Banks Road Infant and Nursery School
Calculation Policy – 2017

Mathematics Mastery

At Banks Road Infant and Nursery School, we have made significant changes to our teaching of Mathematics in order to implement the Mastery approach. At the centre of this approach is the belief that all children have the potential to succeed. Children should have access to the same curriculum content outlined in the National Curriculum programmes of study for their year group. The Mastery approach encourages depth before breadth, so that children become fluent in the fundamentals of mathematics and can apply their knowledge rapidly and accurately. They are encouraged to build their fluency, problem solving and reasoning by taking this approach.

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

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

Abstract – both concrete and pictorial representations should support children's understanding of abstract methods; using numbers and key concepts with confidence.

A large proportion of time is spent reinforcing number to build competency and this policy outlines the different calculation strategies that should be taught and used from EYFS to Year 2 in line with the requirements of the 2014 Primary National Curriculum.
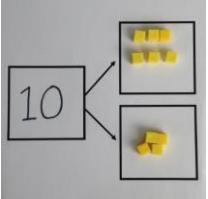
Background
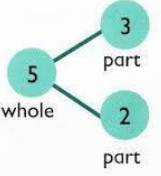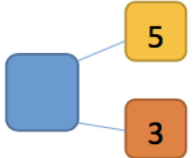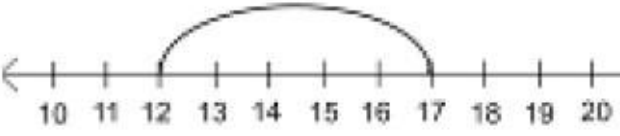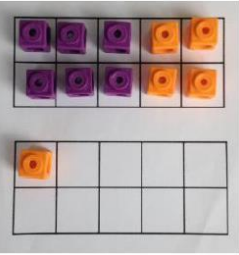
The 2014 Primary National Curriculum for Mathematics differs from its predecessor in many ways. There is an emphasis on depth before breadth and a greater expectation of what children should achieve. The expectation is that the majority of children will move through the programmes of study at broadly the same pace and that children who grasp concepts rapidly should be challenged through rich and sophisticated problem solving. In addition, the removal of levels has given sch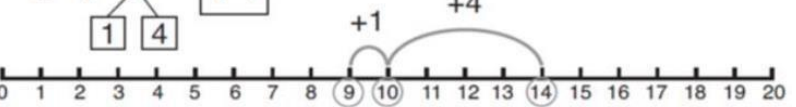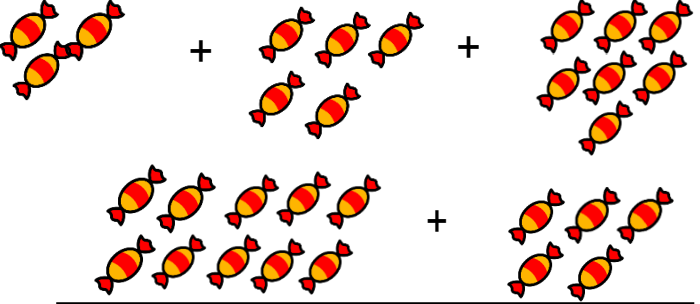ools greater freedom to develop and use their own assessment systems. One of the key differences is the level of detail included, indicating what children should be learning and when. There is an expectation for children to use formal written methods balanced with the explicit requirement for children to use concrete materials and pictorial representations - a key component of the mastery approach.
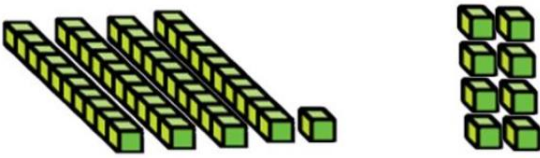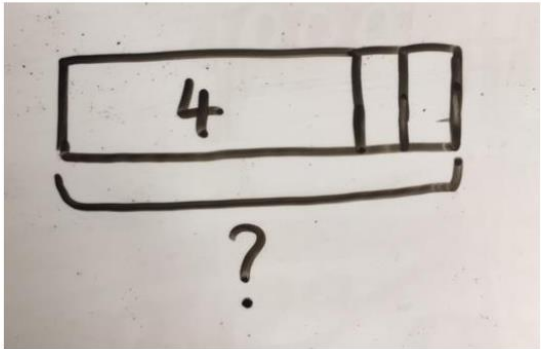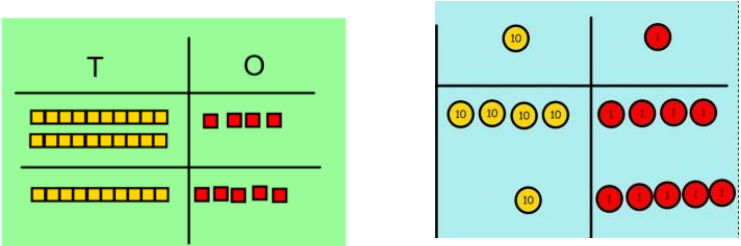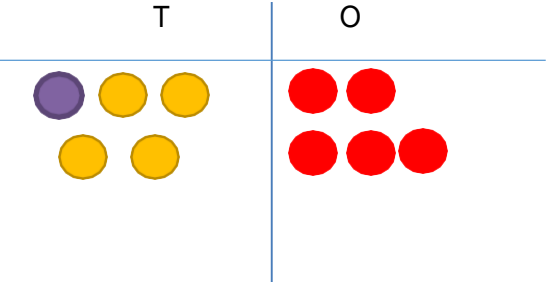
How to use the policy

