Loving one another, building each other up

Littledean Church of England Primary School
Calculation Policy
2020

This calculation policy has been written with the involvement of all staff in order to meet the requirements of the National Curriculum 2014. It is designed to give pupils a consistent and smooth progression of learning in calculation methods across the school.

Early learning in number and calculation in Reception follows the Development Matters EYFS document and this calculation policy is designed to build on progressively from the content and methods established in the Early Years Foundation Stage.

This calculation policy should be used to support pupils to develop a deep conceptual understanding of number and calculation. This policy has been designed to teach pupils through the use of concrete, pictorial and abstract representations:

Concrete is the "doing" stage. Concepts are brought to life by allowing children to experience and handle physical (concrete) objects.

Pictorial is the "seeing" stage. This stage encourages pupils to make a mental connection between the physical object they just handled and the abstract pictures, diagrams or models that represent the objects from the problem. Building or drawing a model makes it easier for children to grasp difficult abstract concepts (for example, fractions). It helps pupils visualise abstract problems and make them more accessible.

Abstract is the "symbolic" stage, where pupils use abstract symbols to model problems. The abstract stage involves the teacher introducing abstract concepts (for example, mathematical symbols). Children are introduced to the concept at a symbolic level, using only numbers, notation, and mathematical symbols (for example, +, –, x, ÷) to indicate addition, subtraction, multiplication or division.

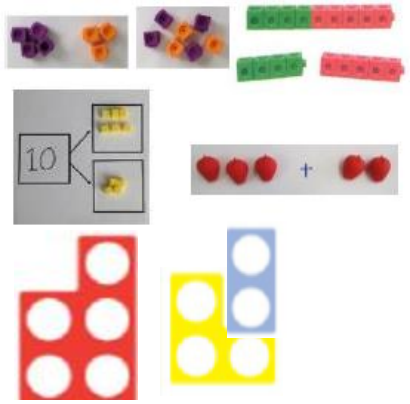
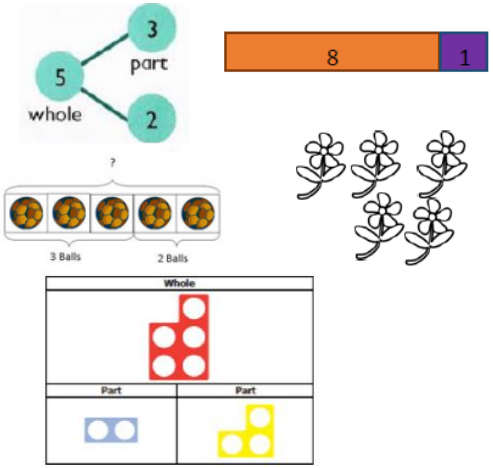
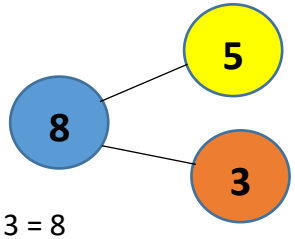
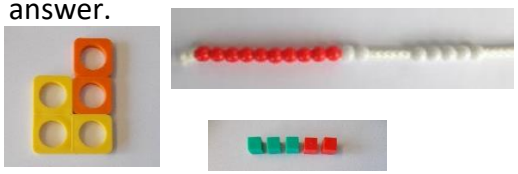
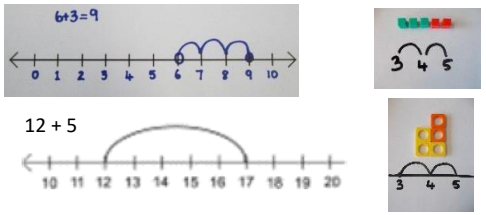
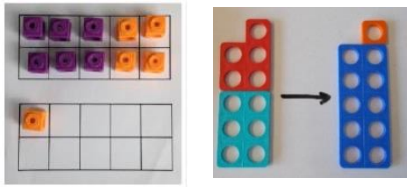
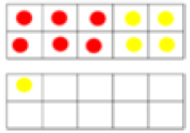
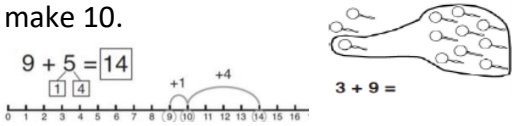
Some of the concrete manipulates used are:

