

Emscote Infant School Calculation Policy

Updated June 2020

This policy supports the White Rose maths scheme used throughout the school.

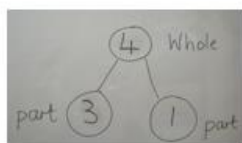
Progression within each area of calculation is in line with the programmes of study in the 2014 National Curriculum.

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

Concrete



Pictorial



Abstract

$$3 + 1 = 4$$



Concrete representation – a pupil is first introduced to an idea or skill by acting it out with real objects. This is a ‘hands on’ component using real objects and is a foundation for conceptual understanding.

Pictorial representation – a pupil has sufficiently understood the ‘hands on’ experiences performed and can now relate them to representations, such as a diagram or picture of the problem.

Abstract representation – a pupil is now capable of representing problems by using mathematical notation, for example $12 \times 2 = 24$.

It is important that conceptual understanding, supported by the use of representation, is secure for all procedures. Reinforcement is achieved by going back and forth between these representations.

Resources Key:

Numicon 	Ten frame 	Number line/Number track
Bar model 	Part part whole 	Dienes/Base 10 Sticks and Dots

Overview at a glance:

	Addition	Subtraction	Multiplication	Division
EYFS/ Year 1	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.	Taking away ones. Counting back. Find the difference. Part whole model. Make 10 using the ten frame.	Recognising and making equal groups. Doubling. Counting in multiples. Use cubes, Numicon and other objects in the classroom.	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.
Year 2	Adding three single digits. Use of base 10 to combine two numbers.	Counting back. Find the difference. Part whole model. Make 10. Use of base 10.	Arrays- showing commutative multiplication.	Division as grouping. Division within arrays- linking to multiplication. Repeated subtraction.

Reception and Year 1

- Very practical and mental - Lots of counting, songs and games
- Based in play, especially in Reception
- Reception is based on numbers 0 – 20 and understanding the concept of these
- Year 1 – counting and recognising up to 100. Working with 0-40

Resources: objects/counters, Numicon, number lines, fingers, games, 100 squares, computers, sticks and dots, base 10 and our own drawings.

Year 2

- Practical, mental, more written but using informal jottings and methods (NOT the 'old fashioned' methods we all remember)
- Continuation of addition and subtraction, introduction of more formal multiplication and division
- Active Maths lessons are used to support and develop understanding of calculations in a practical and visual way.

Resources: 100 squares, number lines, blank number lines, objects, computers, number fans, Numicon and bar modelling.

Reception Learning Objectives in Calculation + - x ÷

Reception Learning Objectives for Addition and Subtraction:

40-60 months statements:

- Finds the total number of items in two groups by counting all of them
- Say the number that is one more than a given number
- Finds one more or one less from a group of up to five objects, then ten objects
- In practical activities and discussion, beginning to use the vocabulary involved in adding and subtracting
- Records using marks that they can interpret and explain
- Begins to identify own mathematical problems based on own interests and fascinations

Current Early Learning Goals:

- Children say which number is one more or less than a given number. Using quantities and objects, they add and subtract two single-digit numbers and count on or back to find the answer

Proposed Early Learning Goals:

- They automatically recall (without reference to rhymes, counting or other aides) number bonds to 5 (including subtraction facts) and some number bonds to 10, including double facts

Reception Learning Objectives for Multiplication and Division:

Current Early Learning Goals:

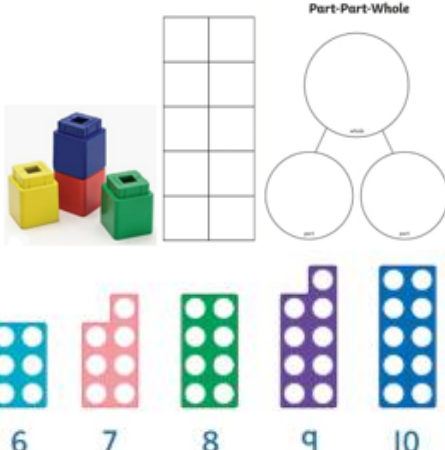
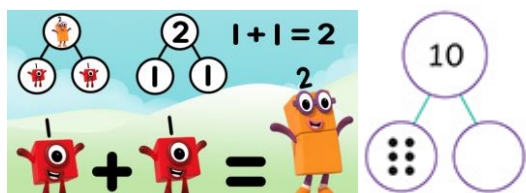
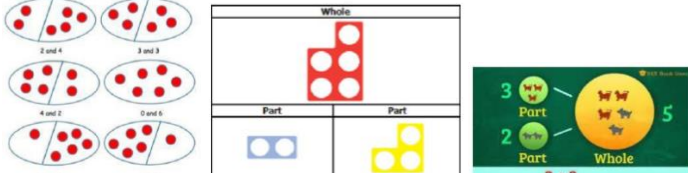
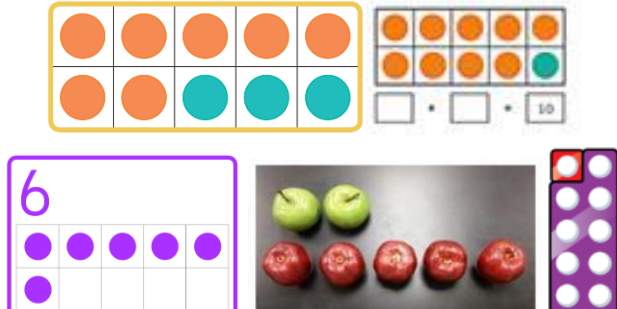
- They solve problems, including doubling, halving and sharing

