Oakhurst Community Primary School
Maths Workshop for Parents

November 2009

Stages in Recording Mathematical Thinking

Although this booklet is divided up into two educational stages- **Foundation Stage and Key Stage 1,** children's mathematical thinking develops at different rates and it is important to think of 'stage' rather than age. The job of the teacher is to assess when children are ready to move on to the next stage in mathematical development, for each of the 4 number operations.
The aim of this booklet is to familiarise parents with some of these stages.

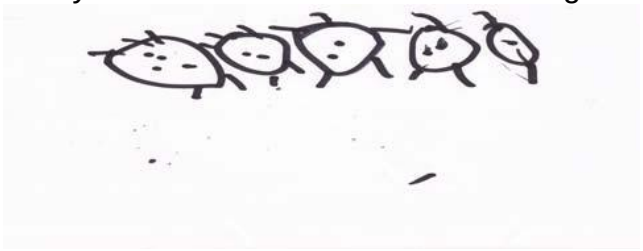
Addition

Foundation Stage

Addition is taught in a practical context using 'real life' situations and practical equipment- counters, beads, coins etc. Much time is also spent on counting rhymes using fingers (e.g. 10 in the Bed / 10 Green Bottles etc) to establish number order.

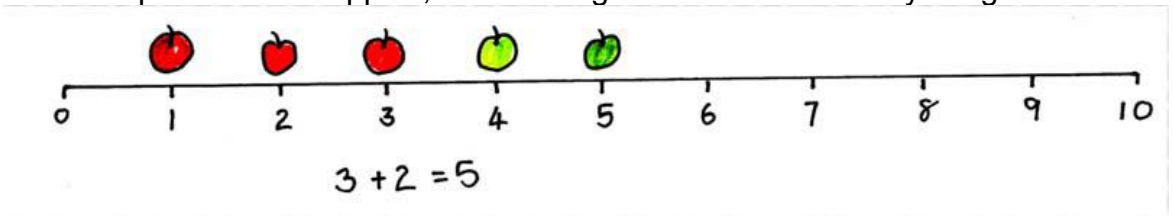
Addition is related to **combining two groups of objects**

Example
3 ladybirds on a leaf. 2 more come along. How many now?

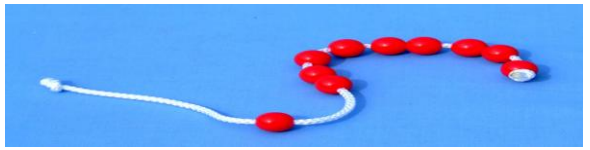


The emphasis is initially on handling the objects, combining 2 sets and counting all the items. Only when the child is secure in handling mathematical equipment to solve addition problems do they move on to a visual representation of a sum. Some children naturally realise that drawing pictures can be time consuming and begin to use their own mark making to represent items to be added. This may not begin until year 1. When children are secure in addition as combining 2 objects and have had plenty of practical experience of in this, they then begin to use prepared **number tracks** and **number lines** to help them add up.

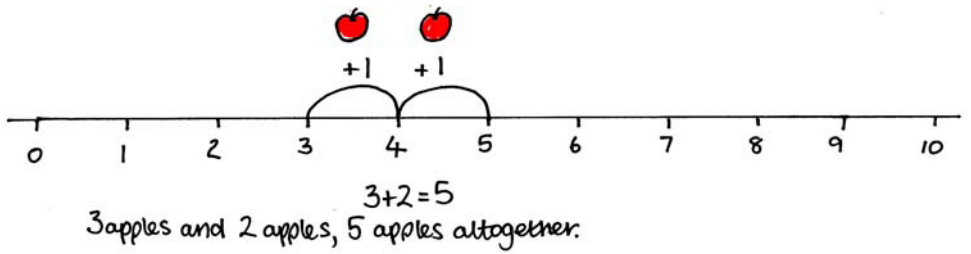
They begin to **relate addition to counting on**
For example: 'I have 3 apples, and then I get 2 more'. How many altogether?



The image of a **number line i**s critical to a child's mathematical development. Laying out cubes/ beads where the number has an order, which is constant, helps to develop a child's mental imagery. This is also modelled using a bead string, to further develop a child's mental image of number.



Later, teachers make links with the practical activity of counting a number of objects to 'jumps on' on a number line.



