Chilvers Coton Community School and Nursery

Calculation Policy

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Maths Mastery

At the centre of the mastery approach to the teaching of mathematics is the belief that all children have the potential to succeed. They should have access to the same curriculum content and, rather than being extended with new learning, they should deepen their conceptual understanding by tackling challenging and varied problems. Similarly, with calculation strategies, children must not simply rote learn procedures but demonstrate their understanding of these procedures through the use of concrete materials and pictorial representations. This policy outlines the different calculation strategies that should be taught at our school which is in line with the requirements of the 2014 Primary National Curriculum.

Background

The 2014 Primary National Curriculum for mathematics differs from its predecessor in many ways. Alongside the end of Key Stage year expectations, there are suggested goals for each year; there is also an emphasis on depth before breadth and a greater expectation of what children should achieve. In addition, there is a whole new assessment method, as the removal of levels gives schools greater freedom to develop and use their own systems. One of the key differences is the level of detail included, indicating what children should be learning and when. This is suggested content for each year group, but schools have been given autonomy to introduce content earlier or later, with the expectation that by the end of each key stage the required content has been covered. For example, in Year 2, it is suggested that children should be able to 'add and subtract one-digit and two-digit numbers to 20, including zero.' In many ways, these specific objectives make it easier for teachers to plan a coherent approach to the development of pupils' calculation skills. However, the expectation of using formal methods is rightly coupled with the explicit requirement for children to use concrete materials and create pictorial representations – a key component of the mastery approach

Mathematical Language

The 2014 National Curriculum is explicit in articulating the importance of children using the correct mathematical language as a central part of their learning (*reasoning*). Indeed, in certain year groups, the non-statutory guidance highlights the requirement for children to extend their language around certain concepts. It is therefore essential that teaching using the strategies outlined in this policy is accompanied by the use of appropriate and precise mathematical vocabulary. New vocabulary should be introduced in a suitable context (for example, with relevant real objects, apparatus, pictures or diagrams) and explained carefully. High expectations of the mathematical language used are essential, with teachers only accepting what is correct.

Use of our Policy

This mathematics policy is a guide for all staff at Chilvers Coton Community School and Nursery it has been adapted from work by the NCETM and Maths Hubs. It is purposely set out as a progression of mathematical skills and not into year group phases to encourage a flexible approach to teaching and learning. It is expected that teachers will use their professional judgement as to when consolidation of existing skills is required or if to move onto the next concept. However, the focus must always remain on breadth and depth rather than accelerating through concepts. Children should not be extended with new learning before they are ready, they should deepen their conceptual understanding by tackling challenging and varied problems. All teachers have been given the scheme of work from White Rose Maths and are required to base their planning around their year group's modules and not to move onto a higher year group's scheme work. These modules use the Singapore Maths Methods and are affiliated to the workings of the 2014 Maths Programme of Study. Teachers are free to use any teaching resources that they wish to use and the policy does not recommend one set of resources over another, rather that, a variety of resources are used. For each of the four operations, different strategies are laid out, together with examples of what concrete materials can be used and how, along with suggested pictorial representations. The principle of the concrete-pictorial-abstract (CPA) approach [Build it, Draw it, Solve it] is for children to have a true understanding of a mathematical concept.

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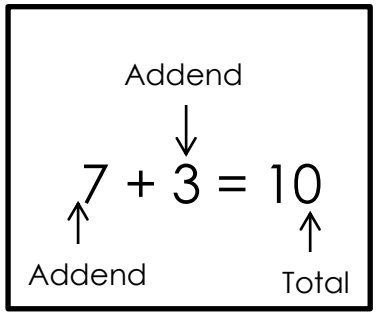
Key Vocabulary

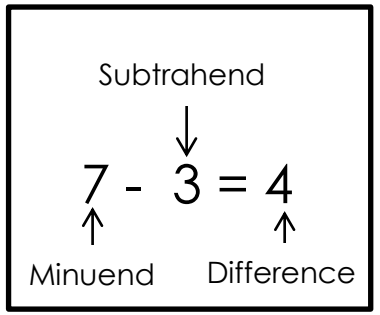
Addition

Add
Addend
More
Plus
Make
Sum
Total
Altogether
Inverse
Double
Equals
Is the same as
Balance
Whole
Parts
Digit
Numeral
Number