This mathematics policy is a guide for all staff at Banks Road Infant and Nursery School and has been adapted from work by the NCETM. It is purposely set out as a progression of mathematical skills with an indication as to which year group phases these relate. However, staff are encouraged to take a flexible approach to teaching and learning, using their professional judgment as to when consolidation of existing skills is required or when to move onto the next concept. It is also important that the focus remain on breadth and depth rather than accelerating through concepts.
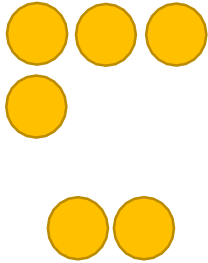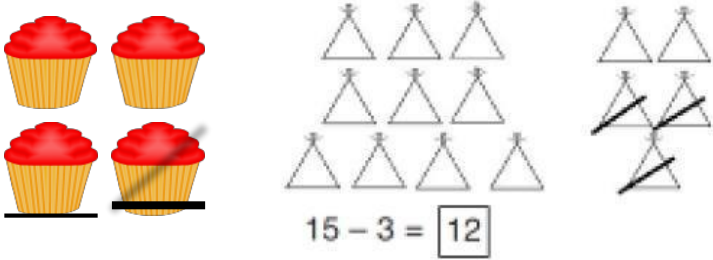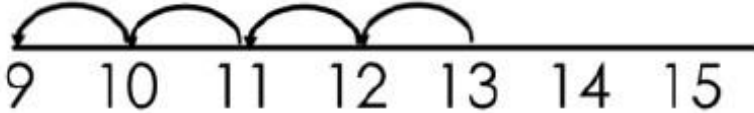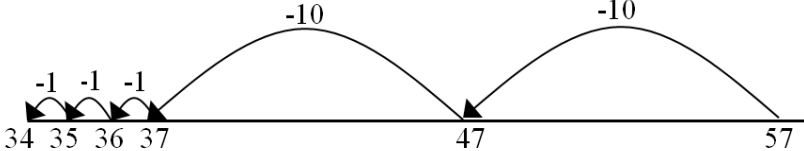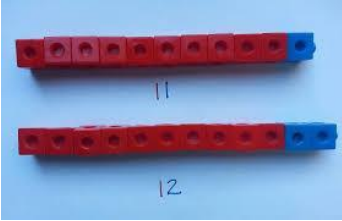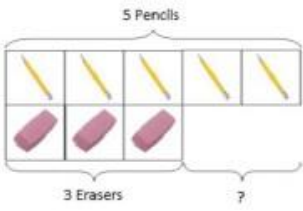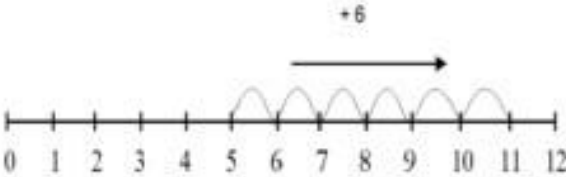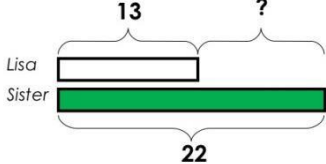
All teachers have been given the schemes of work from the White Rose *Maths Hub* and are required to use these to plan from. They must stay within the National Curriculum objectives of their year group, use the yearly overview document to support long-term coverage and the termly schemes to support medium term and short term planning. Teachers are encouraged to use a wide variety of resources in order to ensure children master the principle of the concrete-pictorial-abstract and have access to these in the file 'Maths 2017' on the staffroom network.

