Great Sankey Primary School

Calculation Policy

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Great Sankey Primary School recognises the importance of delivering an engaging and lively mathematics curriculum across all age ranges. We are committed to ensuring that children have the best possible grounding in maths during their primary years. Mathematics is everywhere we look. Children need to be secure in skills that are so valued and crucial for their future life opportunities.

In order for all children to access the majority of their learning in mathematics, a strong and confident grasp of the four number operations is vital; for mental strategies and formal and informal written methods. This Calculation Policy brings together current teaching practices with the high expectations of the National Curriculum and Primary Framework.

The policy sets out expectations indicative of the minimum expected within each year group. The ultimate decision to progress a child onto a new method of calculation rests with the teacher and child feeling confident and secure with the method they currently rely upon.

The aim of this policy is to set out a clear progressive model of our aims and approaches to mathematics. All staff in school have worked collaboratively to adapt the policy and guidance on teaching approaches for the children in school. All teachers and teaching assistants have had the opportunity to see how the methods in any year build on what went before and feed into what is learned later. The policy also reflects recent adaptations in mathematics teaching in school (for example, the removal of over teaching of the interim 'chunking' as a method for long division). This policy will be reviewed annually to ensure that whole-school approaches in securing calculation skills remain effective.

Key Areas of Development:

- At Great Sankey Primary School we recognise the importance of practical, hands-on experiences of using, calculating and comparing with numbers and quantities. The development of mental methods is crucial in order to establish the very best mathematical start in The Early Years and Key Stage One.

- Concrete resources are an essential staple of all maths lessons and are used to help children visualise and manipulate mathematical concepts. Concrete resources should be readily available to all children during every lesson.

- Mathematical language is encouraged across all subjects and is developed at every opportunity to enable the children to express themselves and their thinking using the correct vocabulary.

- A good recall of number facts (number bonds, multiplication tables) is strongly encouraged and plays an essential role in helping children to develop their mental methods. Children use these basic skills daily and landmarks are celebrated with certificates and whole school accolade.

- Each operation is generally introduced alongside its inverse operation (subtraction with addition, division alongside multiplication). This is to aid fluency and recognition of inverse operations, the links they have and help in the aid of rewriting number sentences and solving simple mental questions (2+3=5 as 5-3=2, developed to -2=☐ by thinking 2+3=5 or 5-2=3).

- Through high quality teaching, children are taught to use a wide range of methods, jotting and are encouraged to be flexible with their thinking and approaches. Children are encouraged to explain their approaches and share these with others, including the discussion of misconceptions to support any difficulties.

- All teaching staff place a strong emphasis on fluency, application and problem solving as an integral stage of the learning within each unit.

- Through our revised topic and skills-based curriculum, cross-curricular opportunities are highlighted and planned for to ensure more meaningful application.

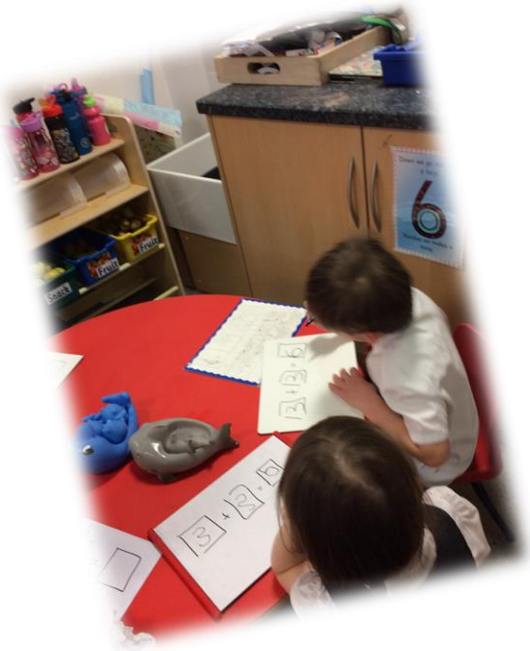
- We have reduced the use of 'expanded' and 'chunking' methods as it was felt that too many steps were confusing the children, in particular the less able. A clearer approach also ensures consistency in the teaching of the methods to the children, using the White Rose Maths as a guide and teaching resource.

- The maths leader regularly updates staff with changes and developments. Planning, teaching and intervention is monitored regularly and opportunities to develop subject knowledge and subject-specific teaching skills are recognised through Inset and staff meetings.

Maths in the Early Years Foundation Stage:

Learning and development in maths starts from the moment children join us at GSP. Children in the Early Years are playing and exploring, actively learning, creating and thinking critically across all areas in this phase. Essential maths skills and knowledge are taught through a range of discreet tasks across different areas.

Resources that develop shape and space, understanding through pictures are actively used to support learning and exploration.



Children are encouraged to use mathematical language through the water and sand trays.

Simple mathematical challenges are given to the children to solve using concrete resources.

Events that interest the children are used to support maths activities. Here we see children using maths through birthdays and their arctic animal topic.

Children are also introduced to materials for counting, number lines and digits.

The new Early Adopters Framework became statutory from September 2021. The teaching of mathematics has been split into the following phases:

Birth to 3 Years

- Combine objects like stacking blocks and cups. Put objects inside others and take them out again.
- Take part in finger rhymes with numbers.
- React to changes of amount in a group of up to three items.
- Compare amounts, saying 'lots', 'more' or 'same'.
- Counting-like behaviour, such as making sounds, pointing or saying some numbers in sequence.
- Count in everyday contexts, sometimes skipping numbers - '1-2-3-5.'
- Climb and squeezing selves into different types of spaces.
- Build with a range of resources.
- Complete inset puzzles.
- Compare sizes, weights etc. using gesture and language - 'bigger/little/smaller', 'high/low', 'tall', 'heavy'.
- Notice patterns and arrange things in patterns.

Nursery

- Fast recognition of up to 3 objects, without having to count them individually ('subitising').
- Recite numbers past 5.
- Say one number for each item in order: 1,2,3,4,5.
- Know that the last number reached when counting a small set of objects tells you how many there are in total ('cardinal principle').
- Show 'finger numbers' up to 5.
- Link numerals and amounts: for example, showing the right number of objects to match the numeral, up to 5.
- Experiment with their own symbols and marks as well as numerals.
- Solve real world mathematical problems with numbers up to 5.
- Compare quantities using language: 'more than', 'fewer than'.
- Talk about and explore 2D and 3D shapes (for example, circles, rectangles, triangles and cuboids) using informal and mathematical language: 'sides', 'corners'; 'straight', 'flat', 'round'.
- Understand position through words alone – for example, "The bag is under the table," – with no pointing.
- Describe a familiar route.
- Discuss routes and locations, using words like 'in front of' and 'behind'.
- Make comparisons between objects relating to size, length, weight and capacity
- Select shapes appropriately: flat surfaces for building, a triangular prism for a roof etc.
- Combine shapes to make new ones – an arch, a bigger triangle etc.
- Talk about and identifies the patterns around them. For example: stripes on clothes, designs on rugs and wallpaper. Use informal language like 'pointy', 'spotty', 'blobs' etc.
- Extend and create ABAB patterns – stick, leaf, stick, leaf.
- Notice and correct an error in a repeating pattern.
- Begin to describe a sequence of events, real or fictional, using words such as 'first', 'then...'

Reception

- Count objects, actions and sounds.
- Subitise.
- Link the number symbol (numeral) with its cardinal number value
- Count beyond ten.
- Compare numbers
- Understand the 'one more than/one less than' relationship between consecutive numbers.
- Explore the composition of numbers to 10.
- Automatically recall number bonds for numbers 0–10.
- Select, rotate and manipulate shapes in order to develop spatial reasoning skills.
- Compose and decompose shapes so that children recognise a shape can have other shapes within it, just as numbers can.
- Continue, copy and create repeating patterns.
- Compare length, weight and capacity.

Early Learning Goals

Number

- Have a deep understanding of number to 10, including the composition of each number.
- Subitise (recognise quantities without counting) up to 5.
- Automatically recall (without reference to rhymes, counting or other aids) number bonds up to 5 (including subtraction facts) and some number bonds to 10, including double facts.

Numerical Patterns

- Verbally count beyond 20, recognising the pattern of the counting system.
- Compare quantities up to 10 in different contexts, recognising when one quantity is greater than, less than or the same as the other quantity.
- Explore and represent patterns within numbers up to 10, including evens and odds, double facts and how quantities can be distributed equally

White Rose

At Great Sankey Primary school, we are utilising and adapting a policy produced by the White Rose Maths Hub (now referred to as the West Yorkshire Hub). The scheme provided acts as a guidance for our teaching staff, breaking down mathematical concepts into smaller steps. This in turn allows us to monitor the progress the children make in their learning better, and ensure that all children are accessing the curriculum at a level appropriate to their needs. We believe that all children, when introduced to a new concept, should have the opportunity to build competency by taking this approach.

Concrete – children should have the opportunity to use concrete objects and manipulatives to help them understand what they are doing

Pictorial – alongside this, children should use pictorial representations. These representations can then be used to help reason and solve problems.

Abstract – both concrete and pictorial representations should support children's understanding of abstract methods.

Teaching and Learning at Great Sankey

At Great Sankey, teachers will often use pre-diagnostic questions to assess the children's understanding of a concept and highlight areas for development prior to discrete teaching. This guides our teaching of Maths and indicates how our teaching should be focussed against different points of the curriculum. The White Rose Hub breaks down Maths learning into 3 main areas: fluency, reasoning and problem solving. This integrated approach is well known to play an essential role in helping pupils gain a deeper understanding of a topic. Below are examples of how you may see this in practice at Great Sankey Primary School.