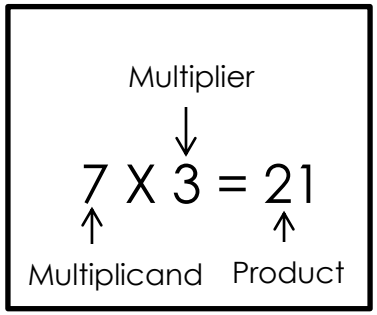
Subtraction

Half
halve
Difference between
Subtract
take away
minus
Inverse
Equals
Is the same as
Balance
Whole
Part
Digit
Numeral
Number
Minuend
Subtrahend



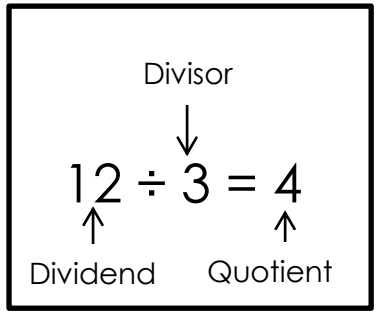
Multiplication

Lots of
groups of
Multiple of
Multiply
multiply by
Repeated addition
Array
Row
column
Double
Equals
Is the same as
Balance
Multiplicand
Multiplier
Product



Division

Halve
Share
share equally
Groups
Equal groups of
Divide
Divided by
Left
Left over
Inverse
Equals
Is the same as
Balance
Dividend
Divisor
Quotient



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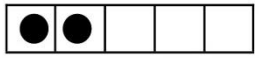
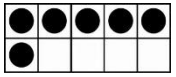
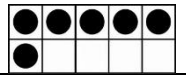
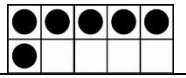
Progression in the use of manipulatives to support			
Nursery	**Reception**	**Year 1**	**Year 2**
Real Life Objects	Real Life Objects	Real Life Objects	Real Life Objects
0-9 digit cards	0-9 digit cards	0-9 digit cards	0-9 digit cards
Number tracks to 10	Number tracks to 10	Number line to 20 and 30	Number lines to 100 and 100 square
Numbered Counting stick	Numbered Counting stick	Counting stick	Counting stick
Five Frame 	Tens Frame 	Tens Frame 	Tens Frame 
		Place Value Charts –Tens and Ones	Place Value Charts – Hundreds, Tens and Ones
Interlocking Cubes – use one colour to represent one amount	Interlocking Cubes – use one colour to represent one amount	Interlocking Cubes – use one colour to represent one amount	Interlocking Cubes – use one colour to represent one amount
		Dienes	Dienes
		Place Value cards tens and ones	Place Value cards tens and ones
Paper Plates represent Part Part Whole	Part Part Whole mat	Part Part Whole mat	Part Part Whole mat
	Bar models with real life objects	Bar models with real life objects/pictures/ representative objects	Bar models with counters
Bead strings to 10	Bead strings to 10	Bead strings to 10 and 20	Bead strings to 10, 20 and 100
Numicon Shapes	Numicon Shapes	Numicon Shapes	Numicon Shapes
Double sided Counters	Double sided Counters	Double sided Counters	Double sided Counters
	Multilink-use one colour to model an amount	Multilink-use one colour to model an amount	Multilink-use one colour to model an amount

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Progression in the teaching of Counting in Foundation Stage

Pre-counting	Ordering	One to one correspondence	Cardinality
The key focus in pre-counting is an understanding of the concepts **more**, **less** and **the same** and an appreciation of how these are related. Children at this stage develop these concepts by **comparison** and no counting is involved	**Count** by reciting the number names in **order forwards** and **backwards** from any **starting point**	**One number** word has to be **matched** to each and every object. Lack of coordination is a source of potential error – it helps if children move the objects as they count, use large rhythmic movements, or clap as they count.	(Knowing the final number counted is the total number of objects) **Count** out a number of objects from a larger collection. Know the number they **stop counting** at will give the **total number** of objects.
Pre-counting ideas Provide children with opportunities to sort groups of objects explicitly using the language of **more** and **less.**   Which group of apples has the most?	**Ordering ideas** Provide children with opportunities to count orally on a daily basis. Rote count so that children are able to understand number order and can hear the rhythm and pattern. Use a drum or clap to keep the beat. 	**One to one correspondence ideas** Play counting games together moving along a track, play games involving amounts such as knocking down skittles.	**Cardinal counting ideas**  How many bananas are in my fruit bowl? Allow children to physically handle the fruit. Provide children with objects to point to and move as they count and say the numbers.