Addition

Objective and Strategies	Concrete	Pictorial	Abstract
Combining two parts to make a whole: part- whole model **EYFS/Y1**	Use cubes to add two numbers together as a group or in a bar.	Use pictures to add two numbers together as a group or in a bar.	Use the part-part whole diagram as shown above to move into the abstract. **4 + 3 = 7** **10= 6 + 4**
Starting at the bigger number and counting on **EYFS/Y1**	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.	**12+5=17** **5+ 12 = 17** Place the larger number in your head and count on the smaller number to find your answer.
Regrouping to make 10. **EYFS/Y1**	**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. **3 + 9 =** **9 + 5 = 14**	**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. **Y2**	**4 + 7 + 6= 17** Put 4 and 6 together to make 10. Add on 7. Following on from making 10, make 10 with 2 of the digits (if possible) then add on the third digit.	Add together three groups of objects. Draw a picture to recombine the groups to make 10.	4 + 7 + 6 = 10 + 7 = 17 Combine the two numbers that make 10 and then add on the remainder.

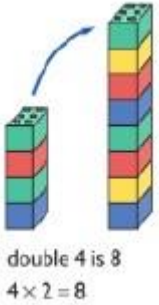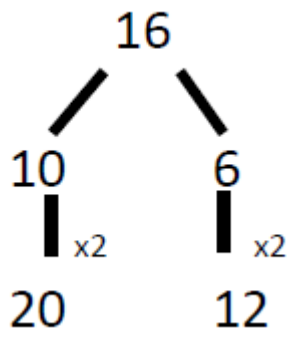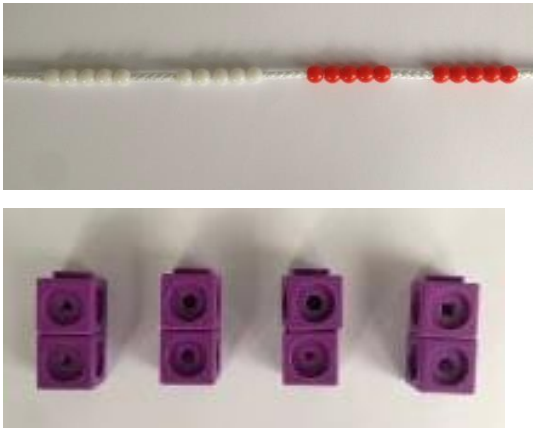|			
Use of base 10 to combine two numbers. **Y2**	TO + O using base 10. Continue to develop understanding of partitioning and place value. 41 + 8 	A bar model which encourages the children to count on, rather than count all. 	The abstract number line: What is 2 more than 4? What is the sum of 2 and 4? What is the total of 4 and 2? 4 + 2
Column method- no regrouping. **Y2**	**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