Fluency:

Typically, teachers start new topics by developing fluency to give learners confidence with the skill being taught. It is essential that learners are able to answer basic questions using basic operations as without these fundamental skills, they will be unable to answer

questions that truly test their understanding of a concept. However, teachers may choose to begin a concept by taking a look at a problem-solving question, encouraging learners to use the skills they have already been taught elsewhere, and applying them in a completely new format. This often helps to deepen a child's understanding of a concept sooner.

Reasoning:

Reasoning is an integral part of the Maths curriculum and encourages the children to reason, explain and justify their thinking. This can take many forms in a Maths lesson. For example, a teacher may get children to voice their thought processes or explain how they know a statement is true. We want our children to be able to clearly communicate their ideas before writing them down and using them in practice. Ensuring that our children use the correct terminology and have a secure understanding and use of maths vocabulary is also an essential part of this.

Problem Solving:

Problem solving is an important skill for all ages and abilities and, as such, needs to be taught explicitly. It helps to develop mathematical power and gives students the tools to apply their mathematical knowledge to solve hypothetical and real word problems. Children of all abilities are encouraged to make decisions and explore different routes when solving problems.

The White Rose teaching for Mastery scheme is designed to support our teaching staff in providing a mastery approach to the teaching and learning of maths against the objectives of the new National Curriculum.

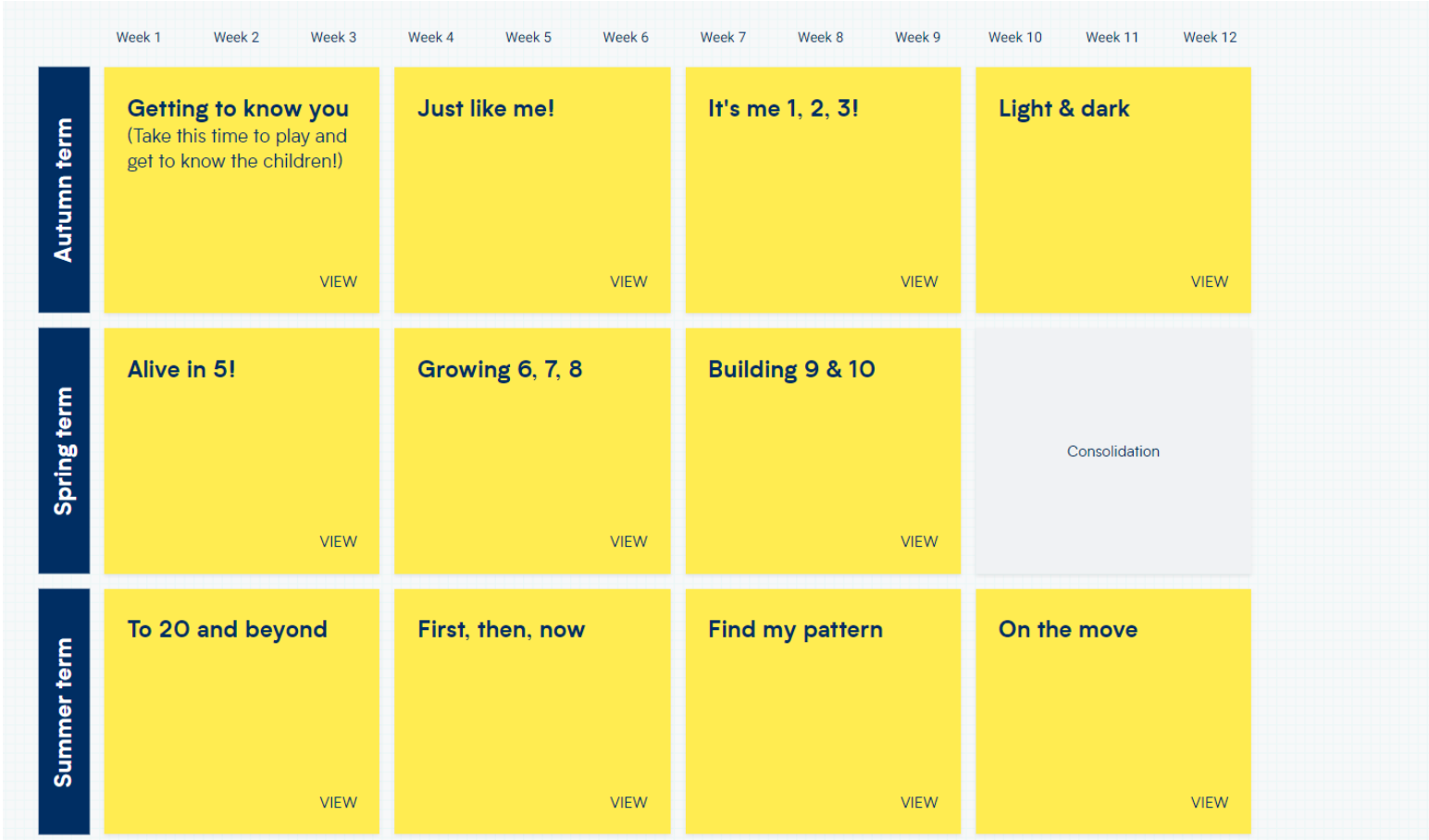
The overview:

- Our maths lessons have number at the centre of learning. A large proportion of time is spent reinforcing number to build competency and fluency.
- Ensure that children are receiving tailored support against each curriculum standard applicable to their year group.
- Ensure that all students have the opportunity to stay together as they work through a variety of concepts from the maths curriculum.
- Provide plenty of opportunities to build reasoning and problem-solving elements into the curriculum.

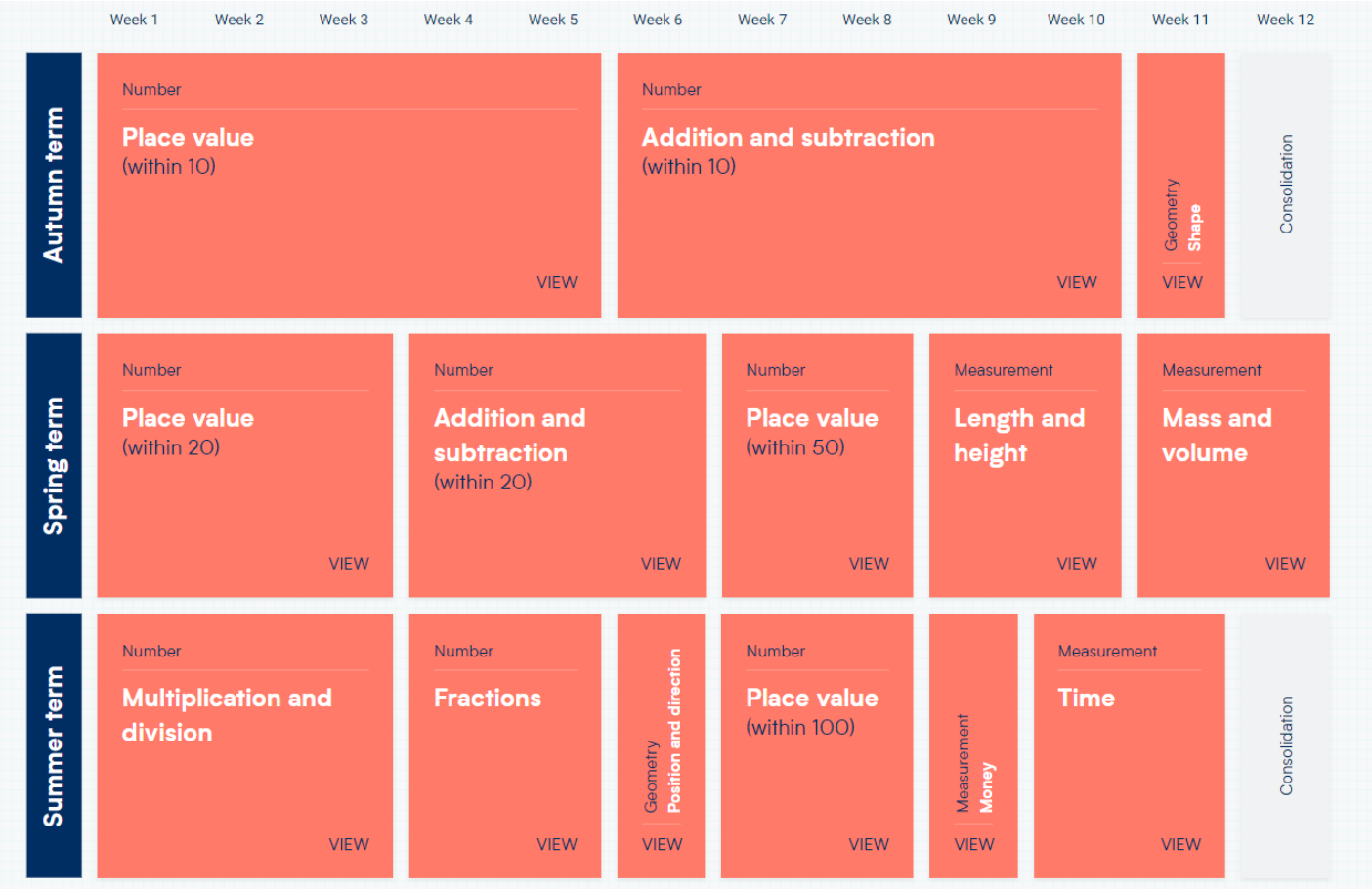
These overviews act as a guide across the year however, there may be some changes, depending on need. Mixed age yearly overviews are available on the White Rose Maths website and staff teaching in these classes are encouraged to use the overview best suited to their current cohort.

