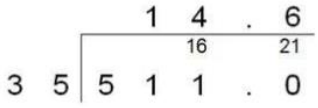
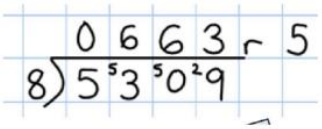
	Short division using place value counters to group: 615 ÷ 5  1. Make 615 with place value counters. 2. How many groups of 5 hundreds can you make with 6 hundred counters? 3. Exchange 1 hundred for 10 tens. 4. How many groups of 5 tens can you make with 11 ten counters? 5. Exchange 1 ten for 10 ones. 6. How many groups of 5 ones can you make with 15 ones?	 Children can continue to use drawn diagrams with dots or circles to help them divide numbers into equal groups. However, children should be encouraged to move towards counting in multiples to divide more efficiently.	Begin with divisions that divide equally with no remainder.  Move onto divisions with a remainder.  Finally move into decimal places to divide the total accurately.  

Hareside Primary School- Calculation Policy

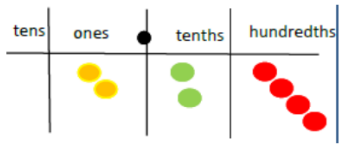
3 Methods of Calculation Used in Each Year Group:

Year 5			
Addition	Concrete	Pictorial	Abstract
	Key Vocabulary-_addition, add, plus, total, altogether, combine, sum, increase, make		
	 Introduce decimal place value counters and model exchange for addition	 	

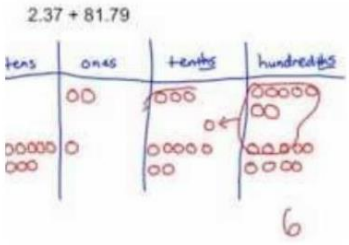
<table>
<tr><td>Subtract
ion</td><td colspan="3">Key Vocabulary: subtraction, subtract, minus, difference, take away, leave, decrease</td></tr>
<tr><td></td><td>234 – 179 =
 
Model process of exchange using numicon, base ten and then move to place value counters.</td><td>Represent the place value counters pictorially; remembering to show what has been exchanged.
  </td><td>Formal column method. Children must understand what has happened when they have crossed out digits. Use zeros for place holders.
 
  </td></tr>
<tr><td>Multiplic
ation</td><td colspan="3">Key Vocabulary: multiplication, multiply, multiplied by, double, equal groups</td></tr>
<tr><td></td><td> 
Children can continue to be supported by place value counters at this stage of multiplication. This is initially done where there is no regrouping.
 
Manipulatives may still be used with the corresponding long multiplication modelled</td><td>The grid method may be used to show how this relates to a formal written method (see abstract column).
<table><tr><td>x</td><td>300</td><td>20</td><td>7</td></tr><tr><td>4</td><td>1200</td><td>80</td><td>28</td></tr></table>
Continue to use bar modelling to support problem solving.
  </td><td> 
The grid method can then be progressed onto the compact method.</td></tr>
</table>

	alongside. (22 x 31)		
Division	Key Vocabulary: divide, divided by, divided into, half, share, share equally, equal groups		
		Students can continue to use drawn diagrams with dots or circles to help them divide numbers into equal groups.  Encourage them to move towards counting in multiples to divide more efficiently.	Begin with divisions that divide equally with no remainder.  Move onto divisions with a remainder.  Finally move into decimal places to divide the total accurately.  

