GOLDINGTON GREEN ACADEMY
Calculation Policy

Statement of Intent

The Equality Act 2010 makes it unlawful for staff to discriminate directly or indirectly, or to harass staff or pupils due to any of the nine protected characteristics.
Goldington Green Academy aims to create a culture that respects and values each other's differences, that promotes dignity, equality and diversity, and that encourages individuals to develop and maximise their true potential.
Everyone within the school community has a responsibility to ensure that this statement is adhered to. Senior Leaders in particular, should lead by example, identify any inappropriate behaviour when it happens and take prompt action to deal with inappropriate behaviour.
We aim to remove any barriers, bias or discrimination that prevents individuals or groups from realising their potential and contributing fully to our school's performance. In removing these barriers we aim to develop a school culture that positively values diversity.
We are committed wherever practicable, to achieving and maintaining a workforce that broadly reflects the local community in which we operate.
Every possible step will be taken to ensure that individuals are treated fairly in all aspects of their employment, engagement or whilst volunteering at our school.

Safeguarding Children
Goldington Green Academy recognises it has a statutory duty under Section 175 of the Education Act 2002 to ensure arrangements are in place for safeguarding and promoting the welfare of children.
We recognise that children who are abused or witness violence may find it difficult to develop a sense of self worth and that school may be the only stable, secure and predictable element in the lives of children at risk. Our school will endeavour to support these pupils by providing an ethos which promotes a positive, supportive and secure environment, providing a sense of being valued. Our policy includes the whole school community: all teaching and non-teaching staff, governors, parents and volunteers working in our school.

At Goldington Green we recognise our legal and ethical duty to keep pupils safe from radicalisation and extremism. As such we incorporate the principles of the PREVENT agenda into all practice including the curriculum. Additionally we ensure that all speakers are carefully vetted by senior staff and that all material available in school, both electronic and otherwise, is suitable. We also ensure that sufficient training is in place so that all staff understand what radicalisation means and why people may be vulnerable to being drawn into terrorism as a consequence of it. Staff know what measures are available to prevent people from becoming drawn into terrorism and how to challenge the extremist ideology that can be associated with it. Any concerns are dealt with in line with our safeguarding policy working in conjunction with Bedfordshire Police and other agencies as appropriate.

Rationale

The aim of this policy is to ensure consistency of calculation methods across the school. By giving children a firm foundation in number and place value, this will

enable pupils to build upon their knowledge and skills in mathematics throughout the Early Years, Key Stage 1 and Key Stage 2.

Develop childrens' fluency with basic number facts.

At Goldington Green Academy, we believe in incorporating basic skills in mathematics daily to improve fluency. This is done through using simple whole class rote learning, which is an important step to develop conceptual understanding, identifying patterns and relationships between numbers.

Mental calculation and formal written methods

Allowing children to record their calculations using informal methods is an important stepping stone to develop fluency for formal written methods of recording, at a later stage. To be efficient in calculating, children are required to know a variety of mental strategies. Children need to be fluent in number facts to 10 and 20, in order to be efficient in mental calculation.

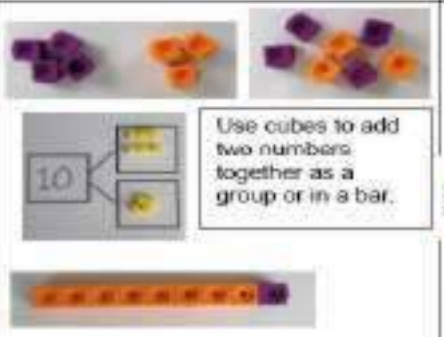
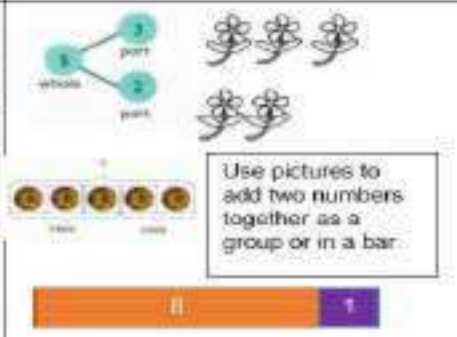
To be used in conjunction with the Goldington Green Academy Mathematics Policy. February 2017