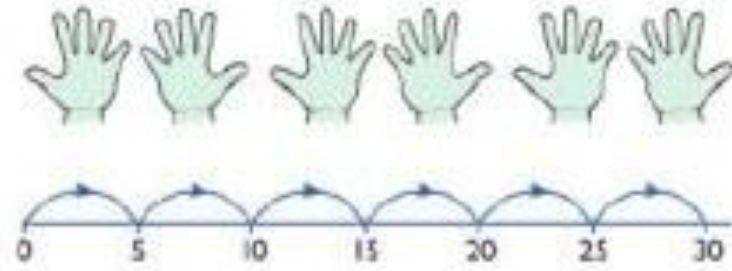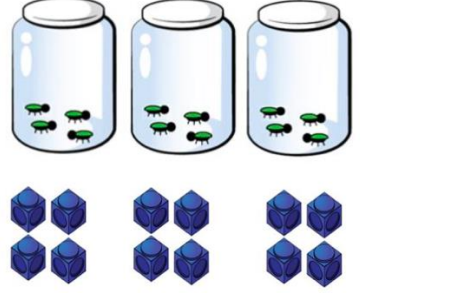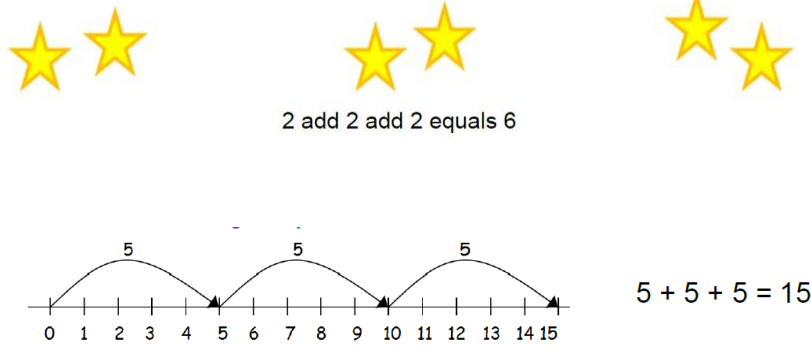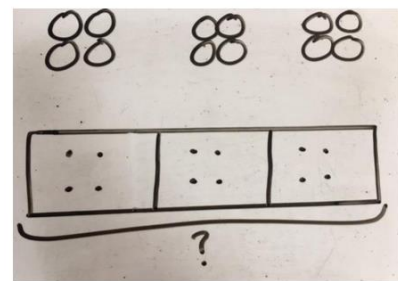
Subtraction

Objective and Strategies	Concrete	Pictorial	Abstract
Taking away ones **EYFS/Y1**	Use physical objects, counters, cubes etc. to show how objects can be taken away. $6 - 2 = 4$	Cross out drawn objects to show what has been taken away. $15 - 3 = 12$	$18 - 3 = 15$ $8 - 2 = 6$
Counting back **EYFS/Y1/Y2**	Make the larger number in your subtraction. Move the beads along your bead string as you count backwards in ones. $13 - 4$ Use counters and move them away from the group as you take them away counting backwards as you go.	Count back on a number line or number track 9 10 11 12 13 14 15 Start at the bigger number and count back the smaller number showing the jumps on the number line. -1 -1 -1 -10 -10 34 35 36 37 47 57 This can progress all the way to counting back using two 2 digit numbers.	Put 13 in your head, count back 4. What number are you at? Use your fingers to help.
Find the difference **EYFS/Y1/Y2**	Compare amounts and objects to find the difference. Use cubes to build towers or make bars to find the difference 5 Pencils 3 Erasers ? Use basic bar models with items to find the difference.	+6 0 1 2 3 4 5 6 7 8 9 10 11 12 Count on to find the difference. **Comparison Bar Models** Draw bars to find the difference between 2 numbers. Lisa is 13 years old. Her sister is 22 years old. Find the difference in age between them. 13 ? Lisa Sister 22	Hannah has 23 sandwiches; Helen has 15 sandwiches. Find the difference between the number of sandwiches.