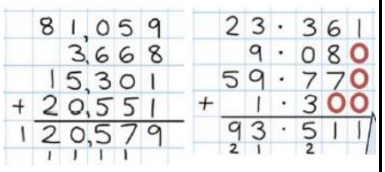
3 Methods of Calculation Used in Each Year Group:

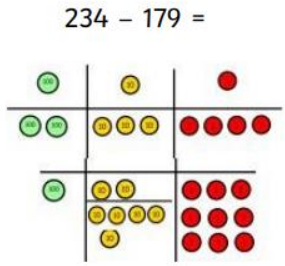
<table>
<tr><th colspan="4">Year 6</th></tr>
<tr><td rowspan="3">Addition</td><td>Concrete</td><td>Pictorial</td><td>Abstract</td></tr>
<tr><td colspan="3">Key Vocabulary-_addition, add, plus, total, altogether, combine, sum, increase, make</td></tr>
<tr><td> 

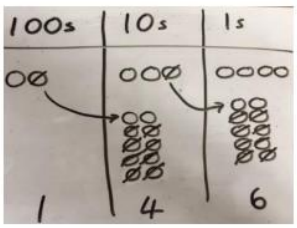
(As year 5)

Introduce decimal place value counters and model exchange for addition.</td><td> 

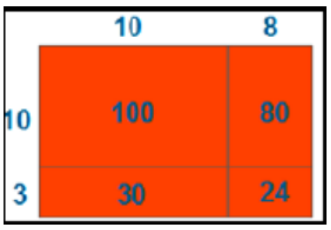
(As in Year 5)</td><td>Insert zeros for place holders.

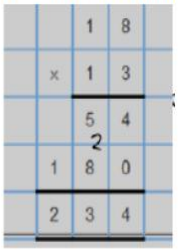
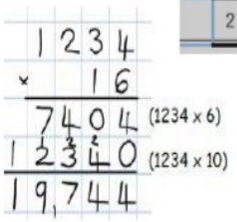
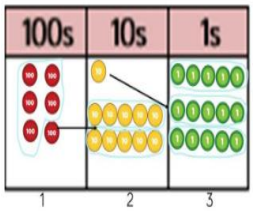
  </td></tr>
<tr><td rowspan="2">Subtract

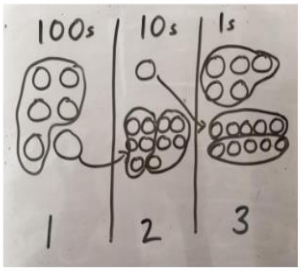
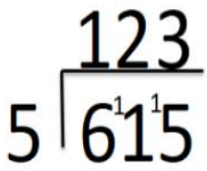
ion</td><td colspan="3">Key Vocabulary: subtraction, subtract, minus, difference, take away, leave, decrease</td></tr>
<tr><td> 

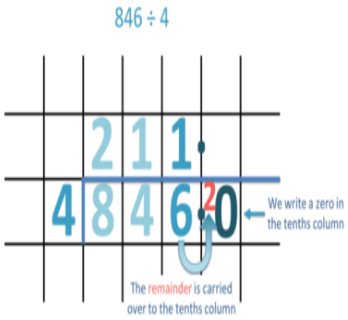
Model process of exchange using numicon, base ten and then move to place value counters.</td><td> 