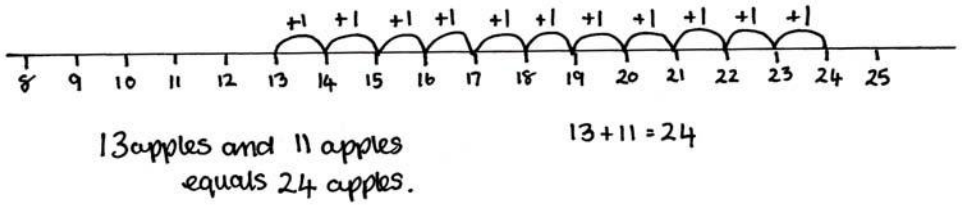
When children are secure in using a 'structured number' line they can then move on to using more informal jottings appropriate for larger numbers. This usually begins in KS1.

Addition

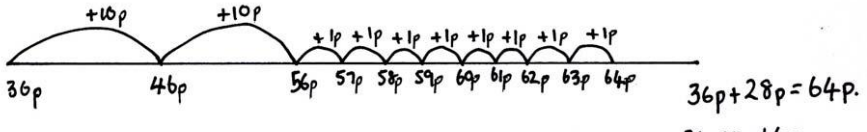
KS 1

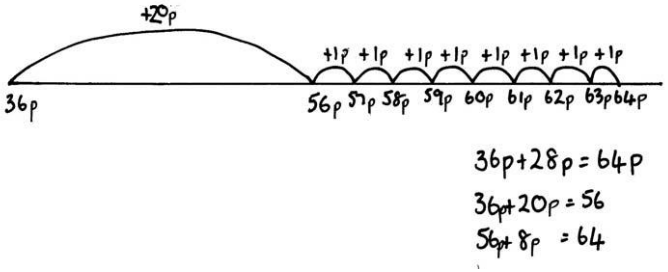
When children have had plenty of opportunity at combining sets of objects and making practical number lines using cubes etc. they can begin to use a 1-20 / 30 number line to add 2 numbers. Teachers continue to use practical apparatus such as bead strings to develop children's visual imagery of number. Children continue to use the structured number line independently as a tool to support mental calculation.

Example
A farmer has 13 apples on one tree and 11 apples on another. How many apples does he have altogether?



Alongside this teachers model the use of 'empty' number lines once children have good visual imagery of number. Much emphasis is put on the fact that **addition can be done in any order** but it is more efficient to start with the larger number. When secure in this, children are then able to use their own 'empty' number line to add numbers. This is quite liberating for many children; they soon realise they do not have to be restricted to the numbers on a 1-30 number line. By partitioning the 2-digit numbers into tens and ones, calculation becomes more efficient.

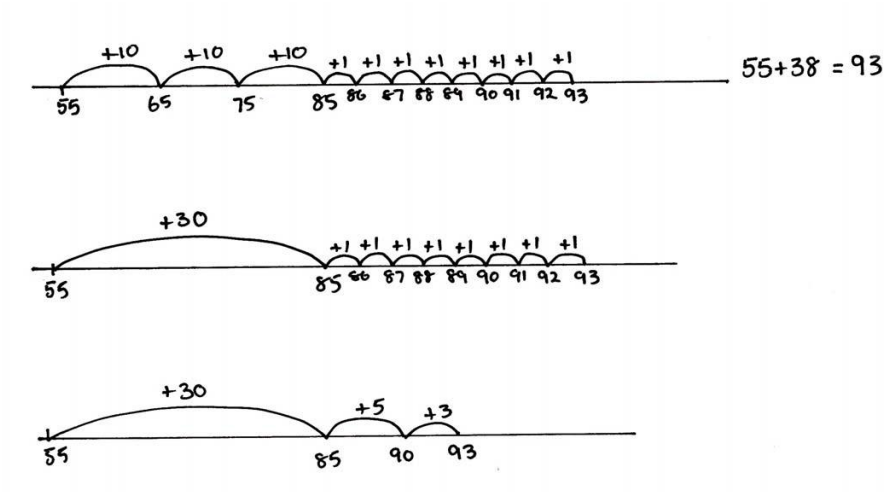




Children can then apply these skills to solving word problems.

Example

There are 38 fiction books and 55 non-fiction books in the library. How many books are there in the library?



Children may prefer to use the **partitioning method** to add together 2-digit numbers rather than using the 'empty' number line.

Example

48+23- both numbers can be partitioned

40+20=60

8+3=11

60+11=71(60+10+1)

The **‘compact’** method of **vertical addition** is not taught until children are **really secure** in this and other methods. Please do not confuse children by showing them the ‘quick way’! They will be taught this in the **juniors**.

Subtraction

Foundation Stage

Children begin by **relating subtraction to taking away** and counting how many are left. Children are given practical apparatus e.g. cubes / counters to solve calculations. Plenty of opportunity is given for children to handle apparatus and physically take away a given number. Children then move on to the representing their thinking pictorially. They may draw ‘sweets’ etc, and then cross out those subtracted to calculate their answer.