Progression in Calculations

Addition

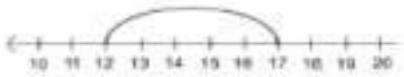
Combining two parts to make a whole; part – whole model

Connections between models should be made, enabling children to understand the same mathematics can be represented in different ways.

Concrete	Pictorial	Abstract
		4 + 3 = 7 10= 6 + 4 5 3 Use the part-part whole diagram as shown above to move into the abstract.

Starting at the bigger number and counting on

At Goldington Green Academy, we embed ‘counting on’ as a foundation to early calculating.

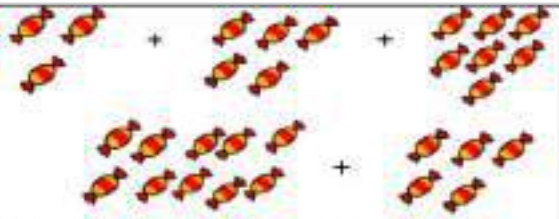
Concrete	Pictorial	Abstract
 Start with the larger number on the bead string and then count on to the smaller number 1 by 1 to find the answer.	12 + 5 = 17  Start at the larger number on the number line and count on in ones or in one jump to find the answer.	5 + 12 = 17 Place the larger number in your head and count on the smaller number to find your answer.

Regrouping to make 10

We call making 10 “magic 10”, as it is helpful to make 10 and this will make calculation easier.

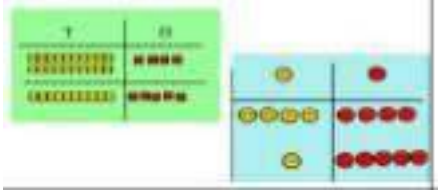
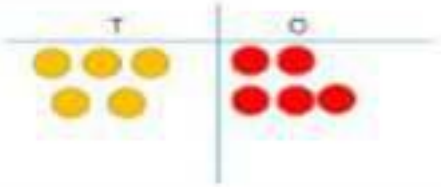
Concrete	Pictorial	Abstract
 6 + 5 = 11  Start with the bigger number and use the smaller number to make 10.	 Use pictures or a number line. Regroup or partition the smaller number to make 10. 9 + 5 = 14 1 4 +1 +4	7 + 4= 11 If I am at seven, how many more do I need to make 10. How many more do I add on now?

Adding three single digits

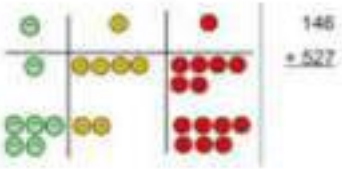
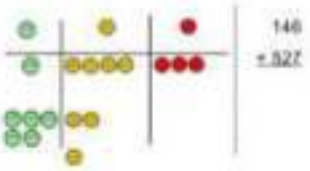
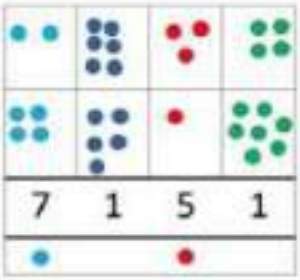
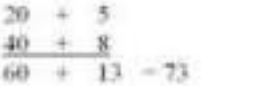
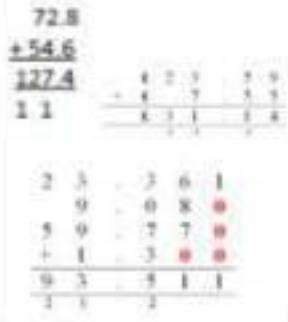
Concrete	Pictorial	Abstract
4 + 7 + 6= 17 Put 4 and 6 together to make 10. Add on 7.  Following on from making 10, make 10 with 2 of the digits (if possible) then add on the third digit.	 Add together three groups of objects. Draw a picture to recombine the groups to make 10.	 Combine the two numbers that make 10 and then add on the remainder.