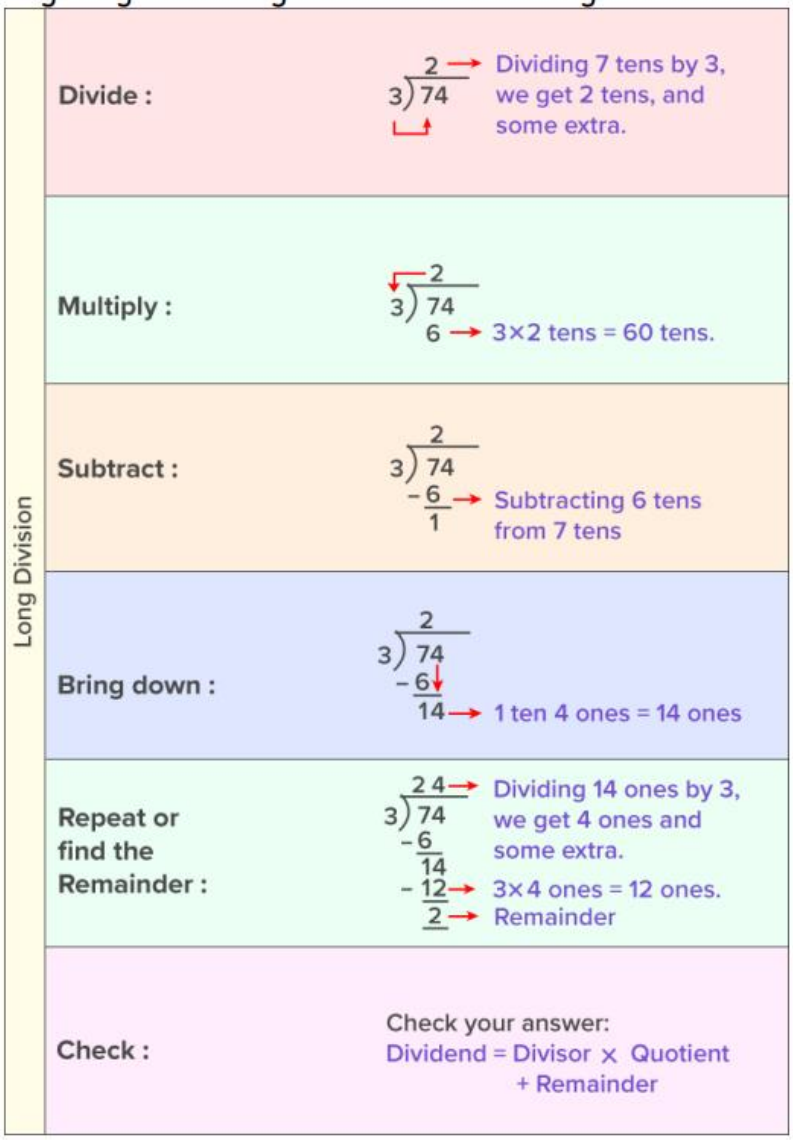
Represent the place value counters pictorially; remembering to show what has been exchanged.</td><td> </td></tr>
<tr><td></td><td colspan="3">Key Vocabulary: multiplication, multiply, multiplied by, double, equal groups</td></tr>
</table>

<table>
<tr>
<td>Multiplication</td>
<td>Manipulatives may still be used with the corresponding long multiplication modelled alongside.</td>
<td> 

<u>Continue to use bar modelling to support problem solving.</u></td>
<td>Progress to using the column method for long multiplication.
 

</td>
</tr>
<tr>
<td>Division</td>
<td colspan="3">Key Vocabulary: divide, divided by, divided into, half, share, share equally, equal groups</td>
</tr>
<tr>
<td></td>
<td>Short division using place value counters to group.
615 ÷ 5
 

1. Make 615 with place value counters.
2. How many groups of 5 hundreds can you make with 6 hundred counters?
3. Exchange 1 hundred for 10 tens.
4. How many groups of 5 tens can you make with 11 ten counters?
5. Exchange 1 ten for 10 ones.
6. How many groups of 5 ones can you make with 15 ones?</td>
<td>Represent the place value counters pictorially.
 
</td>
<td>Children to the calculation using the short division scaffold.
 

Children can then progress onto expressing the remainder as fractions (e.g. 5/8) and decimals (e.g. 663.625).
 
</td>
</tr>
</table>

Long division with remainder	Begin by modelling method with a 1-digit divisor. 

Divide- the number inside the house with the number outside of the house. Put the answer on top.

Multiply –the number outside of the house by the number on top of the house. Put this answer below the number inside the house.

Subtract- the number inside the house from the number below the inside number.

Bring down- the next number in the dividend.

Repeat- all the steps repeated as many times as needed until you get down to 0.
If there is a leftover this is your remainder.

When moving onto using long division with a 2-digit divisor, children can write out multiples first:

2	2	) 6	7	1	0

22, 44, 66, 88, 110 etc