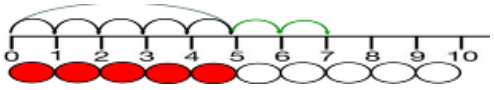
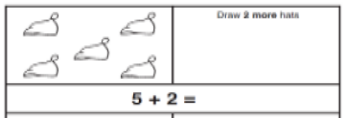
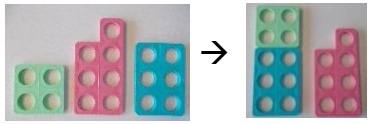
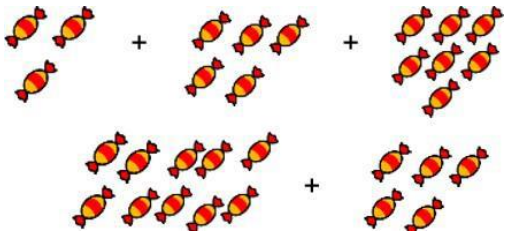
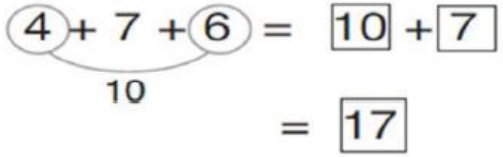
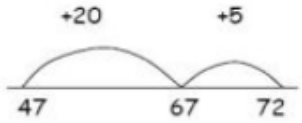
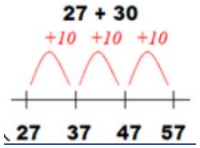
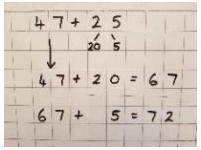
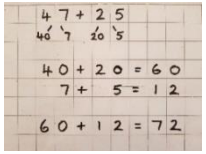
- Straws
- Counters
- Bead strings
- Numicon
- Ten frame
- Base 10 equipment

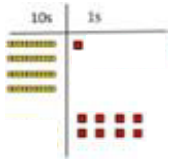
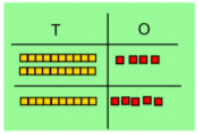
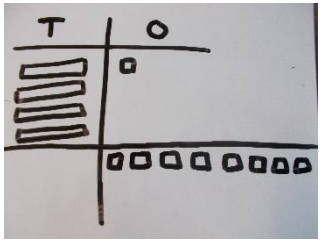
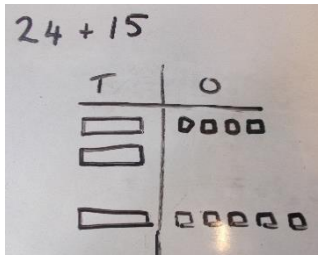
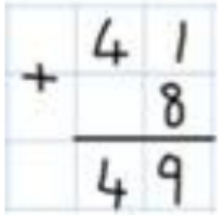
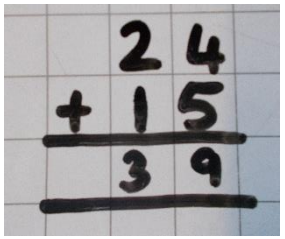
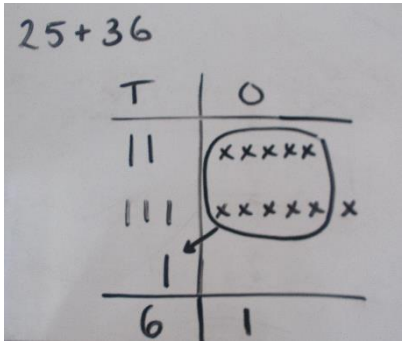
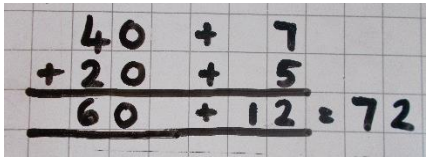
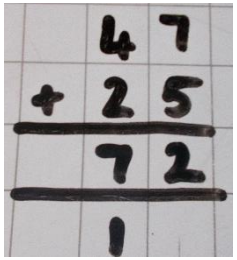
During the pictorial stage we use:

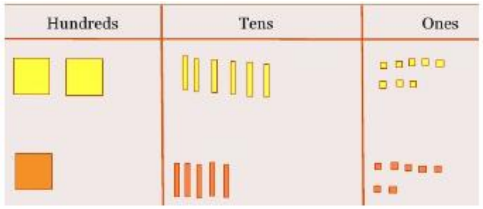
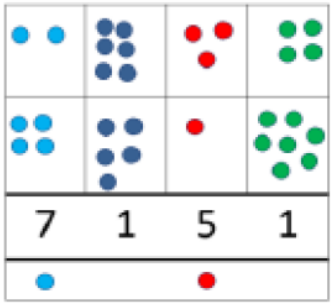
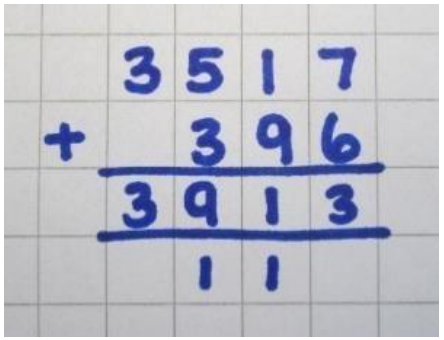
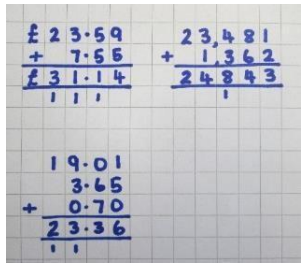
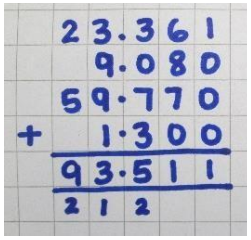
- bar modelling
- number lines
- part-part whole diagrams

Addition

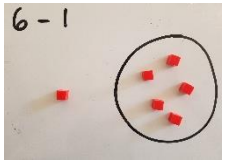
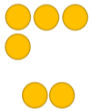
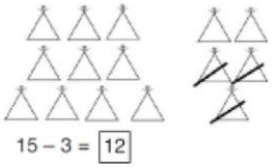
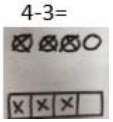
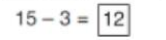
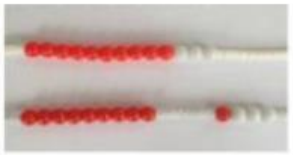
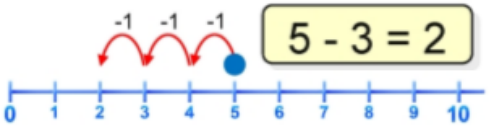
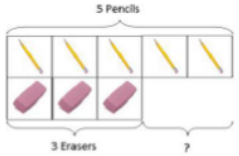
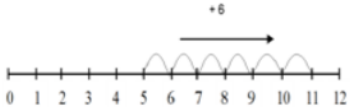
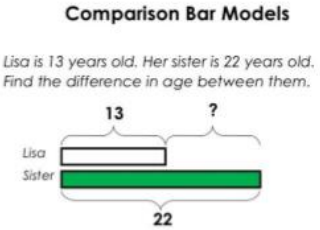
Year	Objective and Strategy	Concrete	Pictorial	Abstract
EYFS/ Year 1	Combining two parts to make a whole: part-whole model	Use Numicon, cubes or any other resources (teddy bears, cars, beads) to add two numbers together as a group or in a bar. 	Use pictures to add two numbers together as a group or in a bar. 	Use the part-part-whole diagram to move into the abstract.  5 + 3 = 8 (5 is a part, 3 is a part, 8 is a whole) 2 + 3 = 5 3 + 2 = 5 5 = 3 + 2 5 = 2 + 3 2 + ◯ = 5 ◯ + 3 = 5 2 + 3 = ◯
EYFS/ Year 1	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.  Other manipulatives include Numicon and cubes	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.
EYFS/ Year 1	Regrouping to make 10	Start with the bigger number and use the smaller number to make 10. Use ten frames and counters/cubes or Numicon and Numicon pegs for stacking. 6 + 5 = 11 	Pupils to draw the ten frame and counters/cubes.  Use pictures or a number line. Regroup or partition the smaller number to make 10. 	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?