Column method – no regrouping

Teaching the column method for calculation, provides opportunity to develop fluency in calculating.

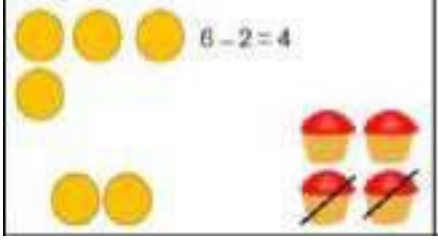
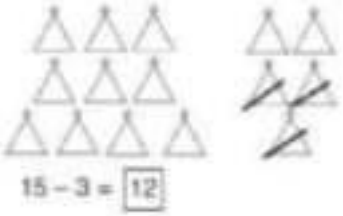
Concrete	Pictorial	Abstract
24 + 15= Add together the ones first then add the tens. Use the Base 10 blocks first before moving onto place value counters. 	After practically using the base 10 blocks and place value counters, children can draw the counters to help them to solve additions. 	Calculations 21 + 42 = 21 + 42

Column method – regrouping

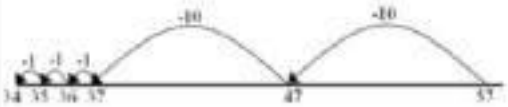
Concrete	Pictorial	Abstract
Make both numbers on a place value grid.  Add up the units and exchange 10 ones for one 10.  Add up the rest of the columns, exchanging the 10 counters from one column for the next place value column until every column has been added. This can also be done with Base 10 to 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.  As the children move on, introduce decimals with the same number of decimal places and different. Money can be used here. 

Subtraction

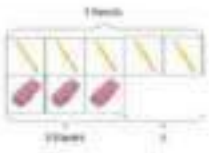
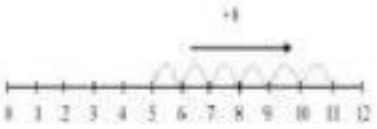
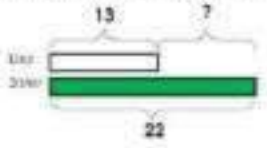
Taking away ones

Concrete	Pictorial	Abstract
Use physical objects, counters, cubes etc to show how objects can be taken away 	Cross out drawn objects to show what has been taken away 	18 -3= 15 8 – 2 = 6

Counting back

Concrete	Pictorial	Abstract
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  Start at the bigger number and count back the smaller number showing the jumps on the number line.  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.

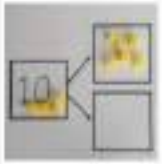
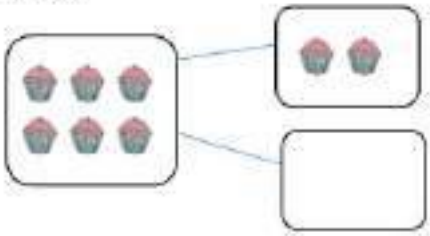
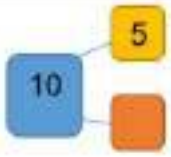
Find the difference

Concrete	Pictorial	Abstract
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. **Comparison Bar Models** Lisa is 13 years old. Her sister is 22 years old. Find the difference in age between them. 	Hannah has 23 sandwiches, Helen has 15 sandwiches. Find the difference between the number of sandwiches.

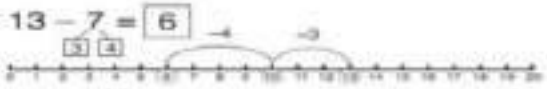
Lessons about addition and subtraction could start with a contextual story. This will help children to develop their understanding of the concepts of addition and subtraction.