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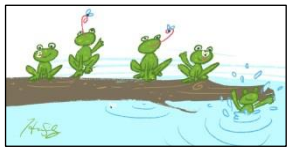
Which group of apples has the least?		Use traditional counting songs throughout the day ensuring children have the visual/kinaesthetic resources eg. 5 little ducks, 10 green bottles,  	

Progression in the teaching of Counting in Foundation Stage

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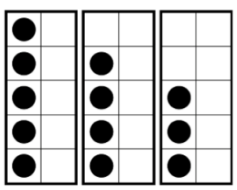
Subitising

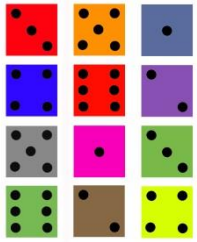
(recognise small numbers without counting them)

Children need to **recognise small amounts without counting** them eg. dot patterns on dice, dots on tens frames, dominoes and playing cards as well as small groups of randomly arranged shapes stuck on cards.

Subitising ideas

Provide children with opportunities to count by recognising amounts.





Abstraction

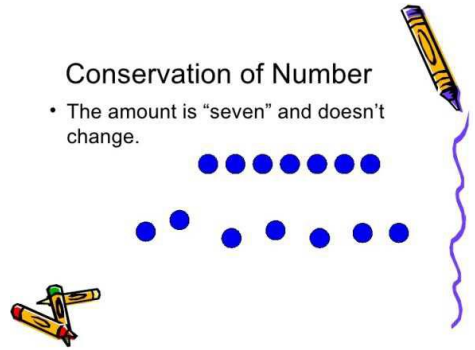
You can count anything – visible objects, hidden objects, imaginary objects, sounds etc. Children find it harder to count things they cannot move (because the objects are fixed) Children also find it difficult to count a mix of different objects, or similar objects of very different sizes.

Abstraction ideas

How many pigs are in this picture? Provide children with a variety of objects to count.

.Conservation of number – MASTERY!

Ultimately children need to **realise** that when objects are **rearranged** the number of them **stays the same**



End of year counting expectations

* count reliably to 20
* order numbers 1-20
* say 1 more/ 1 less than a given number to 20
* estimate a number of objects then check by counting
* use ordinal numbers in context eg first, second, third
* count in twos, fives and tens