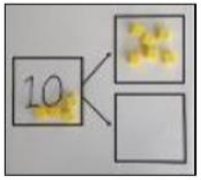
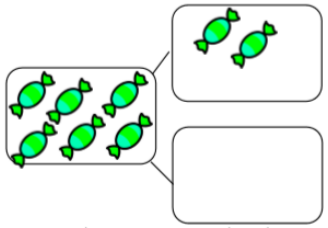
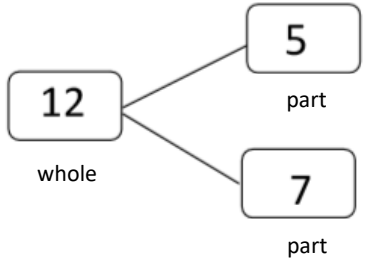
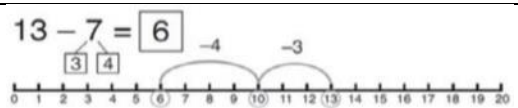
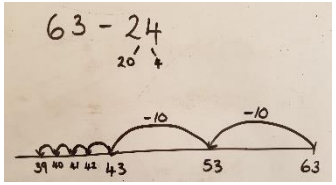
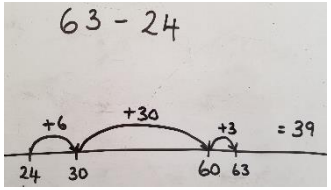
Year	Objective and Strategy	Concrete	Pictorial	Abstract
Year 1	Represent and use number bonds and related subtraction facts within 20	2 more than 5 	  	Emphasis should be on the language: 'one more than five is equal to 6' 'two more than five is 7' 'eight is three more than 5'
Year 2	Adding three single digit numbers	4 + 7 + 6 = 17 Put the 4 and 6 together to make 10. Add on the 7. 	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. 
Year 2 Year 3 – apply these methods to adding mentally: HTO +10s HTO +100s	Adding two 2-digit numbers Add a 2-digit number and tens	Model using Base 10 25 + 47 25+10 	47 + 25   	Partition the smaller number and add on:  Partition both numbers, add the tens and ones separately and then regroup:  27 + 10 = 37 27 + 20 = 47 27 + ☐ = 57

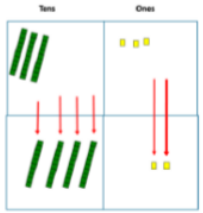
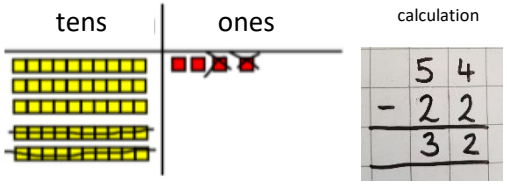
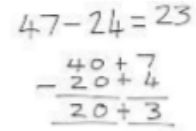
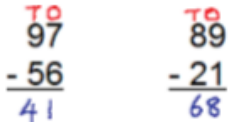
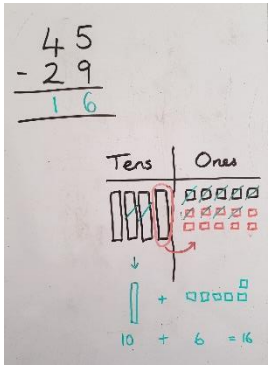
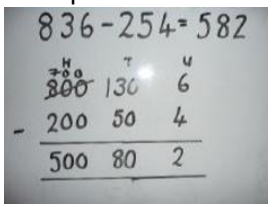
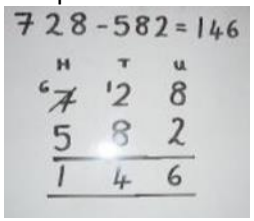
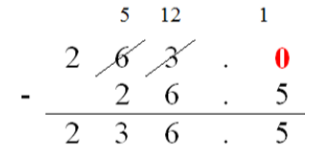
Year	Objective and Strategy	Concrete	Pictorial	Abstract
Year 2/3	Column method – no regrouping. TO + O using base 10. *leading to…* Column method – no regrouping TO + TO	Continue to develop understanding of partitioning and place value 41 + 8 Make both numbers on a place value grid  TO + TO Add together the ones first, then add the tens. 24 + 15 	After practically using the base 10 blocks, pupils can draw the base 10 blocks to help them to solve additions.  TO + TO 24 + 15 	Formal written calculation:  Formal written method: 
Year 3	Column method with regrouping TO + TO	Model using Base 10 25 + 47 	25 + 36 	Formal written method  *Leading to…* 