This policy is based on the White Rose Calculation policy with some minor adaptations.

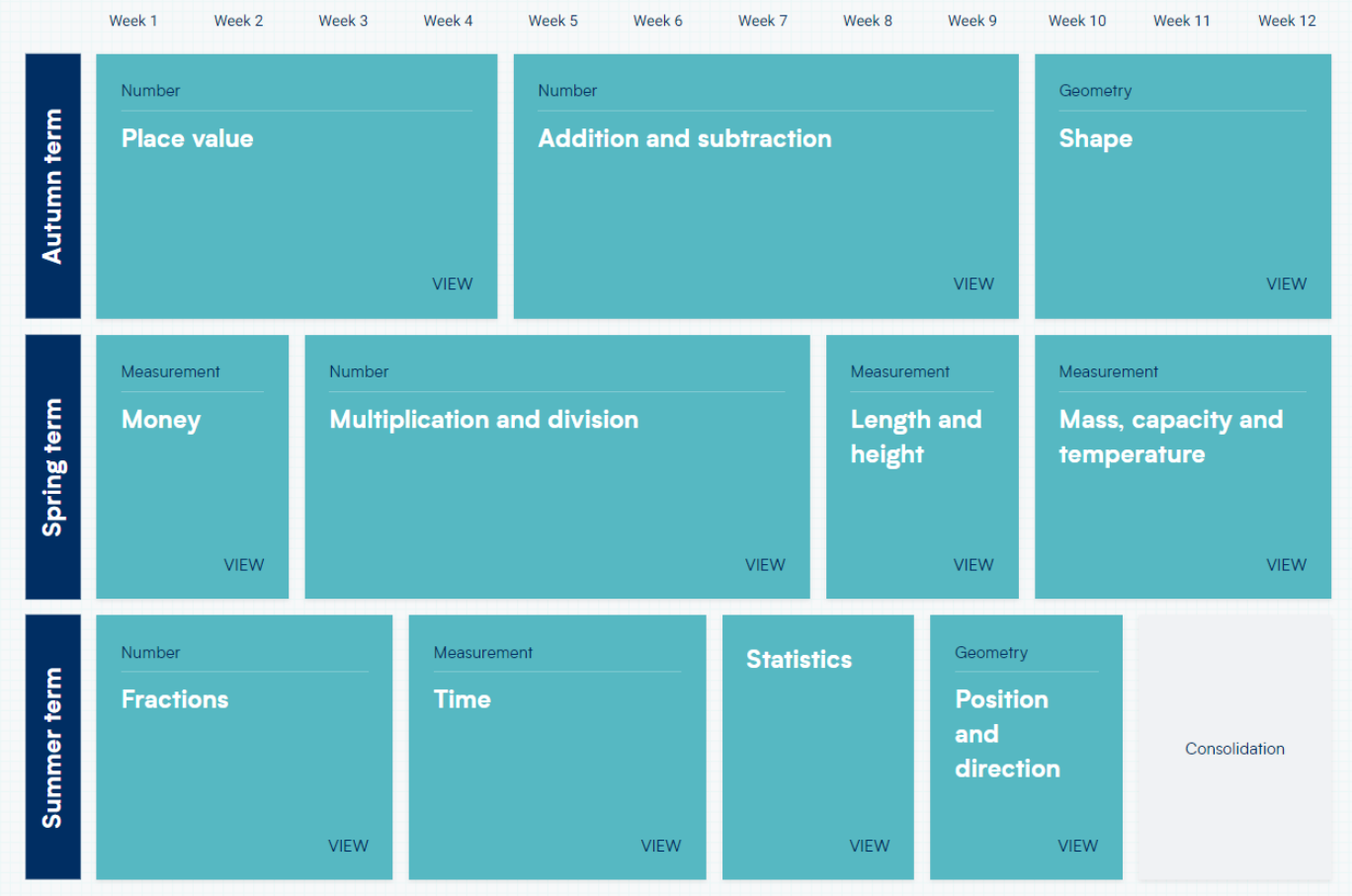
Reception – Yearly Overview



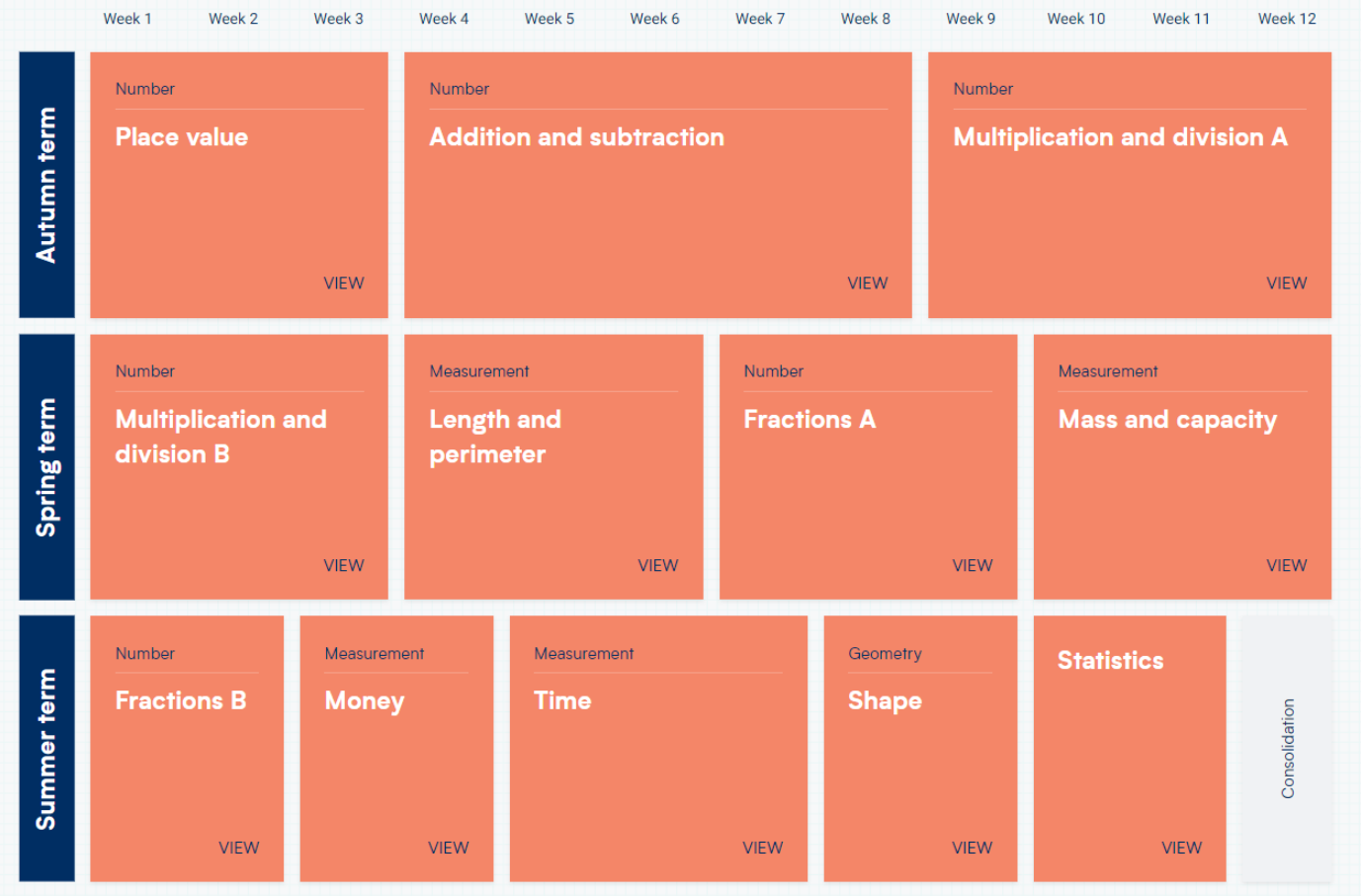
Year 1 – Yearly Overview



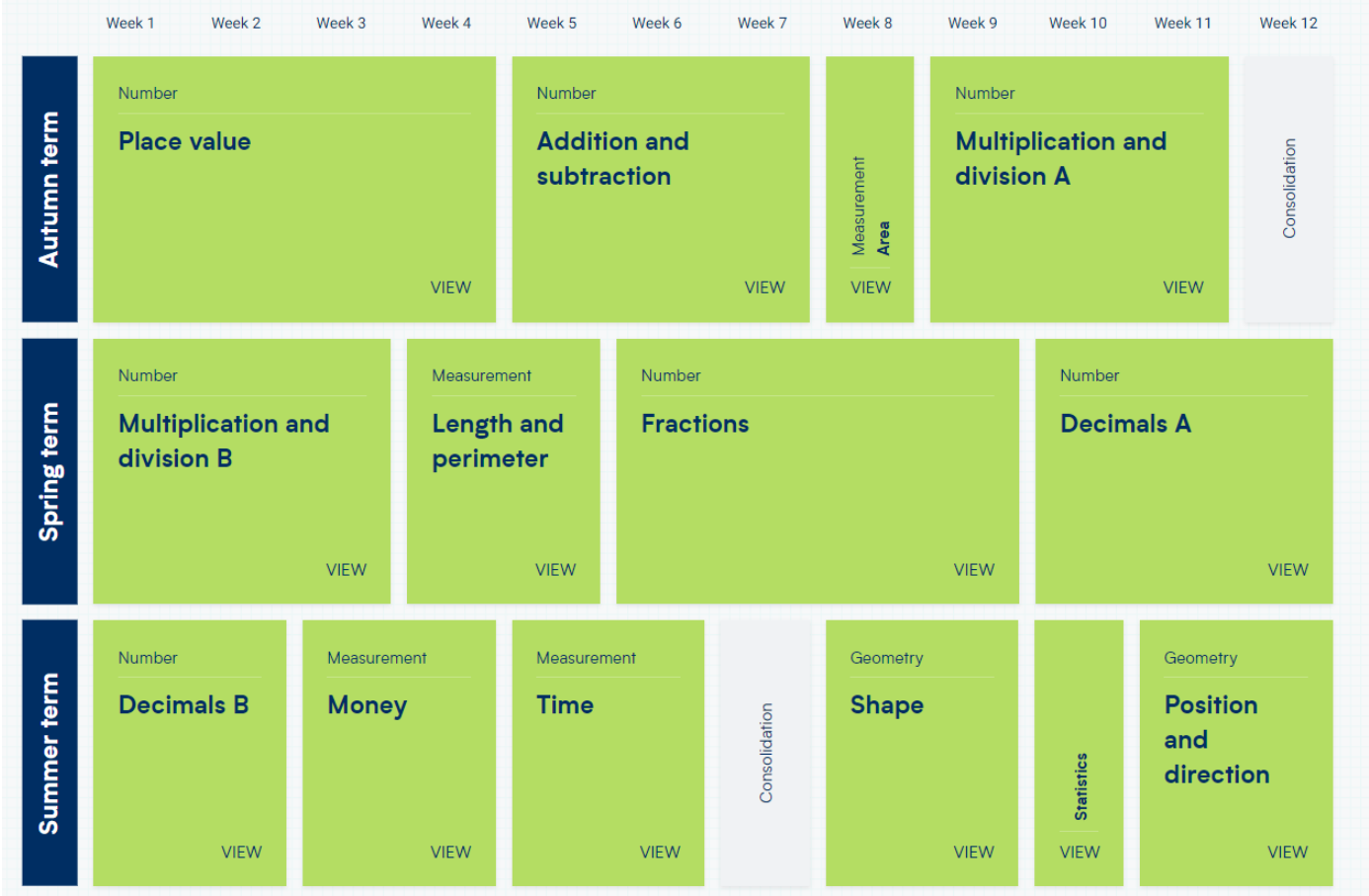
Year 2 – Yearly Overview



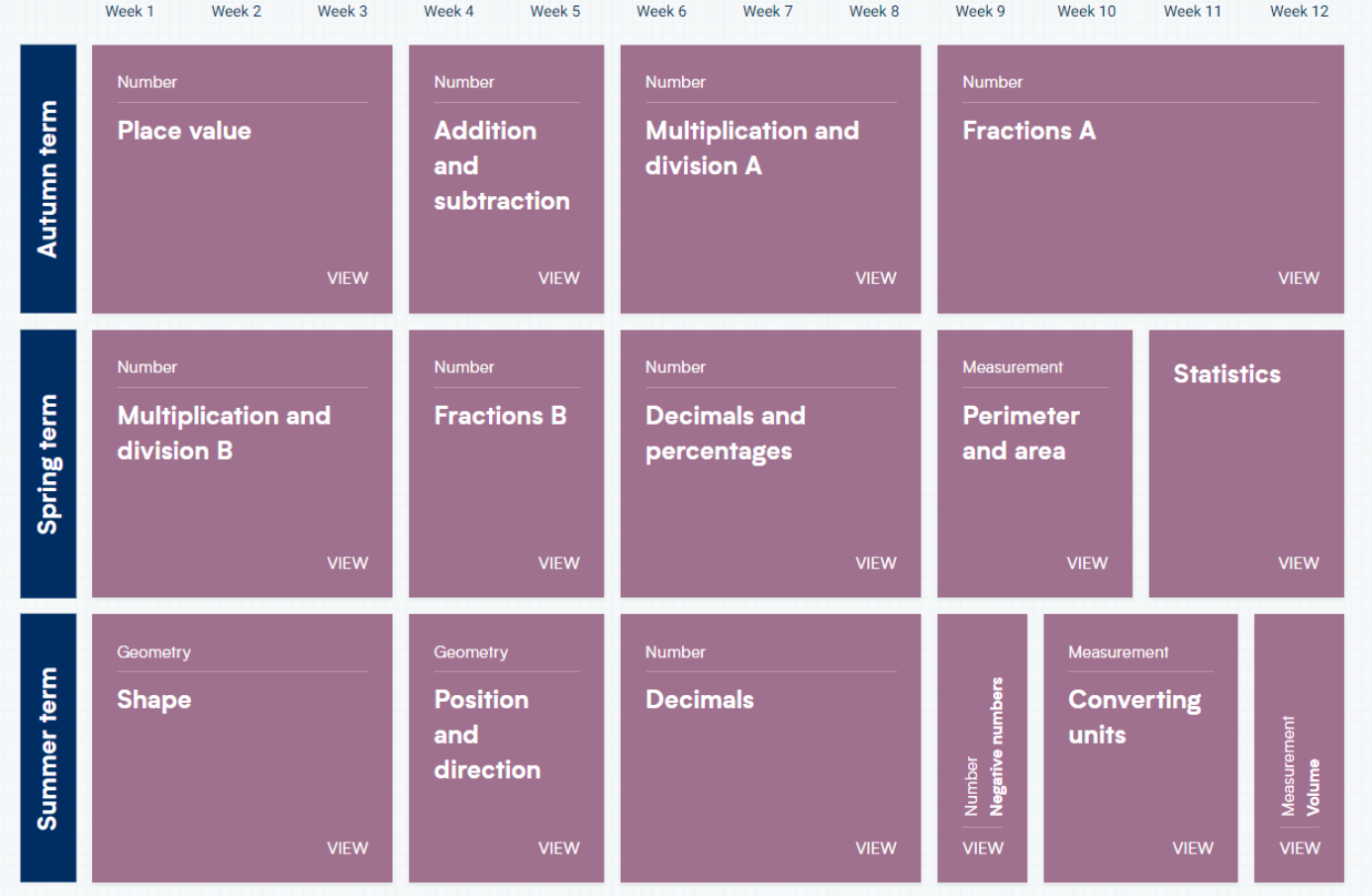
Year 3 – Yearly Overview



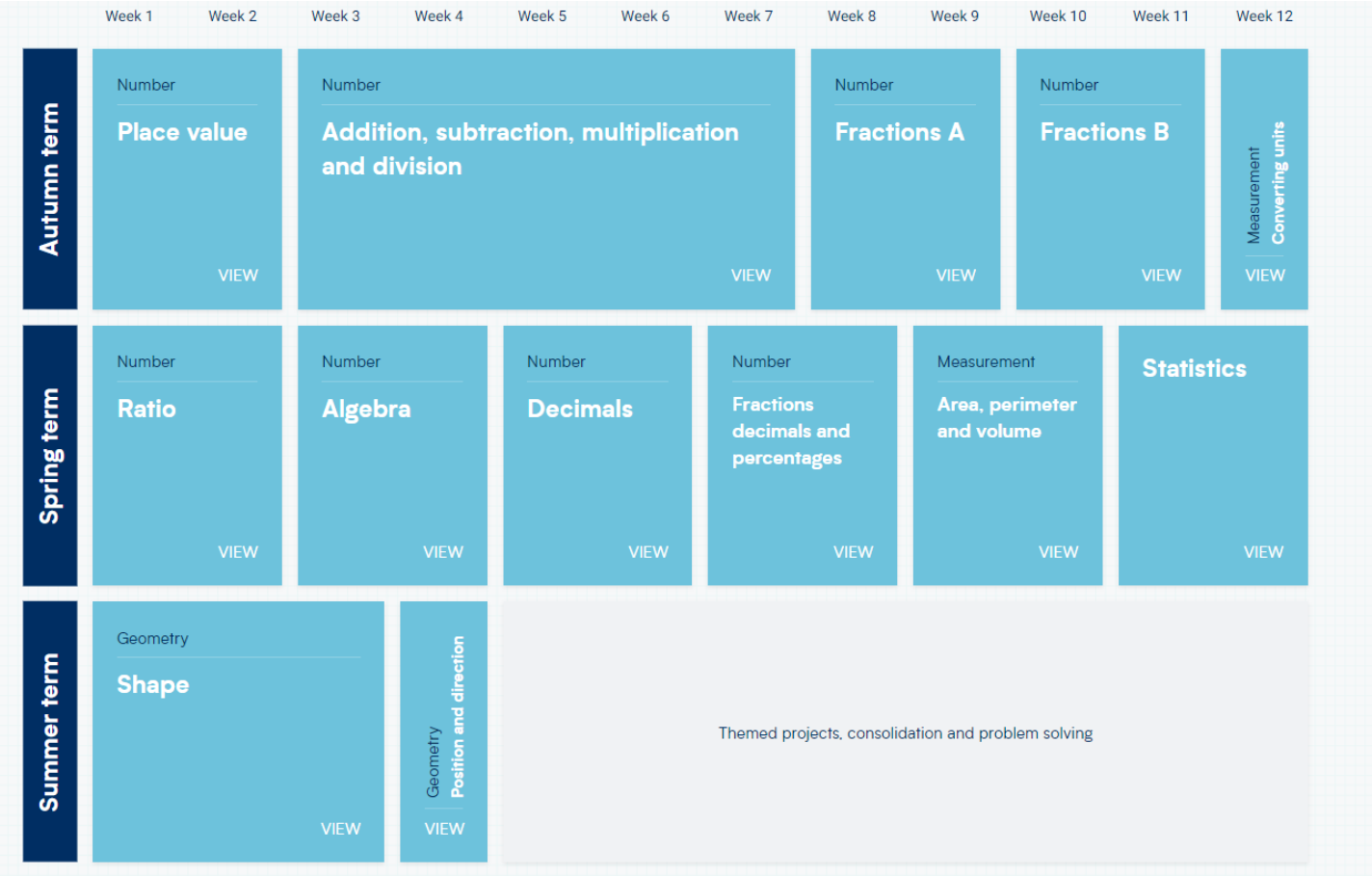
Year 4 – Yearly Overview



Year 5 – Yearly Overview



Year 6 – Yearly Overview



Calculation Policy Guidance Overview

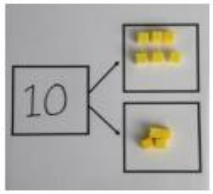
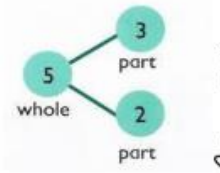
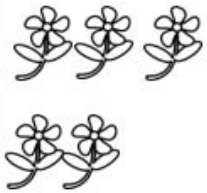
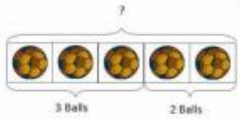
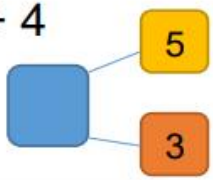
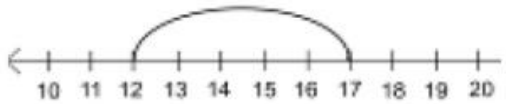
	EYFS/Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Addition	Combining two parts to make a whole: part whole model. Starting at the bigger number and counting on- using cubes. Regrouping to make 10 using ten frame.	Adding three single digits. Use of base 10 to combine two numbers.	Column method- regrouping. Using place value counters (up to 3 digits).	Column method- regrouping. (up to 4 digits)	Column method- regrouping. Use of place value counters for adding decimals.	Column method- regrouping. Abstract methods. Place value counters to be used for adding decimal numbers.