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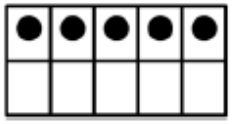
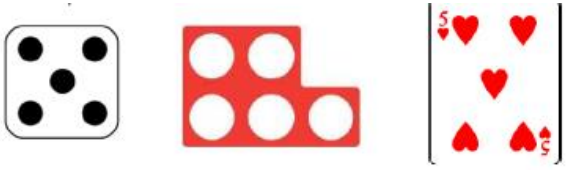
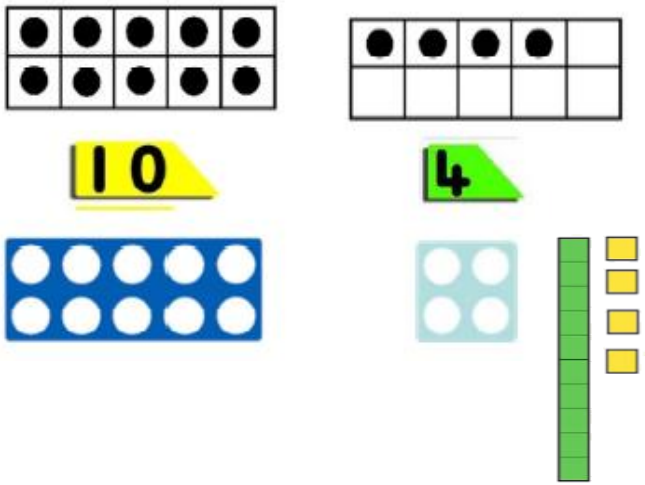
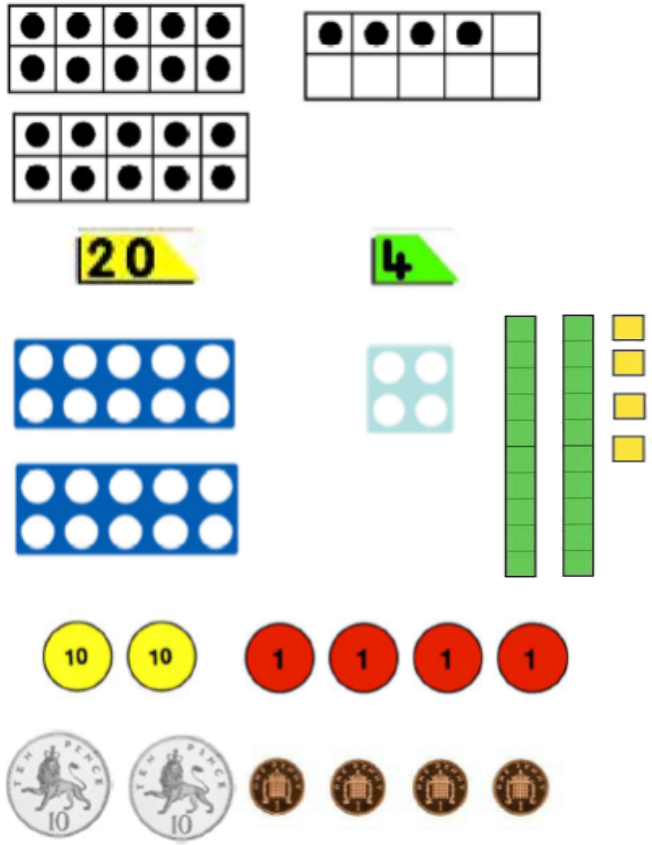
Progression in the teaching of Place Value

Reception	Year 1	Year 2
Understanding ten	**Understanding numbers up to 20**	**Understanding numbers up to one hundred**
A 'Tens Frame' is a simple maths tool that will help our children • Keep track of counting • See number relationships • Learn addition facts to 10 • Understand place value Use tens frame/amount flash cards to ensure children can recognise amounts Use empty tens frames to fill with counters to enable children to understand number relationships Fill in tens frames in rows or in pairs. In a row shows 5. Children can easily then see what is 5 more or 5 less.   Placing the counters in the pairs, allows children to see addition concepts. Include other visual concepts such as dice, cards, dominoes, Numicon etc.	Young children can read 2 digit numbers long before they understand that each digit represents, they may be able to read 62 and 26 and even know which number is larger but don't necessarily have a secure understanding of why the numbers have differing values. Tens-Frames can provide the first steps into understanding a two-digit number simply by using an additional tens frame and then introducing numeral cards this will further assist the understanding of place value 	Continue to develop understanding of place value through the use of tens frames and a range of manipulatives 

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Progression in the teaching of calculations		
	Year 1	**Year 2**
Addition	Combining two parts to make a whole Starting at the bigger number and counting on Regrouping to make 10	Adding three single digits Partitioning two numbers and adding together Column method
Subtraction	Taking away ones Counting back Find the difference Make 10	Counting back Find the difference Make 10 Column method
Multiplication	Doubling Counting in multiples Arrays with support	Doubling Counting in multiples Repeated addition-showing commutative Multiplication
Division	Halving Sharing objects into groups Division as grouping	Halving Division as grouping Division with arrays