Year	Objective and Strategy	Concrete	Pictorial	Abstract
Year 4/5/6	Column method with numbers with regrouping	Pupils continue to use Base Ten to add, exchanging ten ones for a ten and ten tens for a hundred, and ten hundreds for a thousand 	Draw representations using a place value grid 	Formal written method  As the pupils move on, introduce decimals. Money can be used here.  Add decimals with increasing complexity. Add ‘zeros’ where needed to show the place value of decimals. 

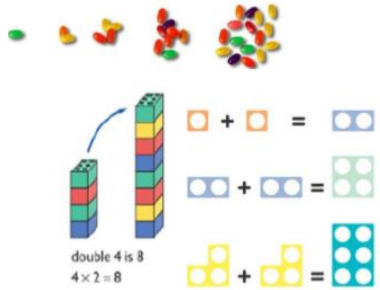
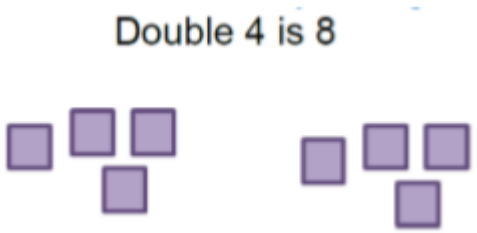
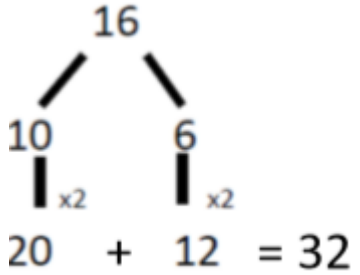
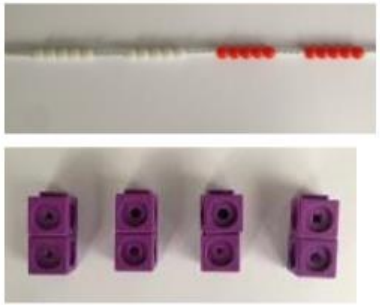
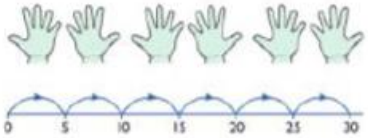
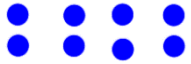
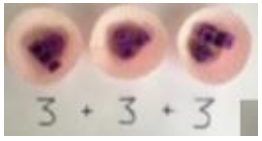
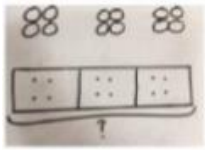
Subtraction