Part Part Whole Model

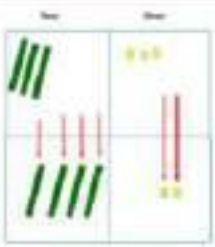
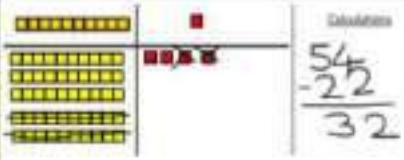
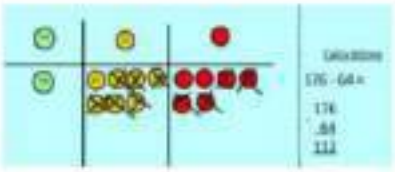
Getting children to illustrate that the same structure can be applied to any number enables children to generalise mathematical ideas. This can build up from simple numbers to more complex numbers, so that children can see the numbers will change, but the structure stays the same.

Concrete	Pictorial	Abstract
 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.

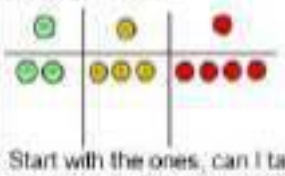
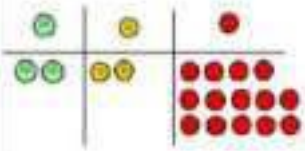
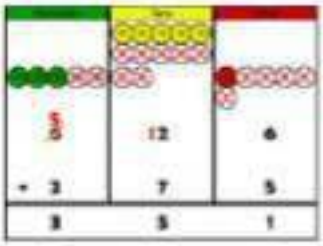
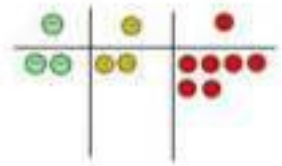
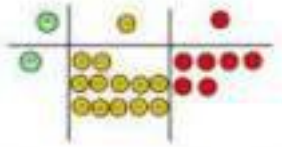
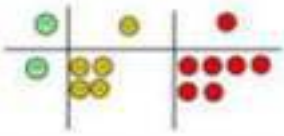
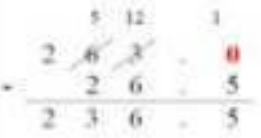
Make 10

Concrete	Pictorial	Abstract
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

Concrete	Pictorial	Abstract
 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. 

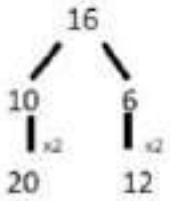
Column method with regrouping

Concrete	Pictorial	Abstract
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. 

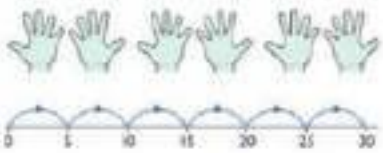
Multiplication

Doubling

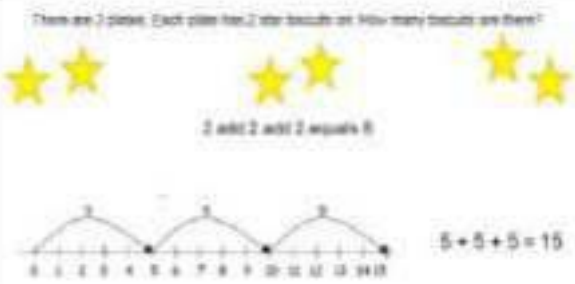
This forms the foundation of multiplication, so that when children learn their times tables they notice relationships with numbers.

Concrete	Pictorial	Abstract
Use practical activities to show how to double a number. 	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.