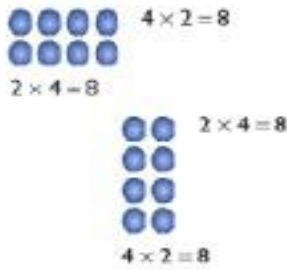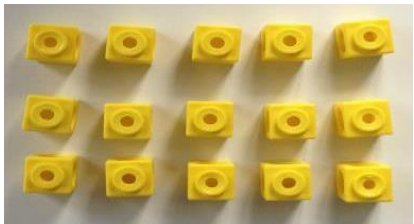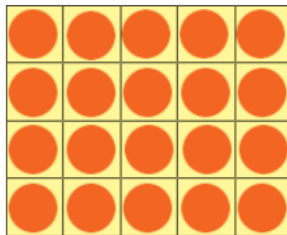|			
Part Part Whole Model **EYFS/Y1/Y2**	Link to addition- use the part whole model to help explain the inverse between addition and subtraction. If 10 is the whole and 6 is one of the parts. What is the other part? **10 - 6 =**	Use a pictorial representation of objects to show the part part whole model.	 Move to using numbers within the part whole model.
Make 10 **EYFS/Y1/Y2**	$14 - 5 =$ 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?
Use of base 10. **Y2**	Making **10** using ten frames. $14 - 5$ 	Children to present the ten frame pictorially and discuss what they did to make 10. 	Children to show how they can make 10 by partitioning the subtrahend. $14 - 5 = 9$ $\diagdown$ $4 \quad 1$ $14 - 4 = 10$ $10 - 1 = 9$
Column method without regrouping **Y2**	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. 	$47 - 24 = 23$ $\begin{array}{r} 40 + 7 \\ - \ 20 + 4 \\ \hline 20 + 3 \end{array}$ This will lead to a clear written column subtraction. $\begin{array}{r} 32 \\ - 12 \\ \hline 20 \end{array}$

Multiplication

Objective and Strategies	Concrete	Pictorial	Abstract
Doubling **EYFS/Y1**	Use practical activities to show how to double a number. double 4 is 8 $4 \times 2 = 8$	Draw pictures to show how to double a number. Double 4 is 8	Partition a number and then double each part before recombining it back together. 16 10 6 x2 x2 20 12
Counting in multiples **EYFS/Y1**	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 **Y1/Y2**	Use different objects to add equal groups. Repeated grouping/repeated addition 3×4 $4 + 4 + 4$ There are 3 equal groups, with 4 in each group.	There are 3 plates. Each plate has 2 star biscuits on. How many biscuits are there? 2 add 2 add 2 equals 6 $5 + 5 + 5 = 15$ Children to represent the practical resources in a picture and use a bar model.	Write addition sentences to describe objects and pictures. 2 + 2 + 2 + 2 + 2 = 10 **4 + 4 + 4 = 12**