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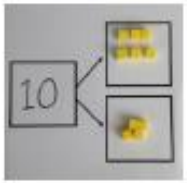
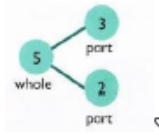
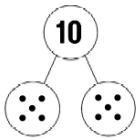
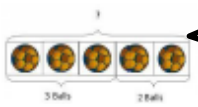
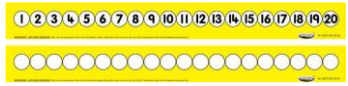
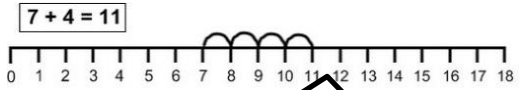
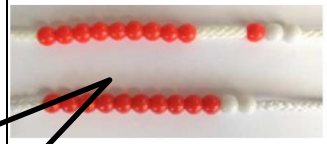
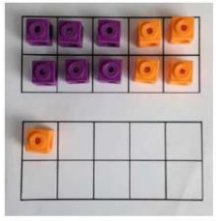
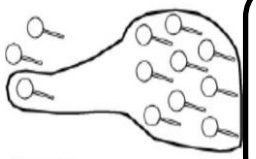
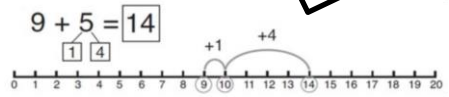
Addition

Strategies and Objectives	Concrete Build it	Pictorial Draw it	Abstract Solve It
Combining two parts to make a whole • Objects • Counting • Use of Part Part Whole Model	    Use Cubes to add two numbers together as a group or in a bar	    Use pictures to add two numbers together as a group or in a bar  	6 + 3 =9 7 = 2+5  Use part part whole diagrams to move from seeing addition as pictorial to abstract
Starting at the biggest number and then counting on • Bead strings • Number lines	Start with the larger number on the bead string then count on 1 by 1 to find the answer   	 Start at the larger number on the number line and count on in ones or in one jump to find the answer.	6 + 13 = 19 . Place larger number in head and then count on the smaller number to find the answer
Regrouping to make 10's • Tens frames • Number lines	  Start with the bigger number and use the smaller number to make 10.	 Use pictures or a number line. Regroup or partition the smaller number to make 10. 3 + 9 = 9 + 5 = 14 1 4  	6 + 5 = If I'm on 6 how many more do I need to make 10? How many more do I add on now?

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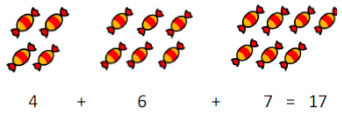
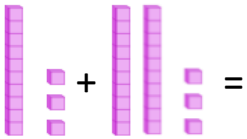
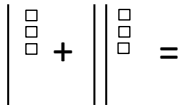
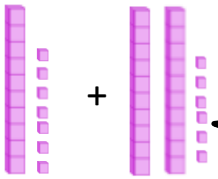
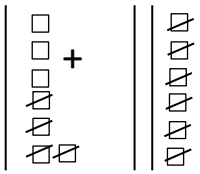
<table>
<tr>
<td>Adding three single digits
• Number lines
• 100 squares
• Tens Frames</td>
<td>4 + 7 + 6= 17
Put 4 and 6 together to make 10. Add on 7.
 
Encourage children to use known facts.
Following on from making 10, make 10 with 2 of the digits (if possible) then add on the third digit.</td>
<td>Add together three groups of objects. Draw a picture to recombine the groups to make 10.
 
</td>
<td>6 + 7 + 4 = 10 + 7
10 = 17
Combine the two numbers that make 10 and then add on the remainder.</td>
</tr>
<tr>
<td>Partitioning using 10's and 1's
• Dienes</td>
<td>Use Dienes to represent 2 digit numbers
  </td>
<td> 
Encourage children to drawn dienes</td>
<td>13 + 23 = 36
10 + 20 = 30
3 + 3= 6
Ensure correct placement of digits so children show their understanding of place value</td>
</tr>
<tr>
<td>Column method with regrouping
• Dienes</td>
<td> 
Add up the units and exchange 10 ones for one ten</td>
<td> 
Children draw the dienes - cross out ten ones and replace with a ten</td>
<td>17+ 26= 43
10 + 20=30
7 + 6 =13</td>
</tr>
</table>