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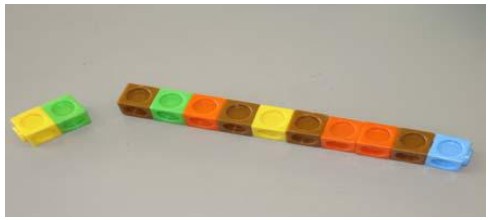
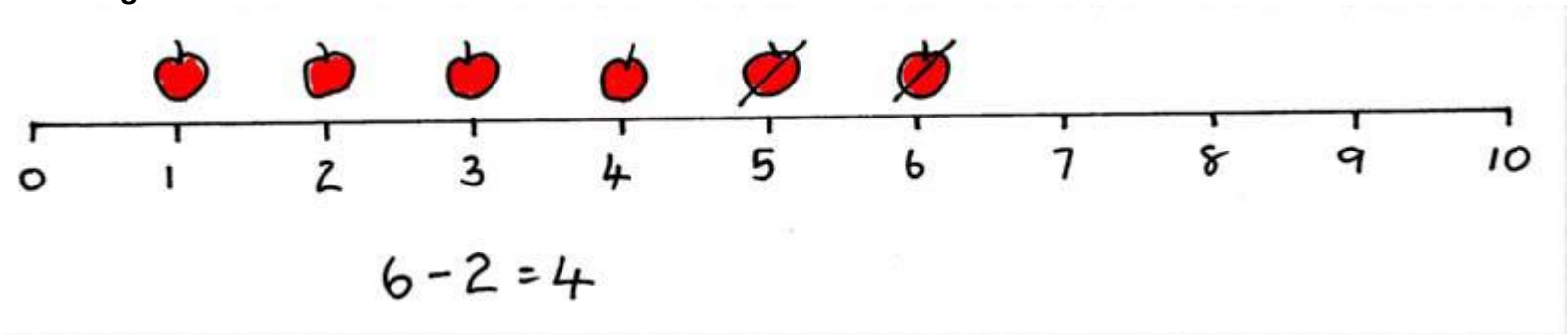
Example

John has 8 sweets. He eats 3. How many are left?

Number tracks are also used to make the link between e.g. a fixed rod' of multilink cubes and a number track where the order is constant:

12-2 using multilink: 

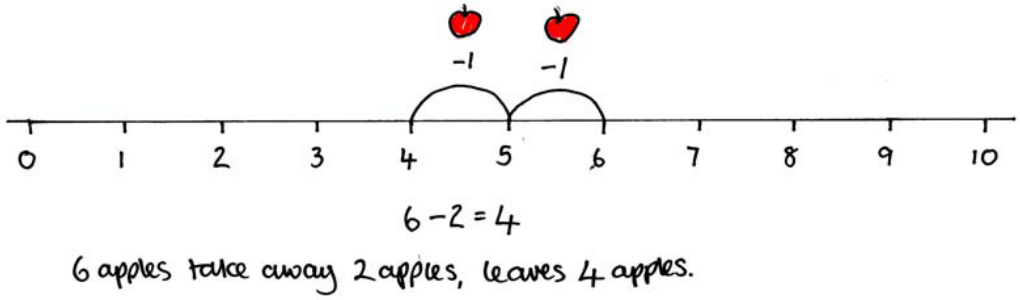
6-2 using a number line



Subtraction at KS1

This then leads onto using a formal number line. Children **remove a smaller number from a larger number by counting back.**

If I have 6 apples and I eat 2, I have 4 apples left.



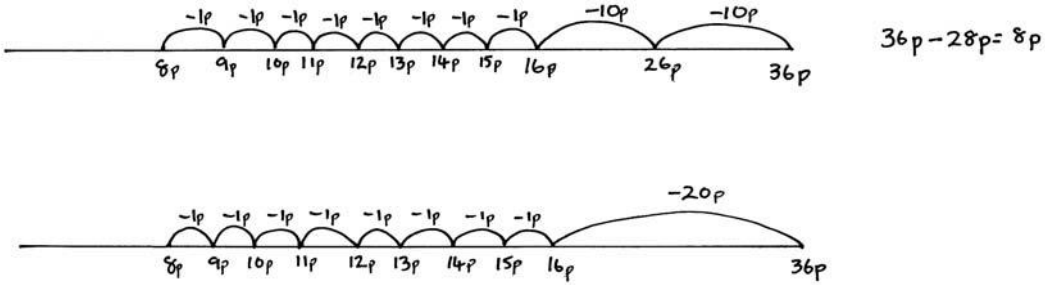
Bead strings help reinforce the link between subtraction as 'taking away' and 'counting back'