Subtraction	Taking away ones Counting back Find the difference Part whole model Make 10 using the ten frame	Counting back Find the difference Part whole model Make 10 Use of base 10	Column method with regrouping. (up to 3 digits using place value counters)	Column method with regrouping. (up to 4 digits)	Column method with regrouping. Abstract for whole numbers. Start with place value counters for decimals- with the same amount of decimal places.	Column method with regrouping. Abstract methods. Place value counters for decimals- with different amounts of decimal places.

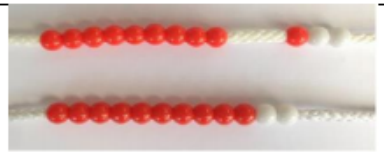
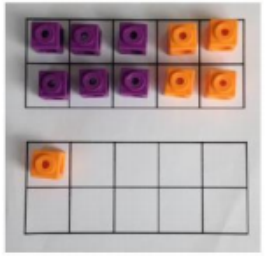
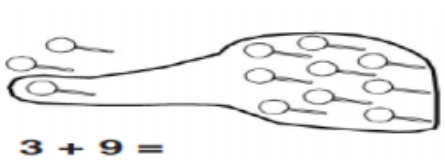
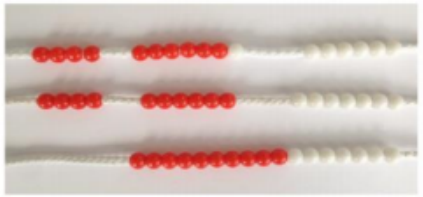
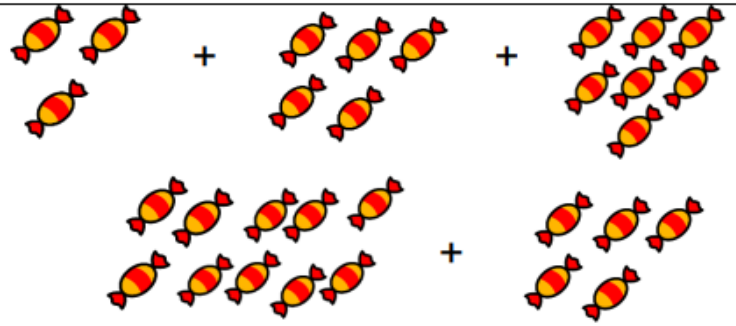
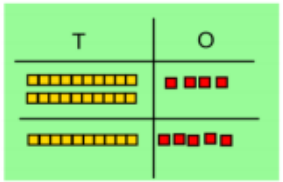
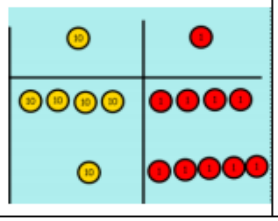
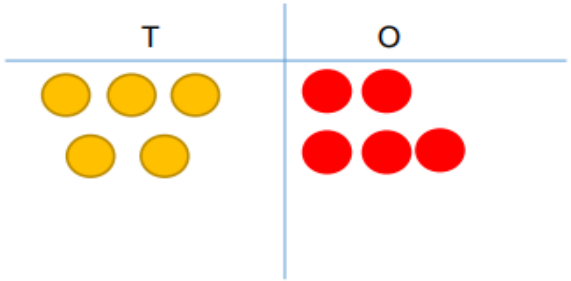
Multiplication	Recognising and making equal groups. Doubling Counting in multiples Use cubes, Numicon and other objects in the classroom	Arrays- showing commutative multiplication	Arrays 2d × 1d using base 10	Column multiplication- introduced with place value counters. (2 and 3 digit multiplied by 1 digit)	Column multiplication Abstract only but might need a repeat of year 4 first(up to 4 digit numbers multiplied by 1 or 2 digits)	Column multiplication Abstract methods (multi-digit up to 4 digits by a 2 digit number)