	Create arrays using counters/ cubes to show multiplication sentences.	Draw arrays in different rotations to find **commutative** multiplication sentences.	Use an array to write multiplication sentences and reinforce repeated addition.
Arrays- showing commutative multiplication **Y2**		$4 \times 2 = 8$ $2 \times 4 = 8$ $2 \times 4 = 8$ $4 \times 2 = 8$ Link arrays to area of rectangles. 	E.g. 10 = 2 x 5 10 = 5 x 2 5 x 2 = 10 2 x 5 = 10 2 + 2 + 2 + 2 + 2 = 10 10 = 5 + 5 5 + 5 + 5 = 15 3 + 3 + 3 + 3 + 3 = 15 5 x 3 = 15 3 x 5 = 15
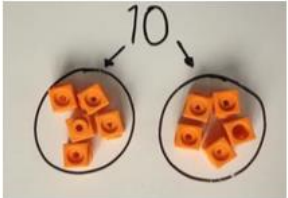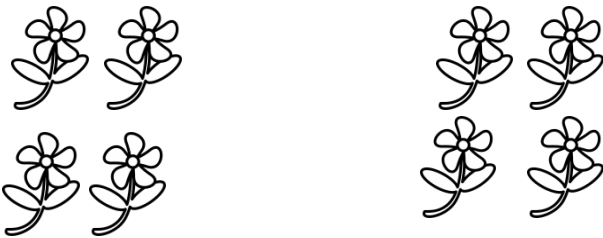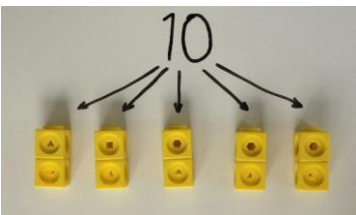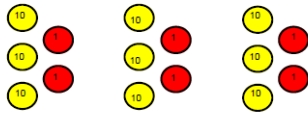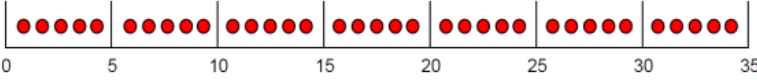
Division

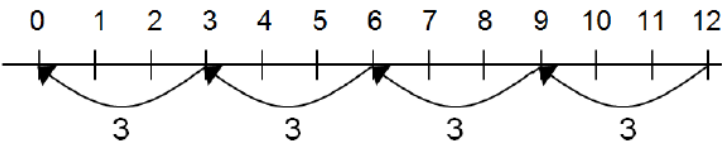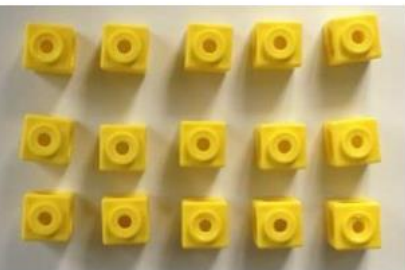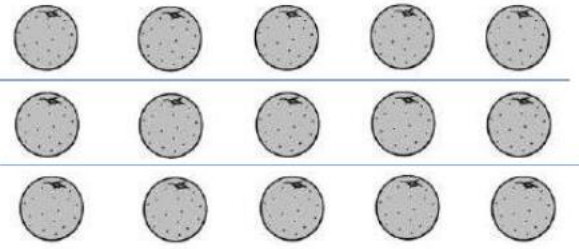| Objective and Strategies	Concrete	Pictorial	Abstract
Sharing objects into groups **EYFS/Y1**	I have 10 cubes, can you share them equally in 2 groups?	Children use pictures or shapes to share quantities. $8 \div 2 = 4$	**Share 9 buns between three people.** **$9 \div 3 = 3$**
Division as grouping **EYFS/Y1/Y2**	Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding. $96 \div 3 = 32$	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. $20 \div 5 = ?$ $5 \times ? = 20$	**$25 \div 5 = 5$** **Divide 25 into 5 groups. How many are in each group?**
Division within arrays **Y2**	Link division to multiplication by creating an array and thinking about the number sentences that can be created. E.g. $15 \div 3 = 5$ $5 \times 3 = 15$ $15 \div 5 = 3$ $3 \times 5 = 15$	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. **$30 \div 5 = 6$** **$30 \div 6 = 5$** **$5 \times 6 = 30$** **$6 \times 5 = 30$**