The difficulty with subtraction is that it can also be interpreted as the **'difference'** between 2 numbers. Children may then use a number line to 'count on', and find **out how many more are needed to make a larger number.**

e.g. the **difference** between 7 and 11 is 4

13-5=8

Children find concept of '**difference'** very difficult and so it is important to give it a real context, e.g. looking at difference in height / length/ temperature readings etc. As children become more secure in their understanding of using a number line to subtract, they count on / back in multiples of tens to subtract larger numbers



As children's place value knowledge becomes more secure, children also add / subtract to the nearest multiple of ten and adjust.
Example

56-19

Children would be taught to subtract 20 and **adjust by one**. Initially children would use informal jottings to calculate such sums alongside being asked to 'see' the process in their head.

56-19 is the same as **56-20+1**

Subtraction-Partitioning

Alongside the number line method for subtraction children also use **partitioning.**

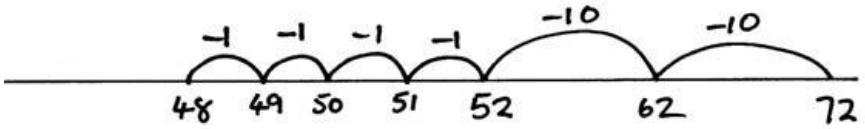
For example in the calculation **72-24=** children keep the larger number whole and partition the smaller number into tens and ones

This calculation could be done as:

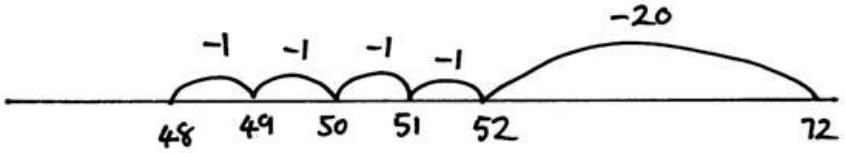
- 72-20=52
- 52-4=48

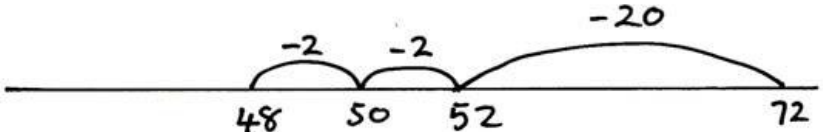
Answer=48

On a **number line**, the same calculation looks like this:



72-24=48



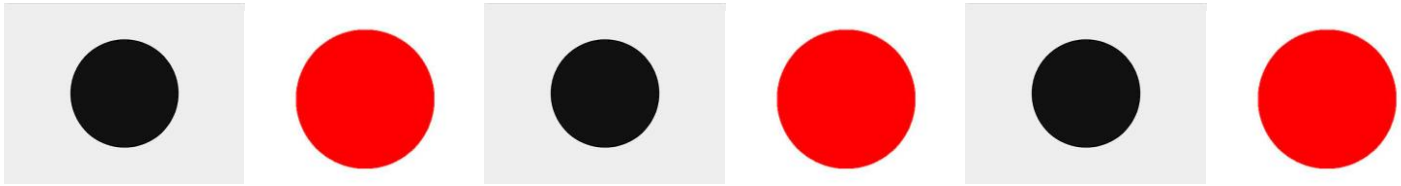


Multiplication

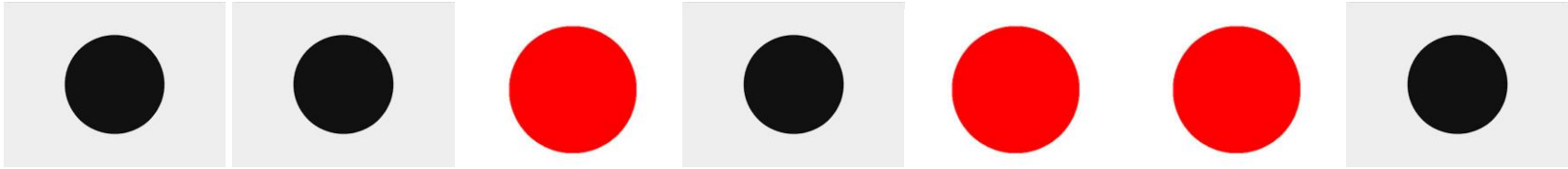
Foundation Stage

At this stage children **talk about, recognise and recreate simple patterns.**

Much emphasis is placed on what makes a pattern a mathematical pattern.
For example why **is** this a pattern:



And this **not** a pattern?