Division	Sharing objects into groups Division as grouping e.g. I have 12 sweets and put them in groups of 3, how many groups? Use cubes and draw round 3 cubes at a time.	Division as grouping Division within arrays- linking to multiplication Repeated subtraction	Division with a remainder-using lollipop sticks, times tables facts and repeated subtraction. 2d divided by 1d using base 10 or place value counters	Division with a remainder Short division (up to 3 digits by 1 digit- concrete and pictorial)	Short division (up to 4 digits by a 1 digit number including remainders)	Short division Long division with place value counters (up to 4 digits by a 2 digit number) Children should exchange into the tenths and hundredths column too

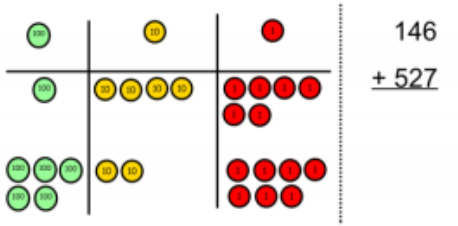
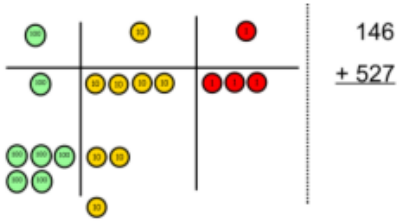
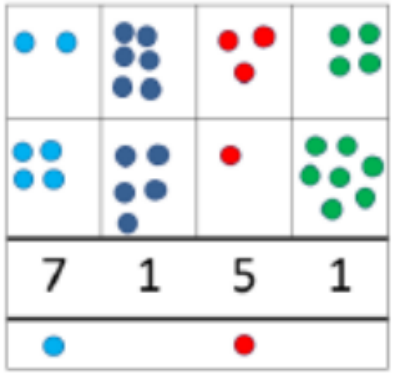
Progression in Calculations

It is important that the children understand the calculation in a concrete way at first (using apparatus), then using pictures to represent their thinking before finally completing calculations in a more abstract way (formal methods). This applies to all year groups. It is paramount for them to explain their reasoning about how they are calculating at every stage.