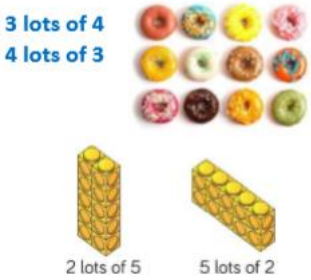
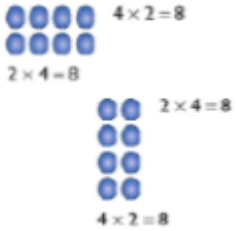
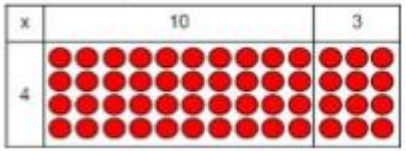
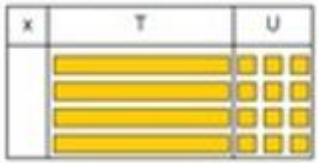
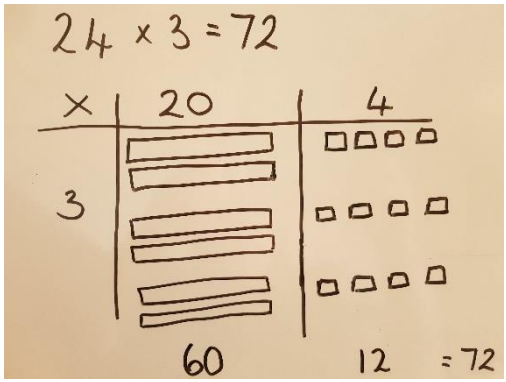
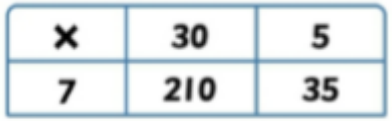
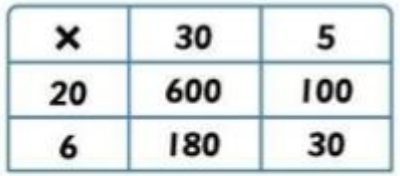
Year	Objective and Strategy	Concrete	Pictorial	Abstract
EYFS/ Year 1	Taking away ones	Use physical objects, counters, cubes, ten frames, Numicon etc to show how objects can be taken away.  6 – 2  4 - 2 	Pupils to draw objects and cross out the correct amount.  A bar model could be used:  	18 – 3 = 15 8 – 2 = 6
EYFS/ Year 1	Counting back	Move objects away from the group counting backwards. 7 – 2 Make the larger number in your subtraction. Move the beads along your bead string as you count backwards in ones. 13 - 4 	Start at the bigger number and count back the smaller number showing the jumps on the number line. 	Put 13 in your head, count back 4. What number are you at? Use your fingers to help.
EYFS/ Year 1	Find the difference	Compare objects and amounts. *Calculate the difference between 7 and 4.* 7 – 5 = 2 Use basic bar models: 	Count on to find the difference.  Draw bars to find the difference between two numbers (very important for later years) 	Find the difference between 8 and 5. 8 – 5, the difference is ☐ Pupils to explore why 9 – 6 = 8 – 5 = 7 – 4 have the same difference. Hannah has 23 sandwiches; Helen has 15 sandwiches. Find the difference between the number of sandwiches.

Year	Objective and Strategy	Concrete	Pictorial	Abstract
EYFS/ Year 1	Represent and use number bonds and related subtraction facts within 20 Part-Part-Whole model	Link to addition – use the part-part-whole model to help explain the inverse between addition and subtraction. Numicon is also used.  If 10 is the whole and 6 is one of the parts, what is the other part? 10 – 6 = 4	Use pictorial representations to show the part-part-whole model. 	Move to using numbers. 
Year 1	Make 10	14 – 5 = Make 14 on the ten frame. Take away the first four 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.	16 – 8 = How many do we take off to reach 10? How many do we have left to take off?
Year 2	Subtraction using a number line TO – TO		Counting back from the big number using partitioning:  Counting on the from the smaller number: 	This is leading to mental methods of TO – TO subtraction.

Year	Objective and Strategy	Concrete	Pictorial	Abstract
Year 3	Column method without regrouping	Use Base 10 to make the bigger number then take the smaller number away. 75 – 42 	Draw the Base 10 alongside the written calculation to help show working: 	 Leading to the formal written method: 
Year 3/4/5/6	Column method with regrouping	Use Base 10. Start with one exchange before moving onto subtractions with 2 exchanges. Make the larger number with Base 10. 234 - 88 Start with the ones, can I take away 8 from 4 easily? I need to exchange one of my tens for ten ones. Now I can subtract 8 ones. Next 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 the subtraction. 	Pupils draw Base 10 onto a place value grid and cross off. 	Formal written method. Pupils can start their formal written method by partitioning the number into clear place value columns:  Moving forward the pupils use a more compact method:  This will lead to an understanding of subtracting any number including decimals: 