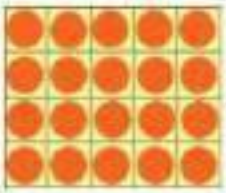
Counting in multiples

Concrete	Pictorial	Abstract
  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

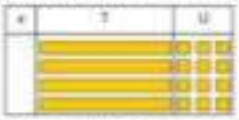
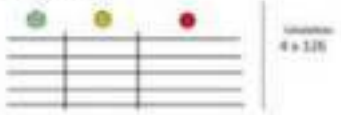
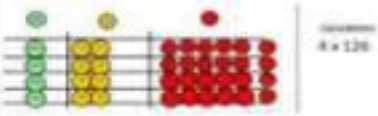
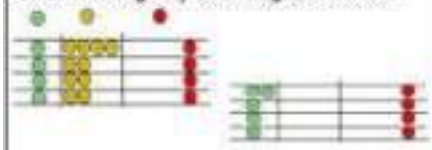
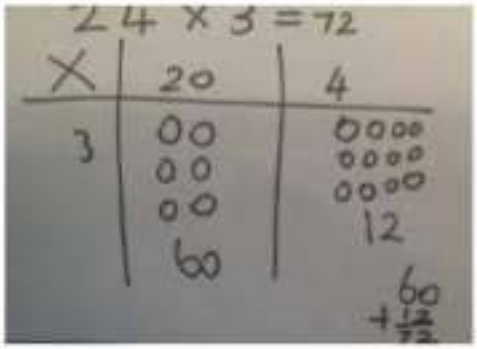
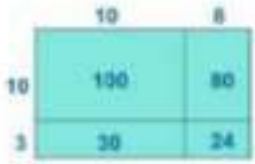
Repeated addition

Concrete	Pictorial	Abstract
   Use different objects to add equal groups.	 5 + 5 + 5 = 15	Write addition sentences to describe objects and pictures. 

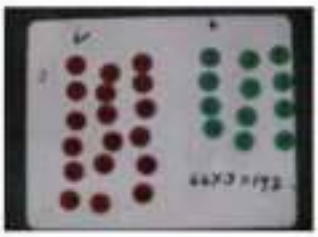
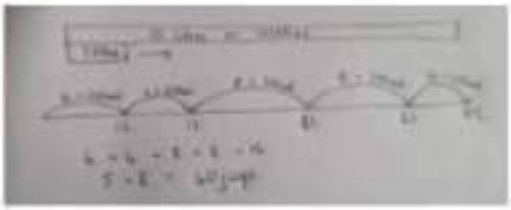
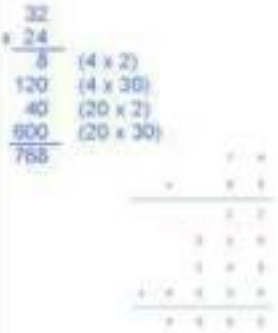
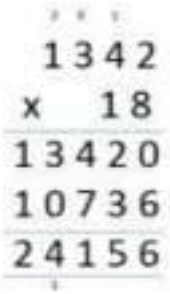
Arrays – showing commutative multiplication

Concrete	Pictorial	Abstract
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

Concrete	Pictorial	Abstract
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. X | 30 | 5 7 | 210 | 35 210 + 35 = 245 Moving forward, multiply by a 2 digit number showing the different rows within the grid method.  

Column multiplication

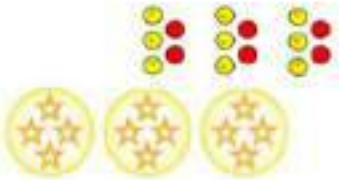
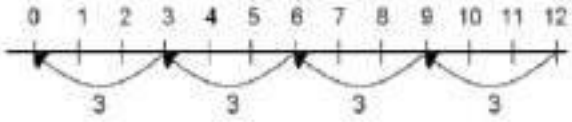
Concrete	Pictorial	Abstract
Children can continue to be supported by place value counters at the stage of multiplication.  It is important at this stage that they always multiply the ones first and note down their answer followed by the tens which they note below.	Bar modelling and number lines can support 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.  This moves to the more compact method. 