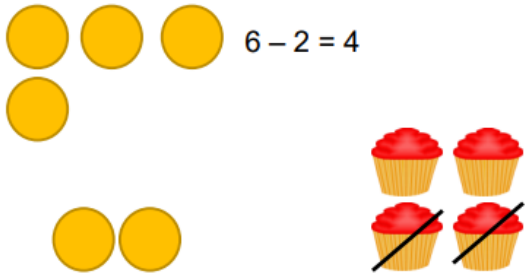
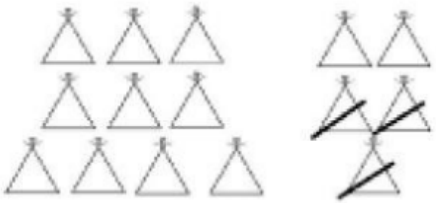
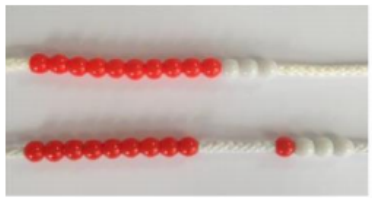
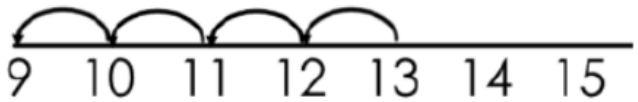
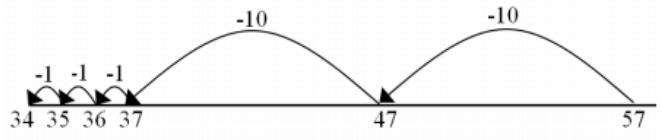
Addition:

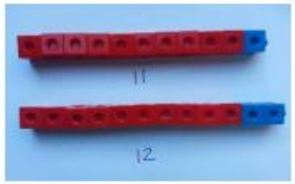
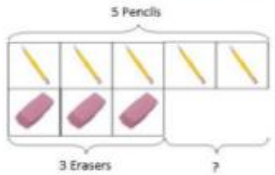
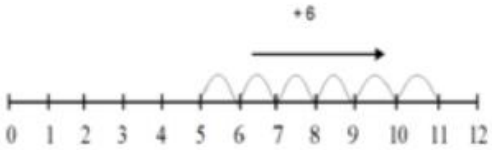
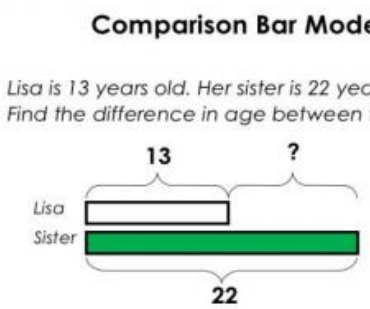
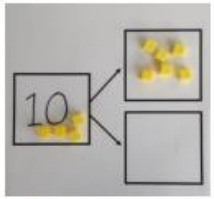
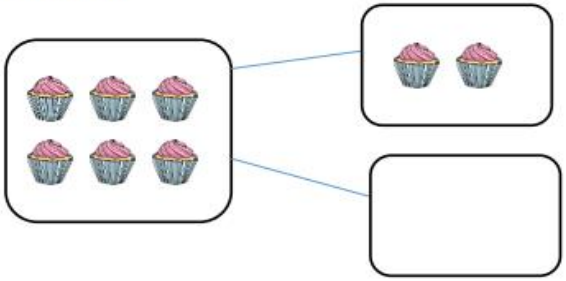
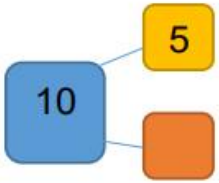
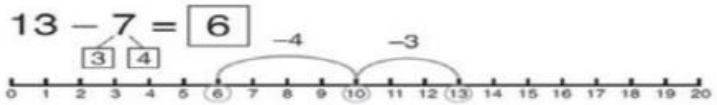
Objective and Strategies	Concrete	Pictorial	Abstract
Combining two parts to make a whole: part-whole model	   Use cubes to add two numbers together as a group or in a bar. 	   Use pictures to add two numbers together as a group or in a bar. 	4 + 3 = 7 10= 6 + 4  Use the part-part whole diagram as shown above to move into the abstract.
Starting at the bigger number and counting on	 Start with the larger number on the bead string and then count on to the smaller number 1 by 1 to find the answer.	12 + 5 = 17  Start at the larger number on the number line and count on in ones or in one jump to find the answer.	5 + 12 = 17 Place the larger number in your head and count on the smaller number to find your answer.

Regrouping to make 10.	 6 + 5 = 11  Start with the bigger number and use the smaller number to make 10.	 3 + 9 = Use pictures or a number line. Regroup or partition the smaller number to make 10. 9 + 5 = 14 1 4 +1 +4 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	7 + 4= 11 If I am at seven, how many more do I need to make 10. How many more do I add on now?
Adding three single digits	4 + 7 + 6= 17 Put 4 and 6 together to make 10. Add on 7.  Following on from making 10, make 10 with 2 of the digits (if possible) then add on the third digit.	 Add together three groups of objects. Draw a picture to recombine the groups to make 10.	4 + 7 + 6 = 10 + 7 10 = 17 Combine the two numbers that make 10 and then add on the remainder.
Column method- no regrouping	24 + 15= Add together the ones first then add the tens. Use the Base 10 blocks first before moving onto place value counters.  	After practically using the base 10 blocks and place value counters, children can draw the counters to help them to solve additions. 	Calculations 21 + 42 = 21 + 42

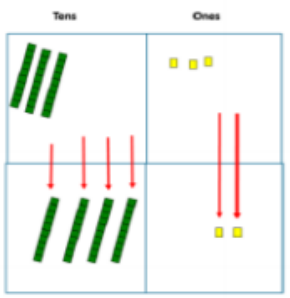
Column method- regrouping	Make both numbers on a place value grid.  146 + 527 Add up the units and exchange 10 ones for one 10.  146 + 527 Add up the rest of the columns, exchanging the 10 counters from one column for the next place value column until every column has been added. This can also be done with Base 10 to help children clearly see that 10 ones equal 1 ten and 10 tens equal 100. As children move on to decimals, money and decimal place value counters can be used to support learning.	Children can draw a pictoral representation of the columns and place value counters to further support their learning and understanding.  7 1 5 1	Start by partitioning the numbers before moving on to clearly show the exchange below the addition. 20 + 5 40 + 8 60 + 13 = 73 536 + 85 621 1 1 As the children move on, introduce decimals with the same number of decimal places and different. Money can be used here. 72.8 + 54.6 127.4 1 1 £ 2 3 . 5 9 + £ 7 . 5 5 £ 3 1 . 1 4 1 1 1 2 3 . 3 6 1 9 . 0 8 0 5 9 . 7 7 0 + 1 . 3 0 0 9 3 . 5 1 1 2 1 2

Subtraction:

Objective and Strategies	Concrete	Pictorial	Abstract
Taking away ones	Use physical objects, counters, cubes etc to show how objects can be taken away.  6 – 2 = 4	Cross out drawn objects to show what has been taken away.  15 – 3 = 12	18 -3= 15 8 – 2 = 6
Counting back	Make the larger number in your subtraction. Move the beads along your bead string as you count backwards in ones.  13 – 4 Use counters and move them away from the group as you take them away counting backwards as you go. 	Count back on a number line or number track  9 10 11 12 13 14 15 Start at the bigger number and count back the smaller number showing the jumps on the number line.  -10 -10 -1 -1 -1 34 35 36 37 47 57 This can progress all the way to counting back using two 2 digit numbers.	Put 13 in your head, count back 4. What number are you at? Use your fingers to help.

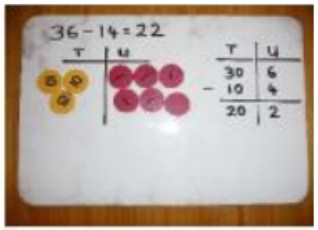
Find the difference	Compare amounts and objects to find the difference.  Use cubes to build towers or make bars to find the difference  Use basic bar models with items to find the difference	 Count on to find the difference. Draw bars to find the difference between 2 numbers. 	Hannah has 23 sandwiches, Helen has 15 sandwiches. Find the difference between the number of sandwiches.
Part Part Whole Model	 Link to addition- use the part whole model to help explain the inverse between addition and subtraction. If 10 is the whole and 6 is one of the parts. What is the other part? 10 - 6 =	Use a pictorial representation of objects to show the part part whole model. 	 Move to using numbers within the part whole model.
Make 10	14 – 9 =  Make 14 on the ten frame. 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.	 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.	16 – 8= How many do we take off to reach the next 10? How many do we have left to take off?

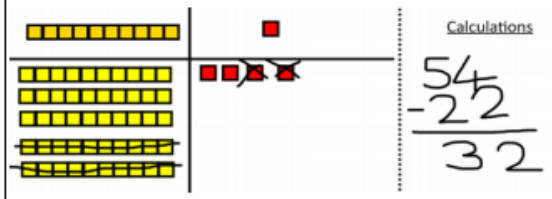
Column method without regrouping

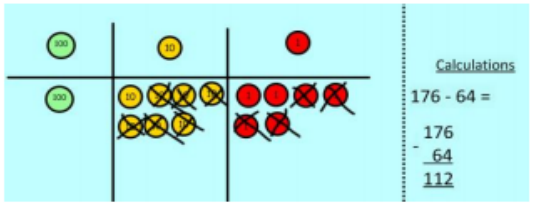


Use Base 10 to make the bigger number then take the smaller number away.

Show how you partition numbers to subtract. Again make the larger number first.





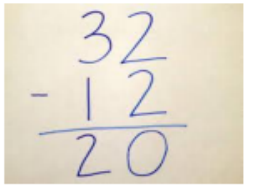


Draw the Base 10 or place value counters alongside the written calculation to help to show working.

47 - 24 = 23

40 + 7
- 20 + 4
20 + 3

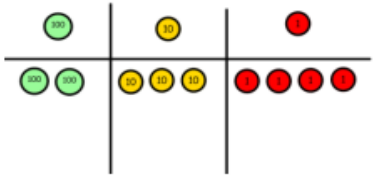
This will lead to a clear written column subtraction.