Division with a remainder
Y2

$14 \div 3 =$

Divide objects between groups and see how much is left over
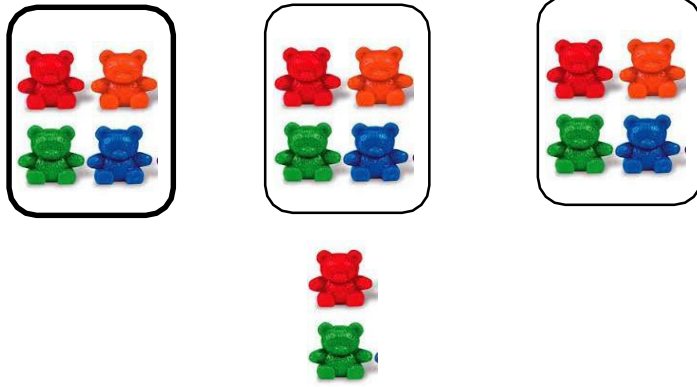
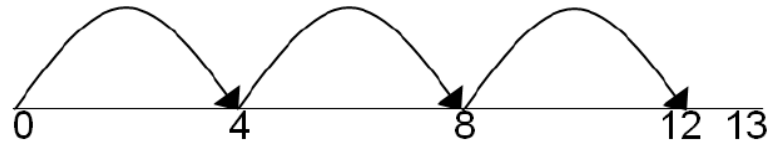**2d ÷ 1d with remainders** using lollipop sticks. Cuisenaire rods, above a ruler can also be used.
$13 \div 4$

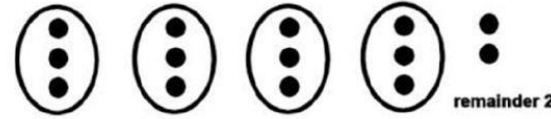Use of lollipop sticks to form wholes- squares are made because we are dividing by 4.

There are 3 whole squares, with 1 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.

remainder 2

Children to represent the lollipop sticks pictorially.
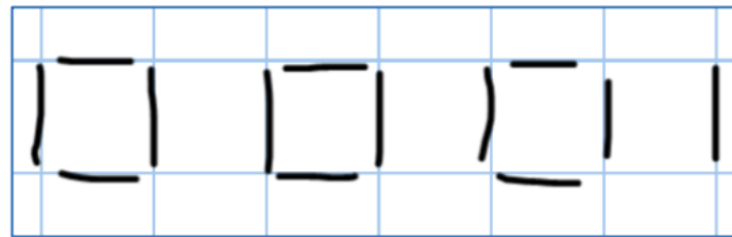
There are 3 whole squares, with 1 left over.

Complete written divisions and show the remainder using r.

$29 \div 8 = 3$ REMAINDER 5

dividend   divisor   quotient   remainder

$13 \div 4 - 3$ remainder 1

Children should be encouraged to use their times table facts; they could also represent repeated addition on a number line.

'3 groups of 4, with 1 left over'

Mathematical Language

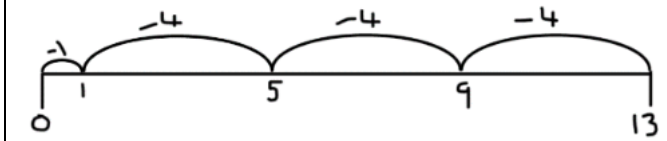The national curriculum for mathematics reflects the importance of spoken language in pupils' development across the whole curriculum – cognitively, socially and linguistically. The quality and variety of language that pupils hear and speak are key factors in developing their mathematical vocabulary and presenting a mathematical justification, argument or proof. They must be assisted in making their thinking clear to themselves as well as others, and teachers should ensure that pupils build secure foundations by using discussion to probe and remedy their misconceptions. (NC England: mathematics programmes of study 2014)

Addition and Subtraction	Multiplication and Division
Add, more, plus, make, sum, total, altogether	Odd, even
Subtract, take-away, minus, less than, fewer, difference	Count in twos, threes, fives
Double, near double	Count in tens forwards and backwards
Half, halve	Times, multiply, lots of, groups of
Inverse	Multiple of
Number bonds, number line	Repeated addition
	Array, row, column
	Share, share equally
	Divide, divided, group, left
	Equal groups

Other relevant vocab
Ones (instead of units)
Tens
Digit
Value
Calculation

Problem Solving and Reasoning
What have you done before that is like this? What do you already know?
What might help you solve this?
Can you find a different way? all the ways?
Can you **prove it**?
Can you see a pattern?
Why do you think that?
Which is the best strategy? Why?