Division

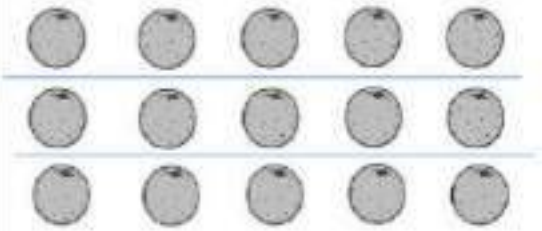
Sharing objects into groups

Concrete	Pictorial	Abstract
   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

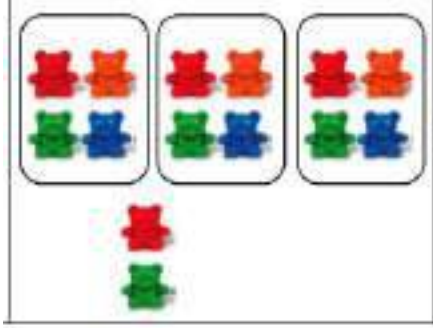
Division as grouping

Concrete	Pictorial	Abstract
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?

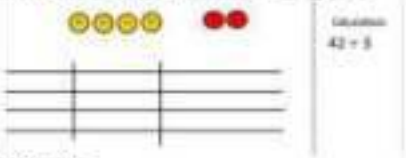
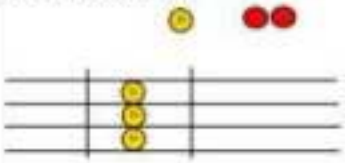
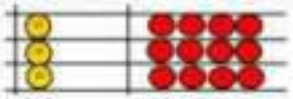
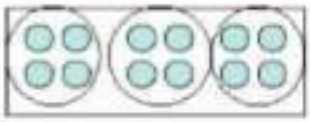
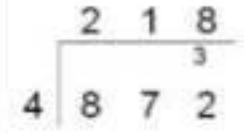
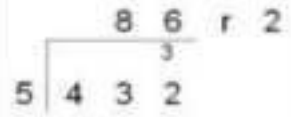
Division within arrays

Concrete	Pictorial	Abstract
 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

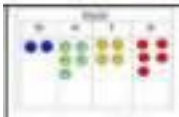
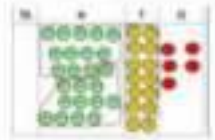
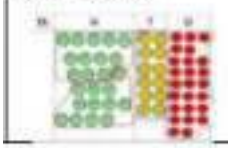
Division with a remainder

Concrete	Pictorial	Abstract
14 ÷ 3 = Divide objects between groups and see how much is left over 	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. 	Complete written divisions and show the remainder using r. 

Short Division

Concrete	Pictorial	Abstract
 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.  Move onto divisions with a remainder.  Finally move into decimal places to divide the total accurately. 

Long Division

Concrete	Pictorial	Abstract
 2544 ÷ 12 How many groups of 12 thousands do we have? None Exchange 2 thousand for 20 hundreds.  0 12 | 2544 How many groups of 12 are in 25 hundreds? 2 groups. Circle them. We have grouped 24 hundreds so can take them off and we are left with one.  02 12 | 2544 24 1 Exchange the one hundred for ten tens so now we have 14 tens. How many groups of 12 are in 14? 1 remainder 2.  021 12 | 2544 24 14 12 2 Exchange the two tens for twenty ones so now we have 24 ones. How many groups of 12 are in 24? 2  0212 12 | 2544 24 14 12 24 24 0	Instead of using physical counters, students can draw the counters and circle the groups on a whiteboard or in their books. Use this method to explain what is happening and as soon as they have understood what move on to the abstract method as this can be a time consuming process.	0 3 1 8 r 5 20 | 6 3 6 5 − 6 0 3 6 − 2 0 1 6 5 − 1 6 0 5