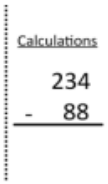


Column method with regrouping

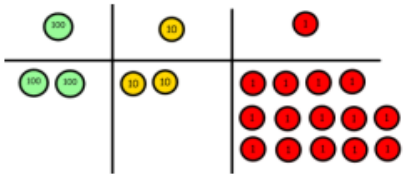
Use Base 10 to start with before moving on to place value counters. Start with one exchange before moving onto subtractions with 2 exchanges.

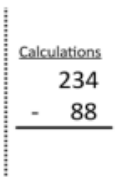
Make the larger number with the place value counters

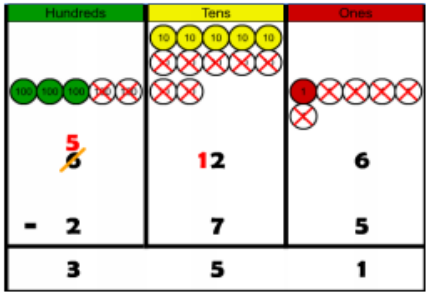




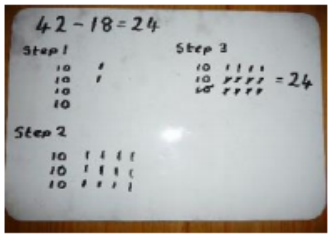
Start with the ones, can I take away 8 from 4 easily? I need to exchange one of my tens for ten ones.





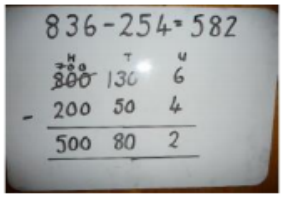


Draw the counters onto a place value grid and show what you have taken away by crossing the counters out as well as clearly showing the exchanges you make.

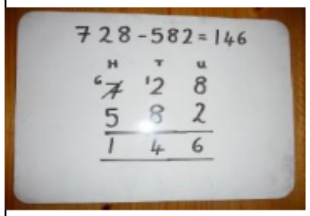


When confident, children can find their own way to record the exchange/regrouping.

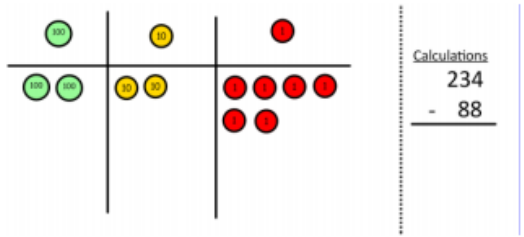
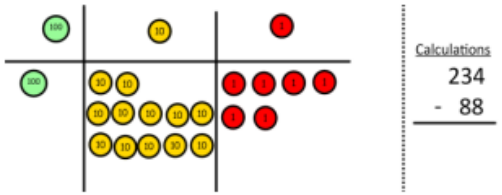
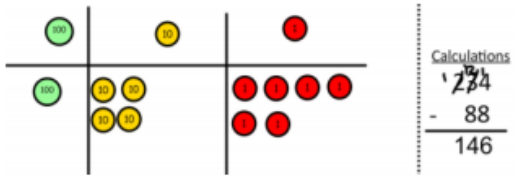
Just writing the numbers as shown here shows that the child understands the method and knows when to exchange/regroup.



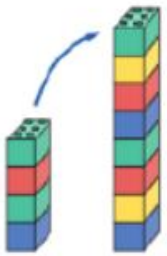
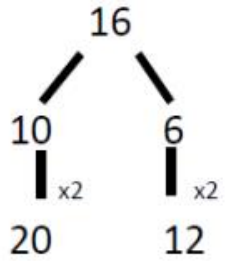
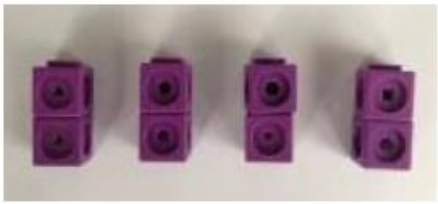
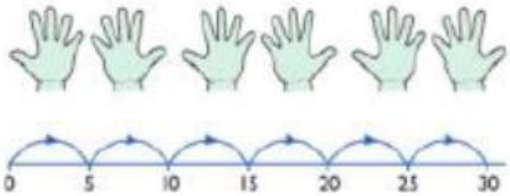
Children can start their formal written method by partitioning the number into clear place value columns.

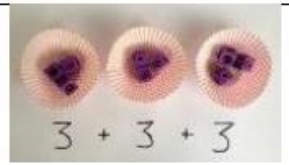
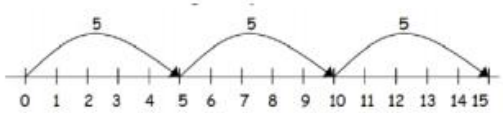
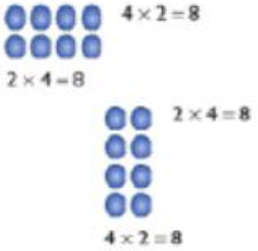
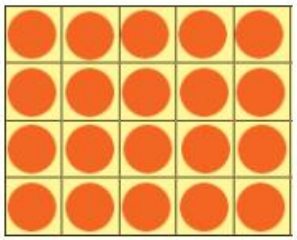


Moving forward the children use a more compact method.

	Now I can subtract my ones.  Now look at the tens, can I take away 8 tens easily? I need to exchange one hundred for ten tens.  Now I can take away eight tens and complete my subtraction  Show children how the concrete method links to the written method alongside your working. Cross out the numbers when exchanging and show where we write our new amount.		This will lead to an understanding of subtracting any number including decimals. $\begin{array}{r} \not{4}^{3}\ \not{0}^{9}\ {}^{1}3 \\ -\ 2\ \ 8\ \ 4 \\ \hline 1\ \ 1\ \ 9 \end{array}$

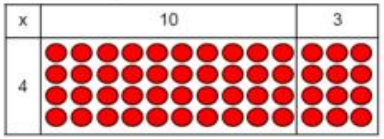
Multiplication:

Objective and Strategies	Concrete	Pictorial	Abstract
Doubling	Use practical activities to show how to double a number.  double 4 is 8 4 × 2 = 8	Draw pictures to show how to double a number. Double 4 is 8 	 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	   Use different objects to add equal groups.	There are 3 plates. Each plate has 2 star biscuits on. How many biscuits are there?  2 add 2 add 2 equals 6  5 + 5 + 5 = 15	Write addition sentences to describe objects and pictures.  2 + 2 + 2 + 2 + 2 = 10
Arrays- showing commutative multiplication	Create arrays using counters/ cubes to show multiplication sentences.  	Draw arrays in different rotations to find **commutative** multiplication sentences.   Link arrays to area of rectangles.	Use an array to write multiplication sentences and reinforce repeated addition.  5 + 5 + 5 = 15 3 + 3 + 3 + 3 + 3 = 15 5 x 3 = 15 3 x 5 = 15

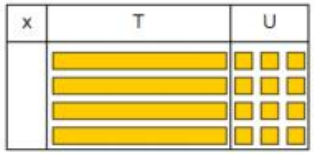
Grid Method

Show the link with arrays to first introduce the grid method.



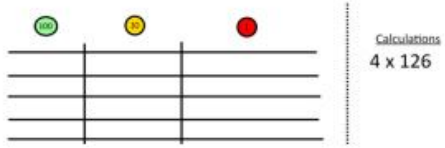
4 rows of 10
4 rows of 3

Move on to using Base 10 to move towards a more compact method.

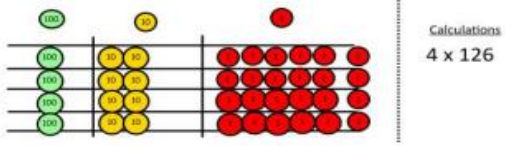


4 rows of 13

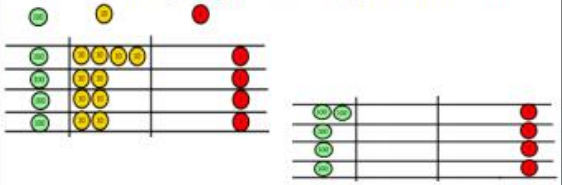
Move on to place value counters to show how we are finding groups of a number.We are multiplying by 4 so we need 4 rows.



Fill each row with 126.



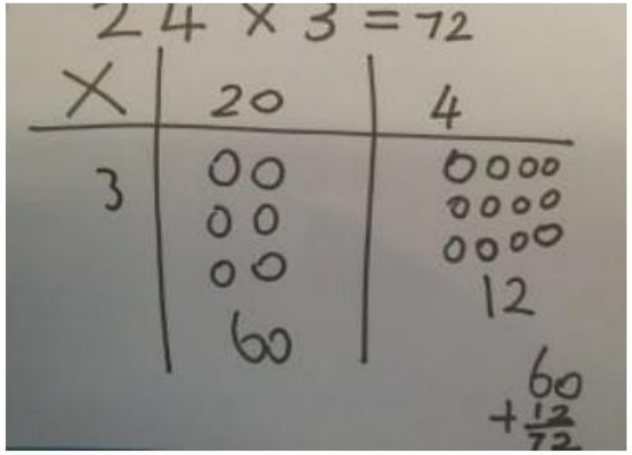
Add up each column, starting with the ones making any exchanges needed.



Then you have your answer.

Children can represent the work they have done with place value counters in a way that they understand.

They can draw the counters, using colours to show different amounts or just use circles in the different columns to show their thinking as shown below.



Start with multiplying by one digit numbers and showing the clear addition alongside the grid.