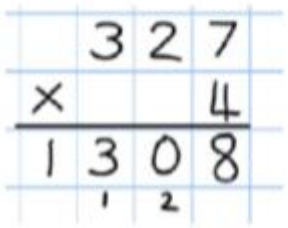
Multiplication

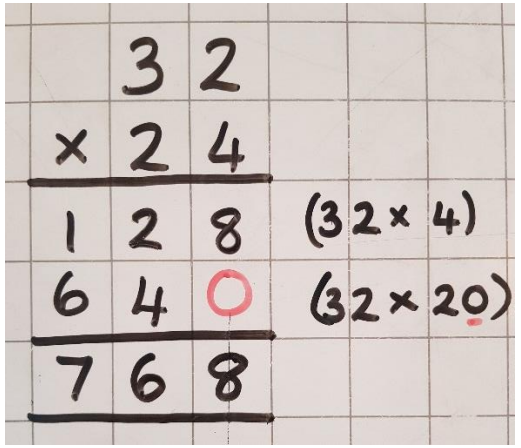
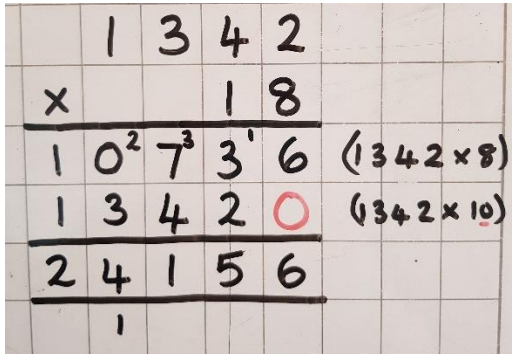
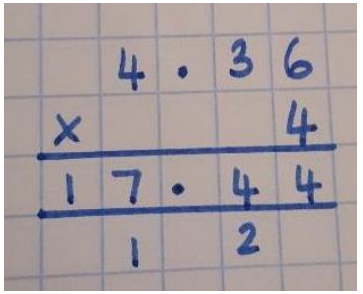
Year	Objective and Strategy	Concrete	Pictorial	Abstract
EYFS/ Year 1	Doubling	Use practical activities using everyday objects and mathematical manipulatives such as cubes and Numicon to demonstrate doubling. 	Draw pictures to show how to double a number: 	Partition a number and then double each part before recombining it back together. 
EYFS/ Year 1	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.  Pupils make representations to show 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…
Year 1	Repeated addition	Repeated grouping/repeated addition. 	Pupils to represent in picture and/or use a bar model. *There are 3 plates. Each plate has 2 star biscuits on. How many biscuits are there?* *2 + 2 + 2 = 6* 	Write addition sentences to describe objects and pictures.

Year	Objective and Strategy	Concrete	Pictorial	Abstract
Year 2	Arrays – showing commutative multiplication	Create arrays using counters, cubes, objects to show multiplication sentences. 	Draw arrays in different rotations to find commutative multiplication sentences.  (Link arrays to areas of rectangles).	Pupils to be able to use an array to write a range of calculations. 5 + 5 + 5 = 15 3 + 3 + 3 + 3 + 3 = 15 5 x 3 = 15 3 x 5 = 15
Year 3	Grid method	Demonstrate the link with arrays to introduce the grid the 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	Pupils can represent the work they have done with Base 10. 	Start with multiplying by one digit numbers and showing the clear addition alongside the grid.  210 + 35 = 245 Moving forward, multiply by a 2-digit number showing the different rows within the grid method.  600 + 100 = 700 180 + 30 = 210 700 + 210 = 910 **It is important at this stage that they always multiply the ones first.**

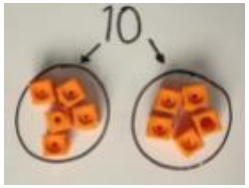
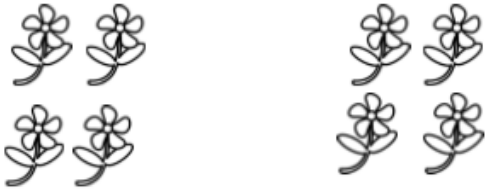
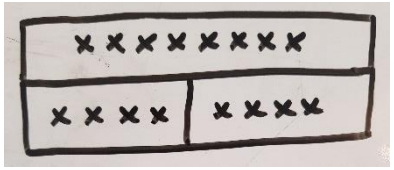
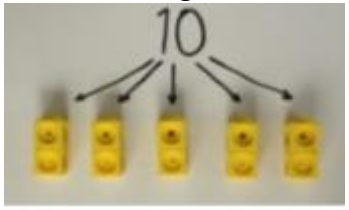
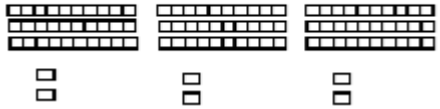
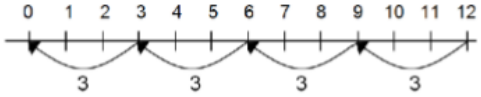
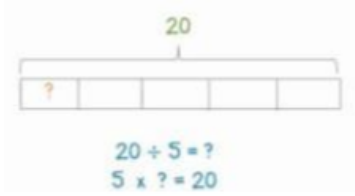
×	30	5
7	210	35