	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. Regrouping to make 10.	Adding three single digits. Column method	Column method- regrouping. (up to 3 digits)	Column method- regrouping. (up to 4 digits)	Column method- regrouping. (with more than 4 digits) (Decimals- with the same amount of decimal places)	Column method- regrouping. (Decimals- with different amounts of decimal places)
Subtraction	Taking away ones Counting back Find the difference Part whole model Make 10	Counting back Find the difference Part whole model Make 10 Column method-	Column method with regrouping. (up to 3 digits)	Column method with regrouping. (up to 4 digits)	Column method with regrouping. (with more than 4 digits) (Decimals- with the same amount of decimal places)	Column method with regrouping. (Decimals- with different amounts of decimal places)
Multiplication	Doubling Counting in multiples Arrays (with support)	Doubling Counting in multiples Repeated addition Arrays- showing commutative multiplication	Counting in multiples Repeated addition Arrays- showing commutative multiplication Grid method	Column multiplication (2 and 3 digit multiplied by 1 digit)	Column multiplication (up to 4 digit numbers multiplied by 1 or 2 digits)	Column multiplication (multi digit up to 4 digits by a 2 digit number)
Division	Sharing objects into groups Division as grouping	Division as grouping Division within arrays	Division within arrays Division with a remainder Short division (2 digits by 1 digit- concrete and pictorial)	Division within arrays 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 interpret remainders appropriately for the context)	Short division Long division (up to 4 digits by a 2 digit number- interpret remainders as whole numbers, fractions or round)

YEAR GROUP	NUMBER	MULTIPLICATION
EARLY YEARS	• Doubles to 5 • Numbers to 20 – focus on 'teen' and 'ty' and using the vocabulary; "12 is ten and two". • Number bonds to 5.	• Rolling numbers – 2's and 10's.
YEAR 1	• Number bonds to 10 / 20. • Halves up to 10 / 20. • Addition in any order; - 2+3 = 5 - 3+ 2 = 5 - 5 = 2 + 3 - 5 = 3 + 2 • Odd / even numbers	• Consolidation of rolling numbers 2's and 10's. • Rolling numbers – 5's and 3's.
YEAR 2	• Secure number bonds to 20. • Fact families and commutativity - 12 + 6 = 18 - 6 + 12 = 18 - 18 – 6 = 12 - 18 – 12 = 6 • Number bonds to 100 (multiples of ten) - 40 + 60 = 100 - 70 + 30 = 100	• Consolidation of rolling numbers; - 2's, 10's, 5's, 3's. • Rolling numbers – 4's. • Secure 2x, 5x, 10x, 3x, 4x. • Fact families and commutativity - 5 x 7 = 35 - 7 x 5 = 35 - 35 divided by 5 = 7 - 35 divided by 7 = 5
YEAR 3	• Secure place value knowledge to 4 places. • Number bonds to 100 - 36 + 64 = 100 - 100 – 64 = 36 • Rapid recall of fraction facts; - 4/8 = 2/4 = ½ - 7/8 = 14/16	• Consolidation of times tables - 2x, 5x, 10x, 3x, 4x. • Secure 6x, 8x, 11x. • Count in multiples of 50 / 100. • Fact families and commutativity for facts learnt.
YEAR 4	• Recognise relationship between fractions and decimals - ½ = 0.5, ¼ = 0.25, ¾ = 0.75, etc. • Roman numerals to 100.	• Consolidation of times tables - 2x, 5x, 10x, 3x, 4x, 6x, 8x, 11x • Secure 7x, 9x, 12x. • Count in multiples of 1000.
YEAR 5	• Secure place value knowledge up to 1,000,000. • Roman numerals to 1000. • Recognise relationships between fractions, decimals and percentages; - ½ = 0.5 = 50%, etc	• Secure multiplication and division facts with fact families and commutativity. • Prime numbers / Composite (non-prime) numbers - Identify prime factors of numbers • Square numbers / Cube numbers
YEAR 6	• Secure place value knowledge up to 10,000,000.	• Secure multiplication and division facts with fact families and commuativity. • Secure knowledge of prime / composite numbers, square / cube numbers.

Reviewed in September 2018 – M. Viola and T. Nurse