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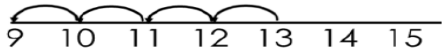
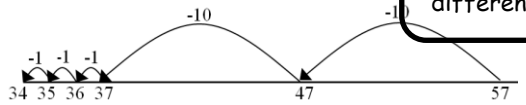
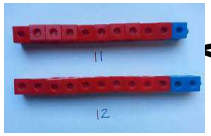
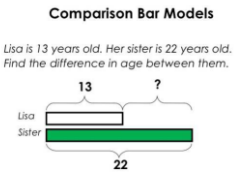
Subtraction

Strategies and Objectives	Concrete Build it	Pictorial Draw it	Abstract Solve It
Taking away ones - Counting objects -	Use real-life physical objects, counters, cubes etc. to show how objects can be taken away. 	Cross out drawn objects to show what has been taken away.  5 – 2 = 3	4 = 6 – 2 18 - 3= 15 8 – 2 = 6
Counting Ones - Counting objects - Bead strings - Number lines	Make the larger number in the subtraction calculation. Move the beads along the bead string whilst counting backwards in ones.  13-4 = Use counters and move them away from the group whilst counting backwards. 	Count back on a number line or number track  Start at the bigger number and count back the smaller number showing the jumps on the number line. Count on to find the difference 	Put 13 in your head, count back 4. What number are you at? Use your fingers to help. Children will need regular practice counting backwards.
Find Difference - Number lines - Objects - Bar models	Compare amounts and objects to find the difference  Use cubes to build towers or make bars to find the difference.	 Use basic bar models with items to find the difference.	Hannah has 23 pencils, Helen has 15 pencils. Find the difference between the number of pencils.

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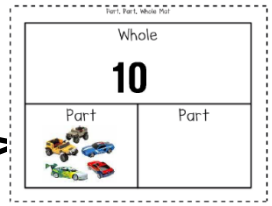
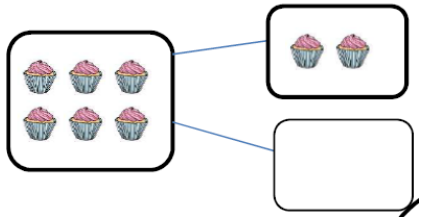
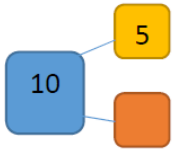
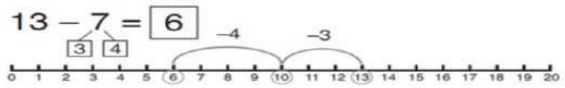
<table>
<tr>
<td>Part-Part Whole

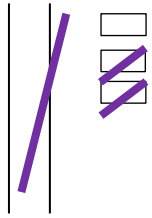
Link to addition use the part whole model to help explain the inverse.</td>
<td> 

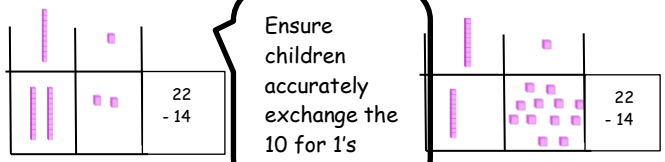
If 10 is the whole and 5 is one of the parts. What is the other part?
10 - 5 = or 10 - ? = 5</td>
<td>Use a pictorial representation of objects to show the part-part-whole model.
  </td>
<td> 

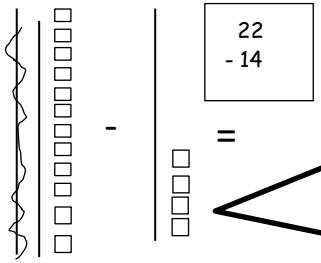
Move to using numbers with the part-part-whole model.

10 - 5 = 5 or 5 = 10 - ?</td>
</tr>
<tr>
<td>Make 10
- Tens frames
- Counters</td>
<td> 
14 – 5 =

Make 14 on the ten frames Take away the four first to make 10 and then takeaway one more so you have taken away 5. You are left with the answer of 9.</td>
<td> 

Start at 13. Take away 3 to reach 10. Then take away the remaining 4 so you have taken away 7 altogether.
You have reached your answer.</td>
<td>16 – 8 =
How many do we take off to reach the next 10? How many do we have left to take off?</td>
</tr>
<tr>
<td>Partitioning using 10's and 1's
- Dienes</td>
<td>23 – 12 =
 
Use Dienes to represent the largest number and then take the smaller number away to find the answer.</td>
<td>23 -12 =
 
Draw dienes for the larger number and then cross out the smaller number to find the answer</td>
<td>23 -12 =11
20 -10 = 10
3 - 2 = 1
10 + 1 = 11

Ensure correct placement of digits so children show their understanding of place value</td>
</tr>
<tr>
<td>Column method with regrouping
• Dienes</td>
<td>Make the larger number with the Dienes. Start with the ones, can I take away 4 from 2 easily? I need to exchange one of my tens for ten ones.
 