Proposed Early Learning Goals:

- Explore and represent patterns within numbers up to 10, including evens and odds, double facts and how quantities can be distributed equally

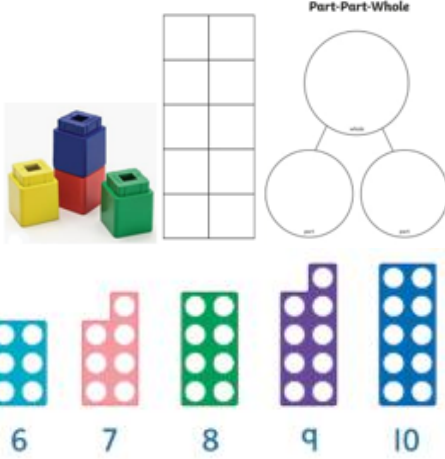
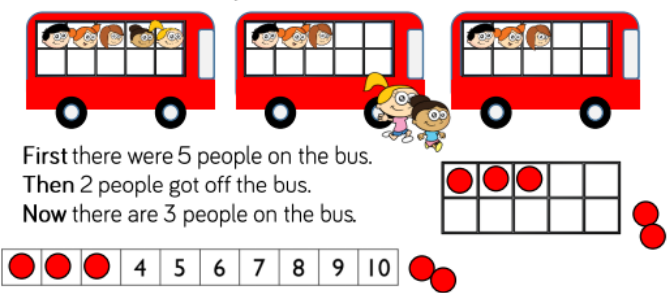
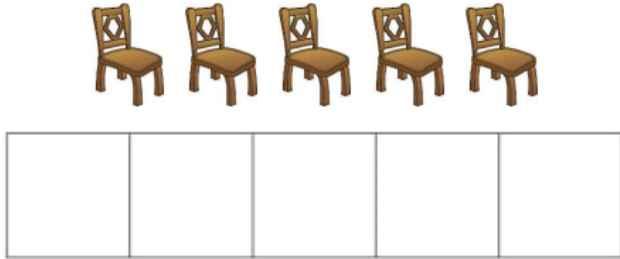
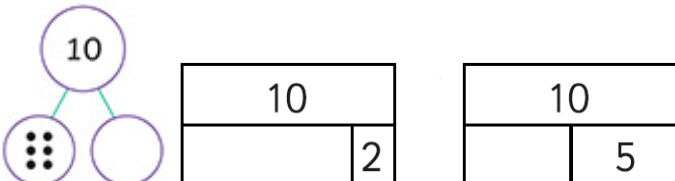
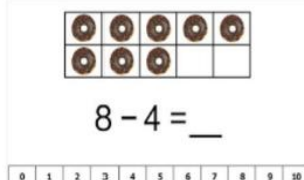
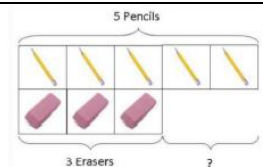
Reception Addition

<u>Resources:</u>	<u>Vocabulary:</u>
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		add more than altogether plus make sum total equals
Introduction: We use Numberblocks videos and focus on a number a week, in great detail. We spend time teaching the children the different ways that numbers can be represented and seen in their environment, formation, counting objects, using numicon, relating to 2D shape, used on a 5 and 10 frame, counting claps, fingers. For example:		
Combining two parts to make a whole: part whole model 1 is a part and 1 is a part and the whole is 2. 6 is a part and 4 is a part and the whole is 10.		
We explore the part part whole relationship when we learn each number, so that the children are learning their number bonds. <u>Particular focus is on number bonds to 10.</u>		
Regrouping to make 10 using ten frame. The ten frame supports addition of single digits, counting all and combining groups. We also get the children used to seeing what each number looks like when represented on a ten frame and that it can be any object/a mix of objects. We use Numicon to demonstrate this too.		
Solve problems using concrete, pictorial images. For example: Sarah has 2 apples. John has 5 apples. How many apples do they have altogether? How many more apples does John have than Sarah?		