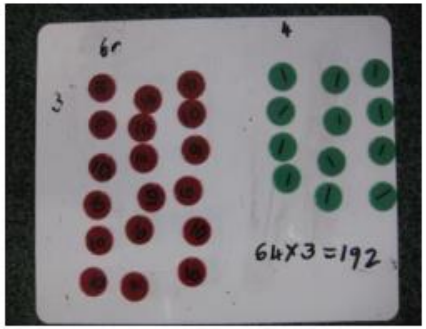
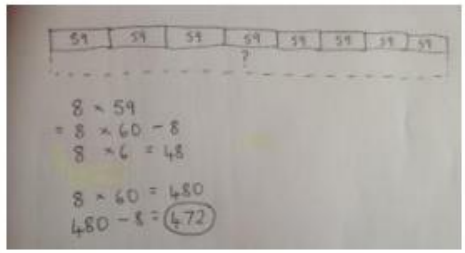
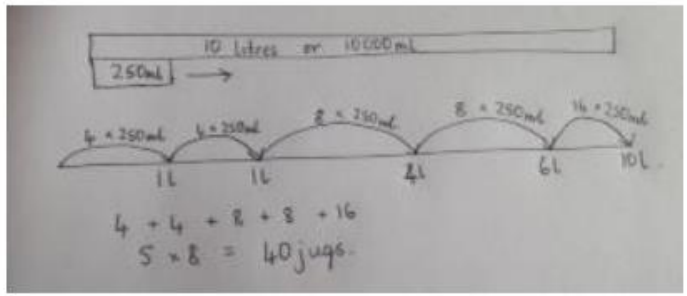
×	30	5
7	210	35

210 + 35 = 245

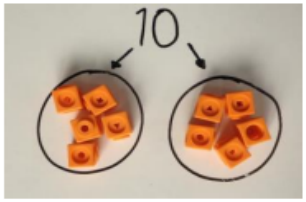
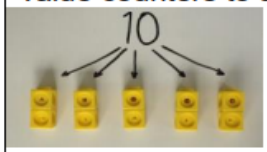
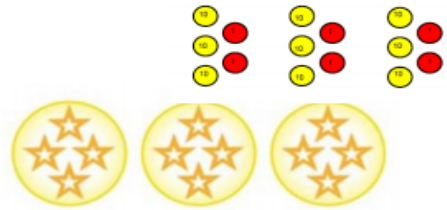
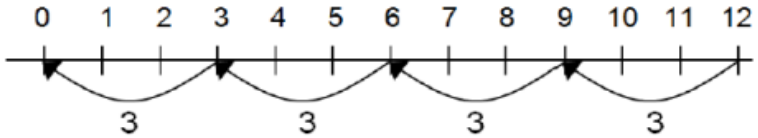
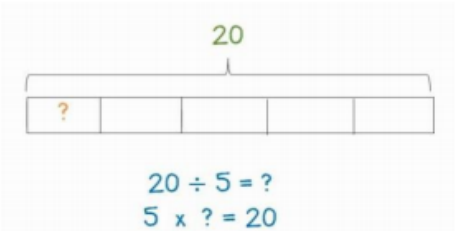
Moving forward, multiply by a 2 digit number showing the different rows within the grid method.

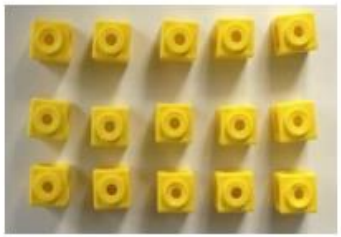
	10	8
10	100	80
3	30	24

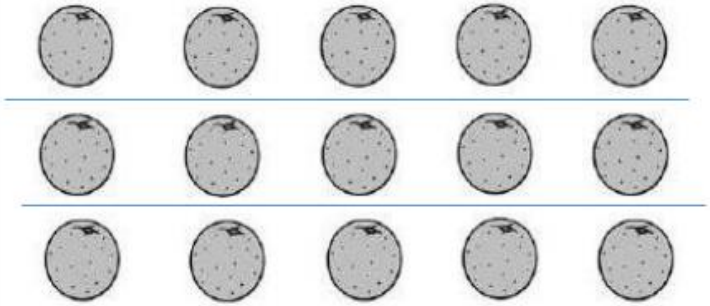
X	1000	300	40	2
10	10000	3000	400	20
8	8000	2400	320	16

Column multiplication	Children can continue to be supported by place value counters at the stage of multiplication.  It is important at this stage that they always multiply the ones first and note down their answer followed by the tens which they note below.	Bar modelling and number lines can support learners when solving problems with multiplication alongside the formal written methods.   	Start with long multiplication, reminding the children about lining up their numbers clearly in columns. If it helps, children can write out what they are solving next to their answer. 32 x 24 8 (4 x 2) 120 (4 x 30) 40 (20 x 2) 600 (20 x 30) 768 74 x 63 12 210 240 + 4200 4662 This moves to the more compact method. 34 x56 204 1700 1904 ✓

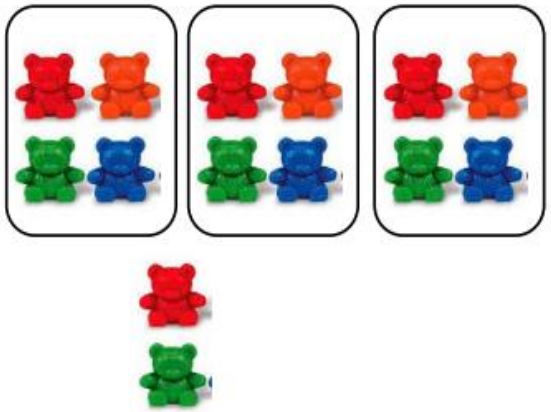
Division:

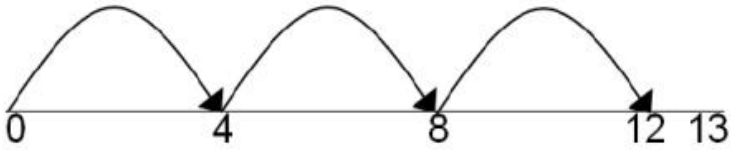
Objective and Strategies	Concrete	Pictorial	Abstract
Sharing objects into groups	   I have 10 cubes, can you share them equally in 2 groups?	Children use pictures or shapes to share quantities.  8 ÷ 2 = 4	Share 9 buns between three people. 9 ÷ 3 = 3
Division as grouping	Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.   96 ÷ 3 = 32 	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?

<table>
<tr>
<td>Division within arrays</td>
<td> 
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</td>
<td> 
Draw an array and use lines to split the array into groups to make multiplication and division sentences.</td>
<td>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</td>
</tr>
<tr>
<td>Division with a remainder</td>
<td>14 ÷ 3 =
Divide objects between groups and see how much is left over

  </td>
<td>Jump forward in equal jumps on a number line then see how many more you need to jump to find a remainder.

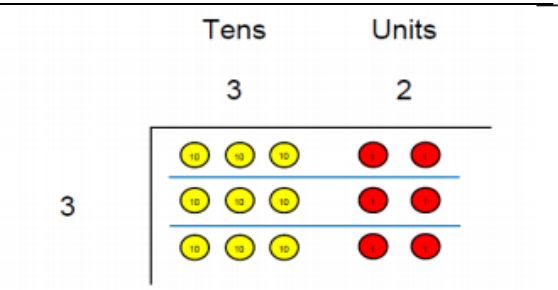
 

Draw dots and group them to divide an amount and clearly show a remainder.

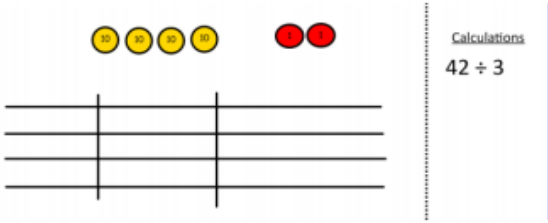
  </td>
<td>Complete written divisions and show the remainder using r.

  </td>
</tr>
</table>

Short division

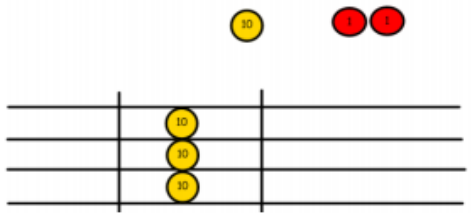


Use place value counters to divide using the bus stop method alongside

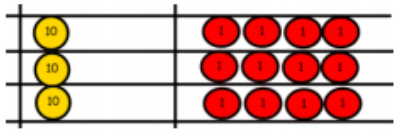


42 ÷ 3=

Start with the biggest place value, we are sharing 40 into three groups. We can put 1 ten in each group and we have 1 ten left over.

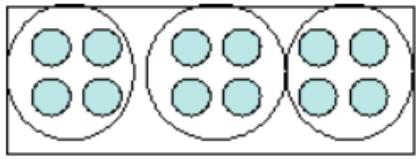


We exchange this ten for ten ones and then share the ones equally among the groups.



We look how much in 1 group so the answer is 14.

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.

$$\begin{array}{r} 218 \\ 4\overline{)872} \end{array}$$

Move onto divisions with a remainder.

$$\begin{array}{r} 86\ r\ 2 \\ 5\overline{)432} \end{array}$$

Finally move into decimal places to divide the total accurately.

$$\begin{array}{r} 14.6 \\ 35\overline{)511.0} \end{array}$$