Ensure children accurately exchange the 10 for 1's</td>
<td> 

Children draw the dienes – cross out the ten and replace with ten ones then subtract the ones and then the tens</td>
<td>32 - 16= 16
32 – 10= 22
22 – 6 = 16

Children may find it easier to move from abstract to concrete quicker than using pictorial.</td>
</tr>
</table>

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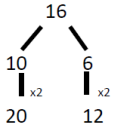
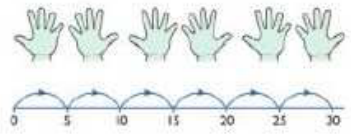
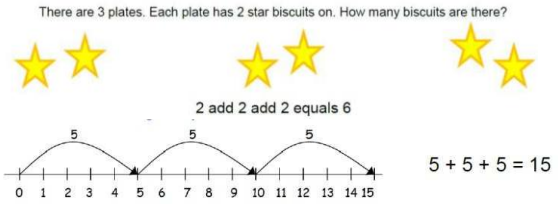
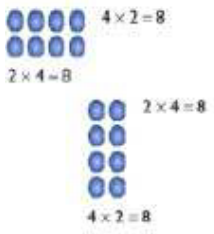
Multiplication

Strategies and Objectives	Concrete Build it	Pictorial Draw it	Abstract Solve It
Doubling	Use practical activities to show how to double a number.  5 x 2 = 10	Draw pictures to show how to double a number Double 5 is 10 Double 4 is 8 	Double 16  Partition a number and then double each part before recombining it back together.
Counting in multiples	 Count in multiples supported by concrete objects in equal groups 	Use a number line or pictures to continue support in counting in multiples. 	Count in multiples of a number aloud. Write sequences with multiples of numbers. 2, 4, 6, 8, 10 5, 10, 15, 20, 25, 30
Repeated addition	  ent add s		Write addition sentences to describe objects and pictures. 
Arrays- showing commutative multiplication	Create arrays using counters/ cubes to show multiplication sentences.  	Draw arrays in different rotations to find **commutative** multiplication sentences 	Use an array to write multiplication sentences and reinforce repeated addition. 5+5+5= 15 3+3+3+3+3=15 3x5 =15 5x3=15 

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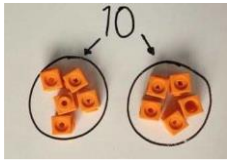
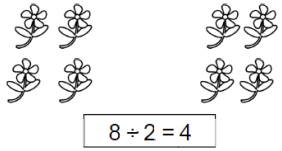
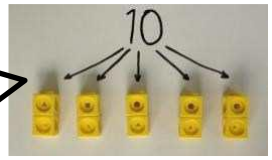
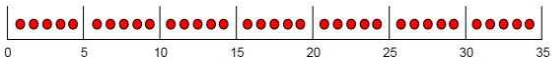
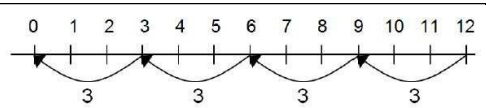
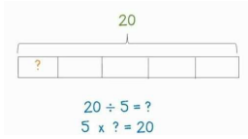
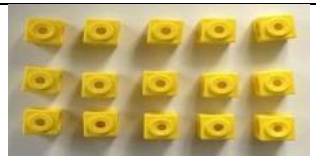
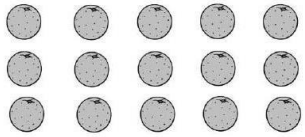
Division