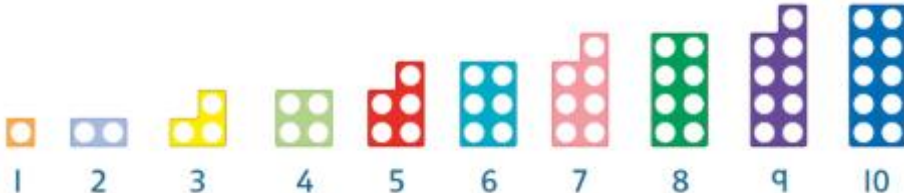
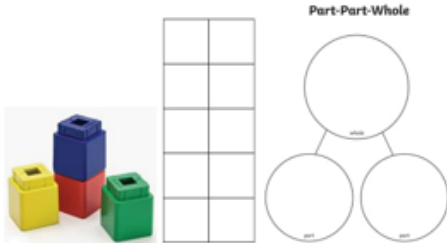
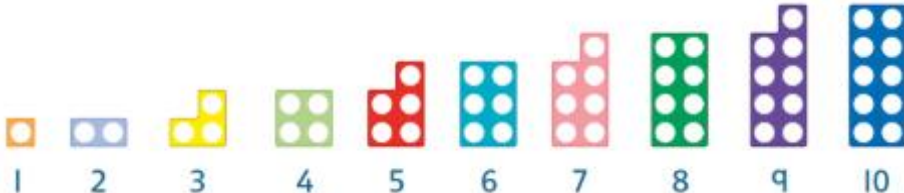
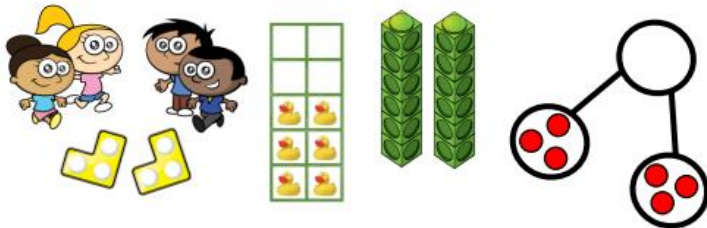
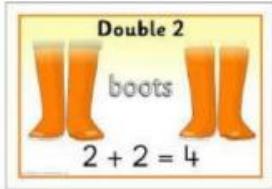
Reception Subtraction

Resources:	Vocabulary:
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 	take-away subtract minus less than fewer leave difference between equals
Introduction: The children use real objects to see that the quantity of a group can be changed by taking items away. The first, then, now structure can be used to create mathematical stories in meaningful contexts. We encourage the children to count out all of the items at the start, take away the required amount practically and recount to see how many are left. We encourage the children to use 10 frames, number tracks and their fingers.	Use first, then now to tell simple maths stories to practise taking away in familiar contexts. 
Taking away ones (1 less) The children use their counting and comparing skills to find one less than numbers up to 5. We encourage the children to use a five frame to represent numbers and then make one less. The children can see the link that one less than a number is the next number they say when they are counting backwards. We use songs, stories and games to demonstrate one less.	
Part whole model We use practical resources and the part part whole model to help the children see how subtraction works. We progress to the Bar Model if some children are ready.	
Finding the difference We use the ten frame to support subtraction by taking away.	
Solve problems using concrete, pictorial images and mathematical stories. For example: Sarah has 5 pencils and John has 3 rubbers. What is the difference in the amount of stationary they have?	

Reception Multiplication

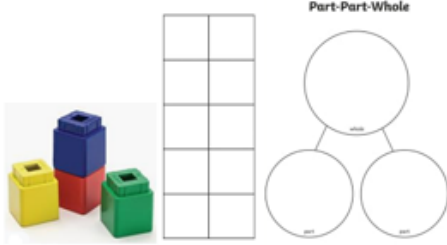
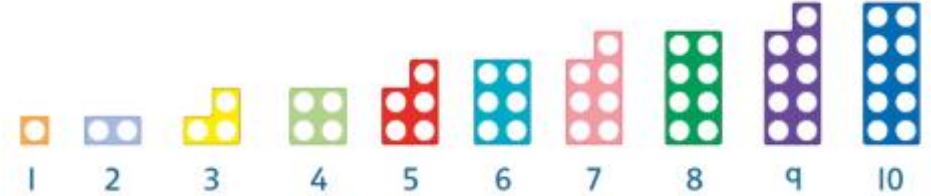
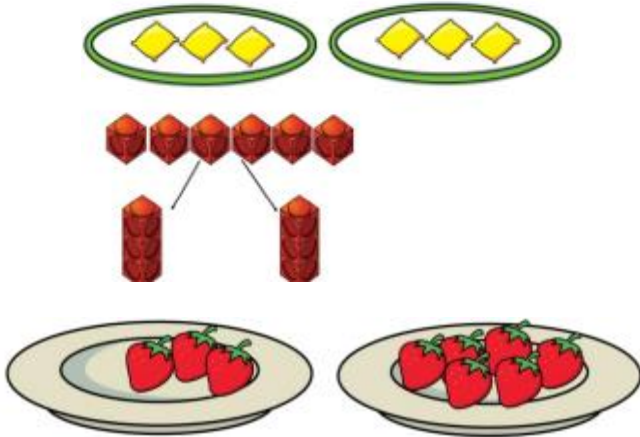
Resources:	Vocabulary:
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 	 	lots of times multiply groups of double equal groups
Introduction: The children will learn that double means ‘twice as many’. They should be given opportunities to build doubles using real objects and mathematical equipment. Building numbers using the pair-wise patterns on 10 frames helps the children to see the doubles.		
Doubling We encourage the children to say the doubles as they build them e.g. Double 2 is 4. We provide examples of doubles and non-doubles for the children to sort and explain why.		
Recognising and making equal groups There are 4 sweets in each jar. There are 3 jars. The children can use repeated addition of 4+4+4=12 and be taught that 3x4=12		

Reception Division

Resources:

Vocabulary:

 	share group divide divided by half
	
Introduction: The children will halve quantities by sharing items into 2 equal groups. The children usually have some experience of sharing and are quick to point out when groups are not shared fairly. This distinction between fair and unfair sharing can be used to emphasise the idea of half being one of 2 equal parts.	
Sharing objects into groups Once the children can confidently halve small quantities, they can explore sharing between 3 or 4 people. They will notice that sometimes there are items left over and can come up with their own suggestions about how to resolve this!	
Division as grouping We have 12 sweets. How do we share them equally between 3 jars? Lots of practical 'sharing' examples.	