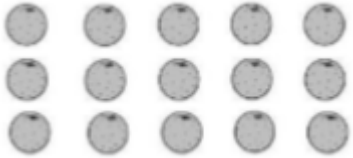
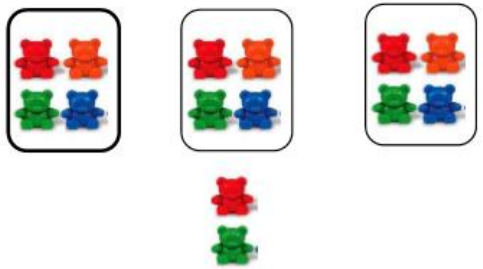
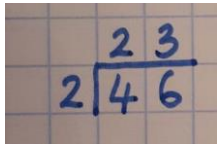
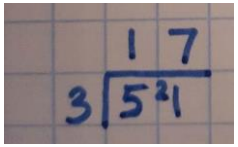
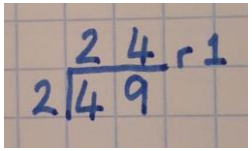
×	30	5
20	600	100
6	180	30

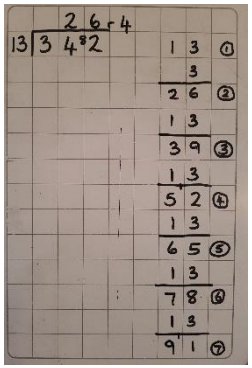
Year	Objective and Strategy	Concrete	Pictorial	Abstract
Year 4/5	Column multiplication – short multiplication		<table><tr><td>x</td><td>300</td><td>20</td><td>7</td></tr><tr><td>4</td><td>1200</td><td>80</td><td>28</td></tr></table> The grid method may be used to show how this relates to a formal written method. Bar modelling and number lines can support learners when solving problems with multiplication alongside the formal written methods.	327 x 4 28 80 1200 1308  This may lead to a compact method.

Year	Objective and Strategy	Concrete	Pictorial	Abstract
Year 6	Column multiplication – long multiplication			Formal written method   This method is then applied to multiplying a decimal by a whole number: 

Division

Year	Objective and Strategy	Concrete	Pictorial	Abstract
EYFS/ Year 1	Division as sharing. Halving	I have 10 cubes, can you share them equally in 2 groups? *One for you, one for me…* 	Pupils use pictures or shapes to share quantities.  8 ÷ 2 = 4  Begin to use a bar model (excellent for problem solving in later years)	Share 8 buns between two people. 8 ÷ 2 = 4
Year 2	Division as grouping/ repeated subtraction	Divide quantities into equal groups. Use cubes, counters or objects to aid understanding.  96 ÷ 3 = 32 	Use a number line to show jumps in groups. The number of jumps equals the number of groups.  Bar modelling. Split the bar into the number of groups you are dividing by and work out how many would be within each group. 	Divide 28 into 7 groups. How many are in each group? 28 ÷ 7 = 4

Year	Objective and Strategy	Concrete	Pictorial	Abstract
Year 2	Division within arrays	Link division to multiplication by creating an array and thinking about the number sentences that can be created. 15 ÷ 3 = 5 5 x 3 = 15 15 ÷ 5 = 3 3 x 5 = 15	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 ÷ 4 = 7 28 ÷ 7 = 4
Year 3	Division with a reminder	14 ÷ 3 = 	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.
Year 4/5	Short division			Begin with divisions that divide equally with no remainder.   Move onto divisions with a remainder. 

Year	Objective and Strategy	Concrete	Pictorial	Abstract
Year 6	Divide numbers up to 4 digits by a 2-digit number using the formal written method of short division			Express remainder as r.  Express remainder as a decimal.