Strategies and Objectives	Concrete Build it	Pictorial Draw it	Abstract Solve It
Sharing objects into groups When we divide into 2 groups we are finding a half ½	I have 10 cubes; can you share them equally into 2 groups? 	Children use pictures or shapes to share quantities.  8 ÷ 2 = 4	One half of 14 is 7 . of 14 = 7 14 ÷ 2 = 7 Share 9 cakes between three people. 9 ÷ 3 = 3
Division as grouping When we divide into 3 groups we are finding a third 1/3	Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.  	 Use a number line to show jumps in groups. The number of jumps equals the number of groups. Think of the bar as a whole. Split it into the number of groups you are dividing by and work out how many would be within each group. 	28 ÷ 7 = 4 Divide 28 into 7 groups. How many are in each group?
Division with arrays	 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	 Draw an array and use lines to split the array into groups to make multiplication and division sentences	Find the inverse of multiplication and division sentences by creating four linking number sentences. 7 x 4 = 28 4 x 7 = 28 28 ÷ 7 = 4 28 ÷ 4 = 7

Chilvers Coton Community School and Nursery Calculation Policy

Times Tables

Times Tables are at the heart of mental arithmetic, which in itself helps form the basis of a child's understanding and ability when working with number. Once the children have learnt their times tables by heart, they are then able to work far more confidently and efficiently through a wide range of more advanced calculations. At Chilvers Coton Community School and Nursery we use a variety of interactive, visual, engaging and rote learning techniques.

Reception	Year 1	Year 2
I can count in steps of 1 I can count in steps of 2 I can count in steps of 10 I can count in steps of 5	All reception targets and I can count in steps of 5 I know my 1 times table I know my 2 times table I know my 10 times table	All Year 1 targets and I know my 5 times table I know my 3 times table

Times tables will be recited throughout the week ideally daily. Chant as: 'One times two is two, two times two is four, three times two is six …..'

Also chant as 'one multiplied by two is two, one two is two, one lot of two is two, one group of two is two, the product of one and two is two etc.'

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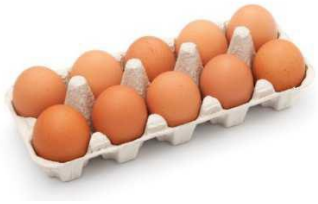
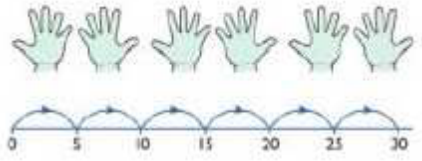
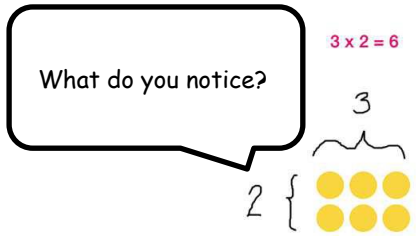
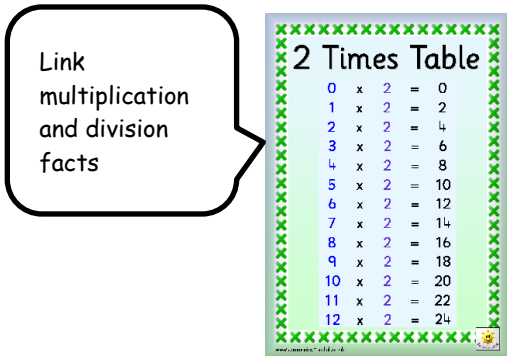
Progression in the teaching of times tables

Children will be taught the concept of multiplication using practical resources.	Children will progress on to using number lines or pictures	Children will count in multiple steps.	Children will recite times tables by rote. Links will be made with 'grouping' and division whilst times tables are being taught.
Concrete **Build it**	**Pictorial** **Draw it**	**Abstract** **Solve It**	**Abstract** **Practise it**
Count in multiples supported by concrete objects in equal groups.   Use real-life arrays or build arrays.  	 Use a number line or pictures to continue support in counting in multiples.  	Count in multiples of a number aloud. Write sequences with multiples of numbers. 2, 4, 6, 8, 10 5, 10, 15, 20, 25, 30 Record multiplication number sentences.  	Recite times tables by rote orally