Year 1 Learning Objectives in Calculation + - x ÷

Year 1 Learning Objectives for Addition and Subtraction:

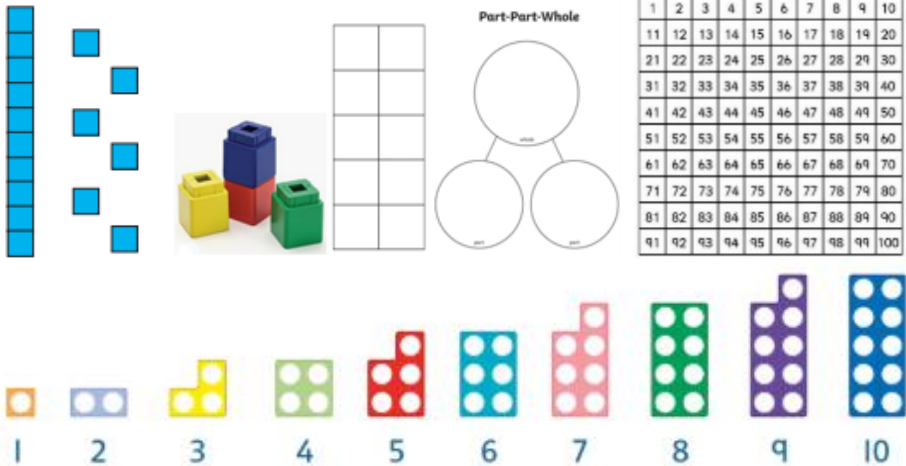
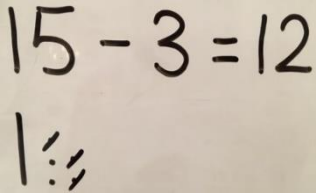
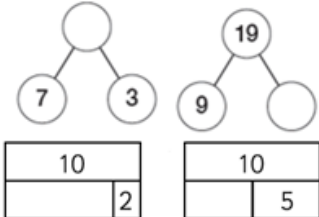
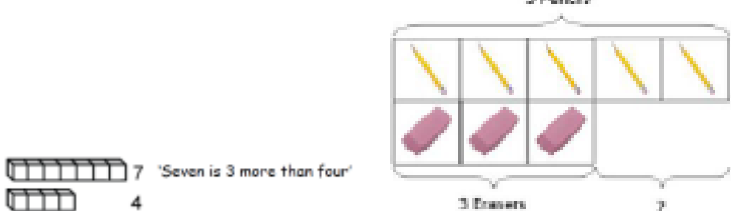
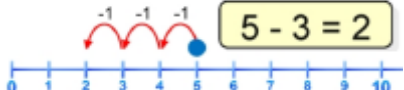
- Represent and use number bonds and related subtraction facts within 10 (then 20 in the Spring Term)
- Read, write and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs
- Add and subtract one-digit numbers to 10, including zero (Autumn Term)
- Add and subtract one-digit and two-digit numbers to 20, including zero (Spring Term)
- Solve one step problems that involve addition and subtraction, using concrete objects and pictorial representations and missing number problems such as $7 = \square - 9$

Year 1 Learning Objectives for Multiplication and Division:

- Count in multiples of twos, fives and tens
- Solve one step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher

Year 1 Addition

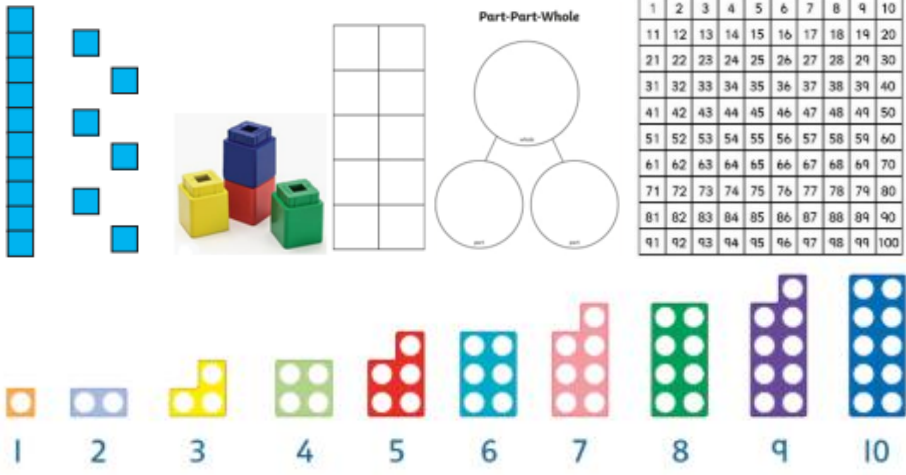
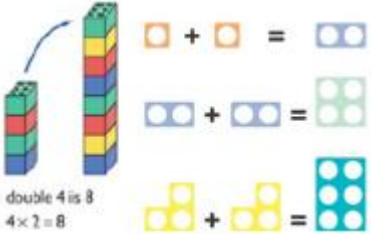
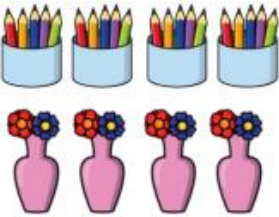
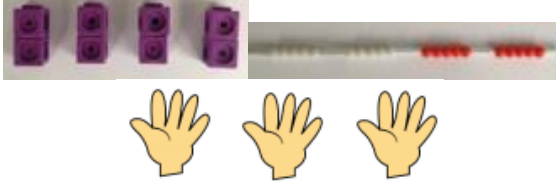
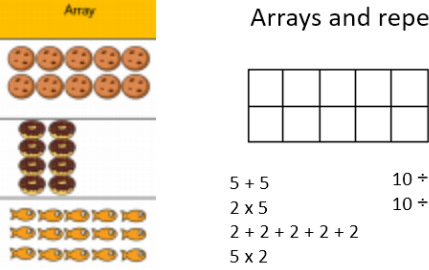
<u>Resources:</u>	<u>Vocabulary:</u>
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0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 	subtract minus less than fewer leave difference between equals the difference decrease
Introduction: The children are introduced to the language of subtraction rather than the subtraction symbol being explored straight away. 'Taking away' is used in a range of real life contexts such as flying away and eating. The use of zero is important so children know that when nothing is taken away the whole remains the same. First, then, now...story representations can help the children understand the concept of how many left.	There were 7 birds in a tree and 3 flew away. Complete the sentences.  At first there were ___ birds. Then ___ flew away. Now there are ___ birds in the tree.
Taking away ones Use physical objects, counters, cubes etc to show how objects can be taken away. Represent this pictorially. Children also learn to draw 'sticks and dots' to represent the tens and ones and cross off the ones they are taking away.	 4-2=2  15-3=12
Part whole model We use practical resources and the part part whole model to help the children see how subtraction works. We progress to the Bar Model if some children are ready.	
Finding the difference Compare objects and amounts. Also, lay objects to represent the bar model.	
Counting back Using number lines and number tracks. For example: The children start with 5 and count back 3.	 5-3=2

Year 1 Multiplication

Resources:

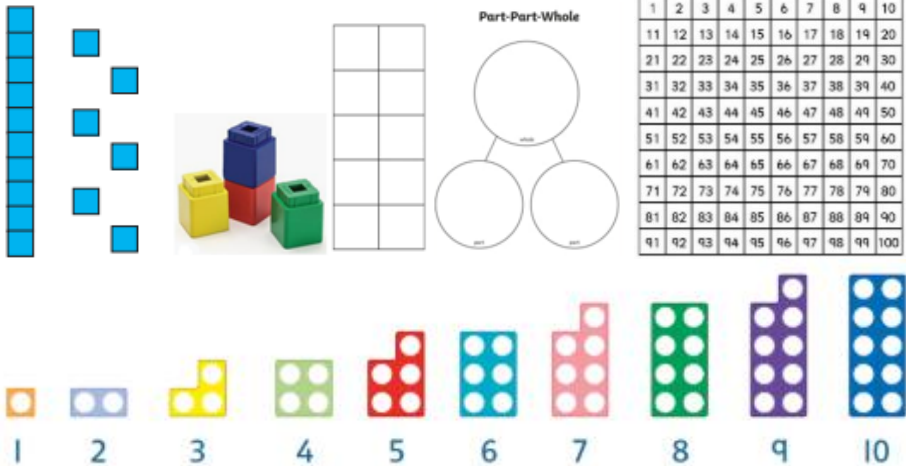
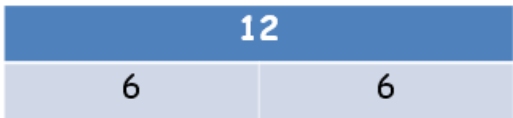
Vocabulary:

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 	lots of times multiply groups of double multiplied by the product of equal groups
Introduction: Children learn to count in 2s, 5s, 10s. They use pictures, bead strings, number lines and hundred squares to support their counting.	
Doubling We use practical activities using manipulatives including cubes and Numicon to demonstrate doubling.	
Recognising and making equal groups Children begin by using stories which link to pictures and concrete manipulatives to explore making equal groups. They write statements such as 'there are ___ groups of ___'. They recognise and explain how they know when they are equal or not. At this stage children do not explore multiplication formally.	 There are ___ groups of ___ pencils. There are ___ groups of ___ flowers.
Counting in multiples. The children use cubes, Numicon and other objects in the classroom to count in 2s, 5s and 10s.	
Making arrays and using repeated addition. The children begin to make arrays by making equal groups and building them up in columns or rows. They use a range of concrete and pictorial representations alongside sentence stems to support their understanding. They then use repeated addition alongside their arrays.	Arrays and repeated addition  Remember whenever you are dividing by 2 you are halving. So $10 \div 2$ is the same as half of 10.

Year 1 Division

Resources:

Vocabulary:

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 	share group divide divided by half
Introduction: Children explore sharing as a model of division.	Share the muffins equally between the two plates. Complete the sentence. ___ cakes shared equally between 2 is ___ 
Sharing objects into groups Division by grouping They use 1:1 correspondence to share concrete objects into equal groups. Children also need to be given the opportunity to see when a number of objects cannot be shared equally into equal groups.	There are 10 cakes and 2 boxes. An equal amount needs to be put into each box. 
Bar modelling with division When the children are becoming confident, they then use the bar model to demonstrate division. It can also help support the teaching of fractions in year 1 too.	 We have also used this method to find a fraction of a number e.g. $\frac{1}{2}$ of 12 = 6

Year 2 Learning Objectives in Calculation + - x ÷

Year 2 Learning Objectives for Addition and Subtraction:

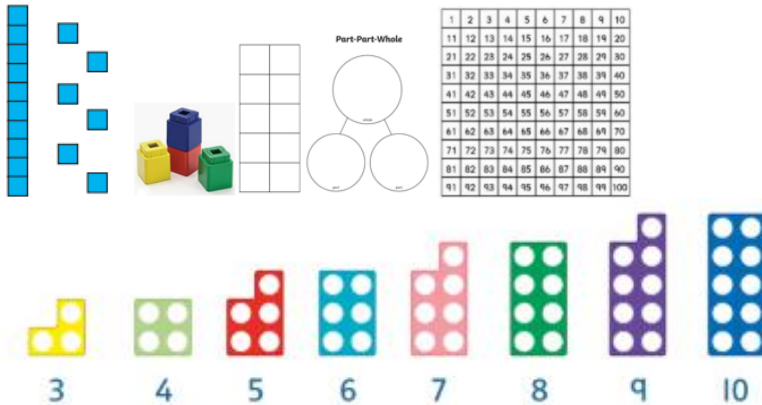
- Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100
- Add and subtract numbers using concrete objects, pictorial representations, and mentally, including: a two-digit number and ones; and a two-digit number and tens; two two-digit numbers; adding three one-digit numbers
- Show that the addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot.
- Solve problems with addition and subtraction: using concrete objects and pictorial representations, including those involving numbers, quantities and measures; applying their increasing knowledge of mental and written methods
- Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems

Year 2 Learning Objectives for Multiplication and Division:

- Recall and use multiplication and division facts for the 2, 5 and 10 times tables, including recognising odd and even numbers
- Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (x), division ($\div$) and equals (=) sign.
- Solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods and multiplication and division facts, including problems in contexts
- Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot

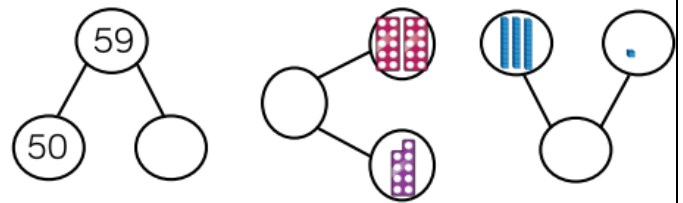
Year 2 Addition

A horizontal number line with tick marks at every integer from 0 to 20. The numbers are written in bold black font above the line.



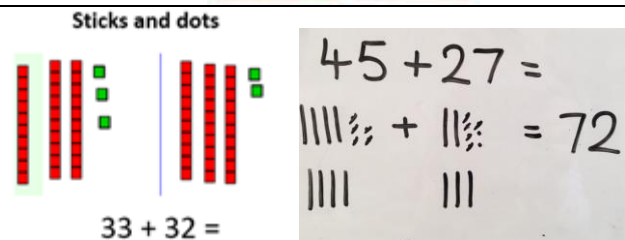
add
addition
more than
altogether
plus make
sum total
is equal to
is the same as
parts and wholes

Children need to be able to represent numbers to 100 using a range of concrete materials, such as bead strings, Numicon, Dienes equipment etc. Children should also be able to state how a number is made up e.g. 42 as 4 tens and 2 ones or 42 ones. Children should have an understanding of what each digit represents when partitioning a number.



Use concrete and pictorial representations to support the children adding three single digit numbers.

Children use Dienes (Base 10) and partitioning to add together 2-digit numbers including an exchange. They will become confident in exchanging 10 ones for one 10. They are encouraged to draw the base 10.



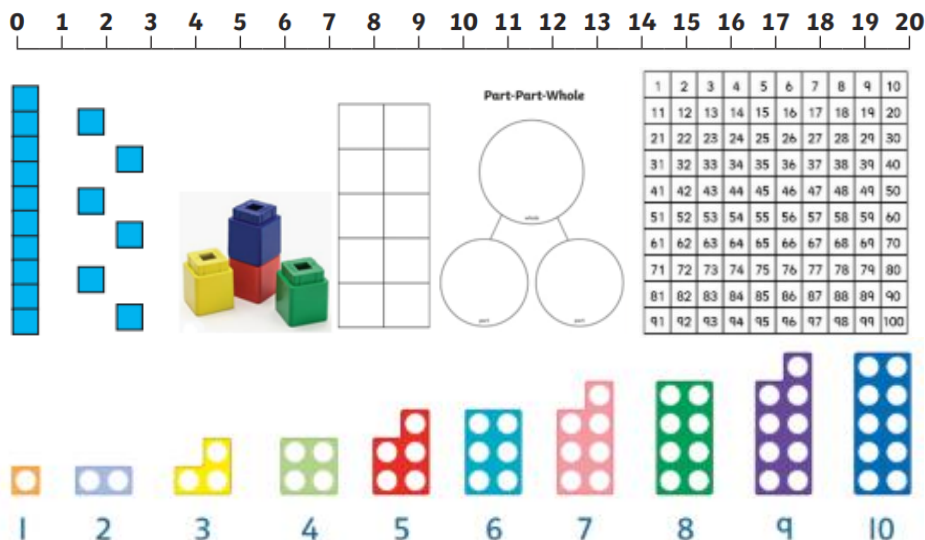
Children apply their understanding of known addition facts to identify all related facts. Showing the link between representation, such as part-whole models and bar models can support and deepen the children's understanding.

Children need to discuss and share strategies for checking addition and subtraction calculations. Checking calculations is not restricted to using the inverse. Teachers should discuss using concrete resources, number lines and estimating as part of a wide range of checking strategies.

$$\begin{array}{cc} 13 + 5 & 13 - 5 \\ 18 - 13 & 5 + 13 \end{array}$$

14

Resources:



Vocabulary:

take-away
subtract
minus
less than
fewer
leave
difference between
equals
the difference
decrease

Introduction:

Just as with addition, children need to have a strong understanding of place value for subtraction. They need to be able to partition two-digit numbers. Number lines and blank number lines can also be used by the children to support their strategies.

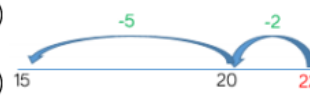
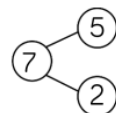
Use the number line to subtract 12 from 51



Can you subtract the ones first and then the tens?
Can you partition the ones to count back to the next ten and then subtract the tens?

Counting back

In order to progress to using number lines more efficiently, they need to be secure in their number bonds.

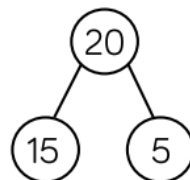


We can partition 7 into 5 and 2 and use this to bridge the 10

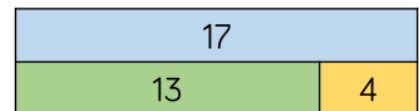
Part whole model

Showing the link between representations, such as part-whole models and bar models can support and deepen the children's understanding. Children learn to write all the number sentences to show the fact family. E.g. $13+4=17$, $4+13=17$, $17-4=13$ and $17-13=4$

Part-whole model



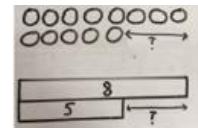
Bar model



Find the difference

Children to draw the cubes/other concrete objects which they have used or use the bar model to illustrate what they need to calculate.

Calculate the difference between 8 and 5:



Use of base 10

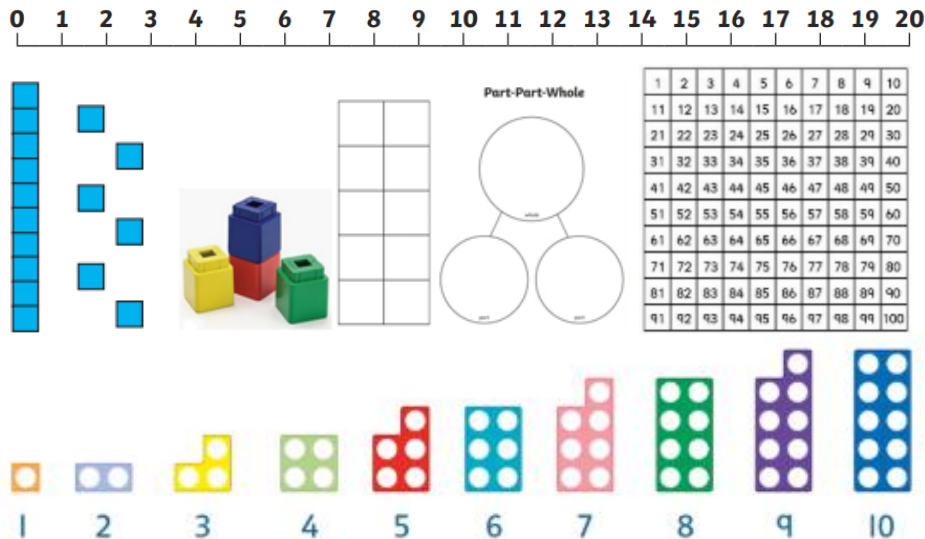
Children use concrete materials and also draw images of the Dienes (Base 10) so they can independently solve subtraction calculations. Children use their knowledge that one ten is the same as ten ones to exchange when crossing a ten in subtraction.

$$34 - 28 = 6$$

34 - 28 = 6

Year 2 Multiplication

Resources:

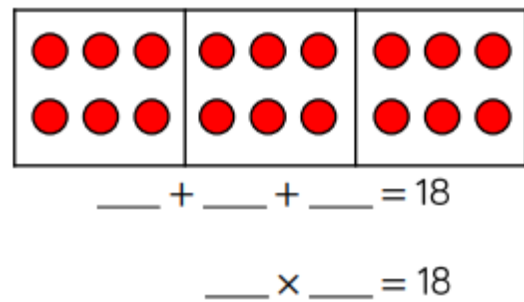


Vocabulary:

lots of
times
multiply
groups of
double
multiplied by
the product of
equal groups

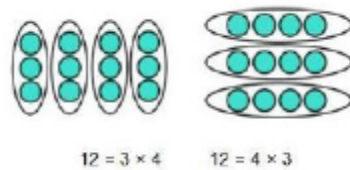
Introduction:

Children are introduced to the multiplication symbol for the first time. They should link repeated addition and multiplication together. They should also be able to interpret mathematical stories and create their own involving multiplication. The use of concrete resources and pictorial representations is still vital for understanding.



Arrays showing commutative multiplication

Pupils should understand that an array can represent different equations and that as multiplication as commutative the order doesn't affect the answer.



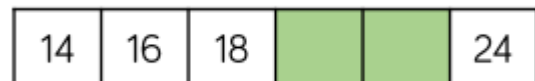
Recall and use multiplication facts for the 2, 5, 10 times tables

Children should be comfortable with the concept of multiplication so they can apply this to multiplication tables. Images as well as number tracks should be used to encourage children to count in 2s, 5s and 10s.

How many wheels are there on five bicycles?



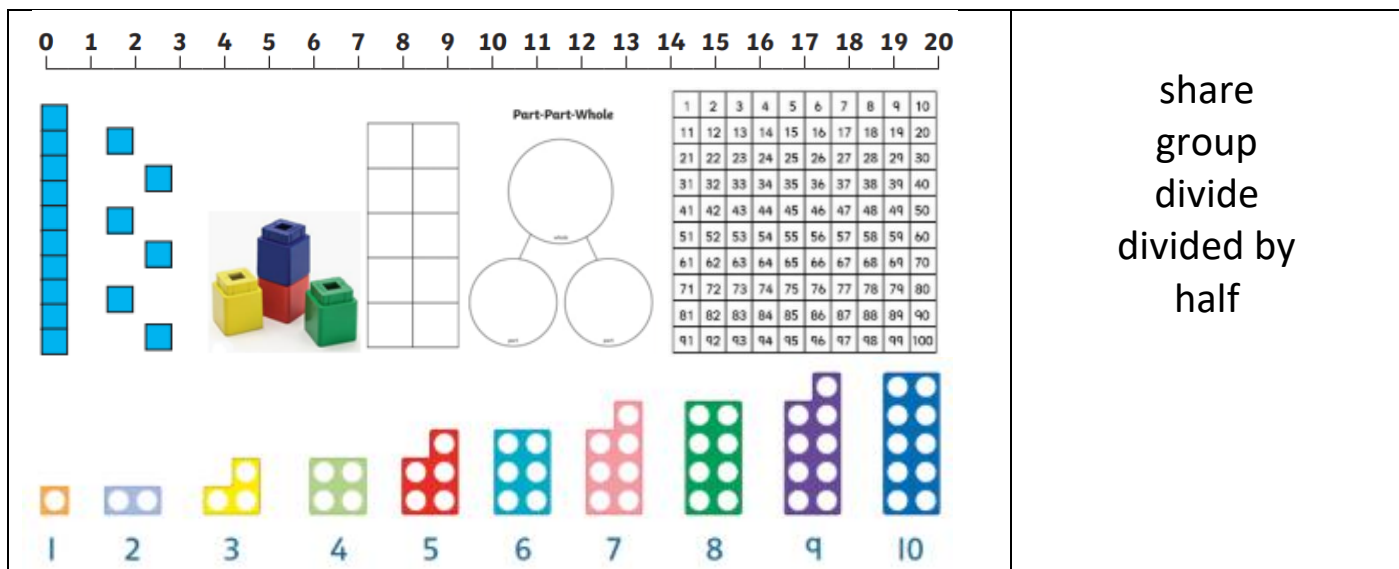
If there are 14 wheels, how many bicycles are there?



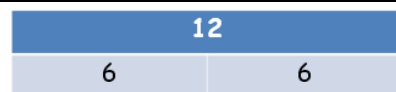
Year 2 Division

Resources:

Vocabulary:



Introduction:



e.g. $\frac{1}{2}$ of 12 = 6

Share the 12 cubes equally into the two boxes.



Division within arrays – linking to multiplication

Apples can be sold in packs of 10
How many packs can be made below?

$$\square \div \square = \square$$

Abstract number line to represent the equal groups that have been subtracted.