The ability to see a pattern is crucial to all mathematical development.

Multiplication

KS1

In its simplest form, multiplication is the process of adding a whole number to itself a certain number of times.

For example the multiplication of 5 by 3, is 5 + 5 + 5 producing the **product** of 15.

The process is written as 5 x 3= 15

(5 multiplied 3 times)

Some of us may see this same sum not as 5 multiplied 3 times but as 5 ‘sets of 3’. At this stage, it does not matter whether children see five ‘3’ s or three ‘5’s. What is important that they see it as **repeated addition** and later realise that **multiplication can be done in any order.**

Children begin at the **pictorial stage** and may draw a combination of both pictorial and later number line jottings to solve problems

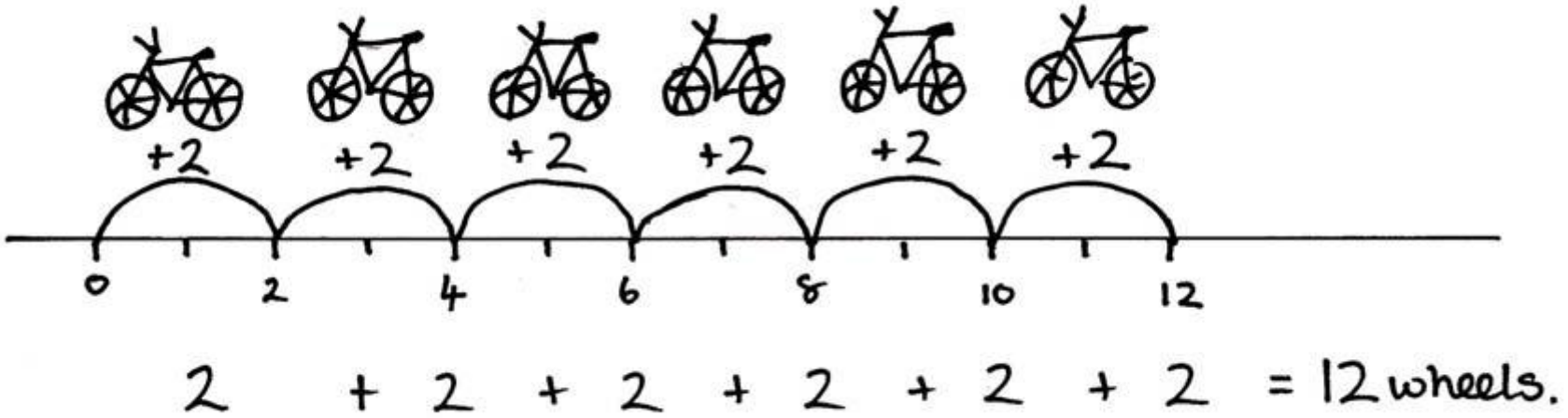
For example

There are 3 Christmas trees with 10 stars on each. How many stars altogether?

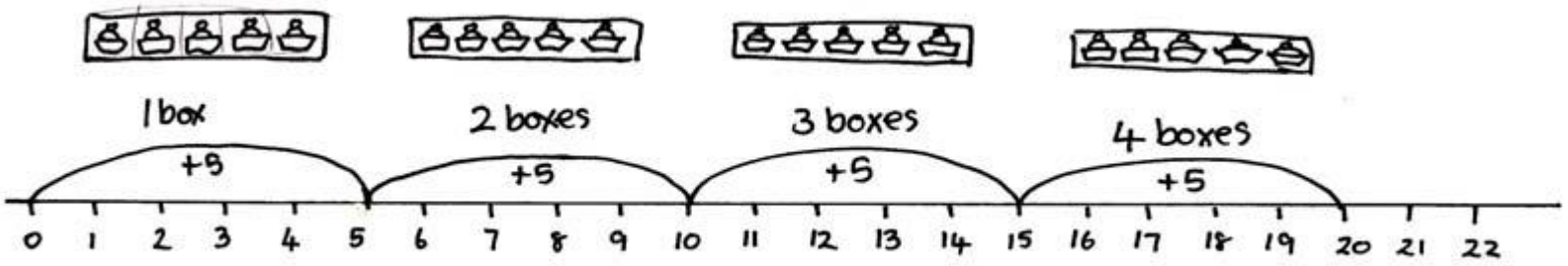
Children still at the **pictorial stage** would solve the problem like this:

'I draw 3 trees and put 10 stars on each one, then I count all the stars' **3x10=30**

Children are also shown how to use a number line to solve multiplication problems, which helps to establish the concept of 'x' as repeated addition
e.g. '6 bicycles, 12 wheels altogether

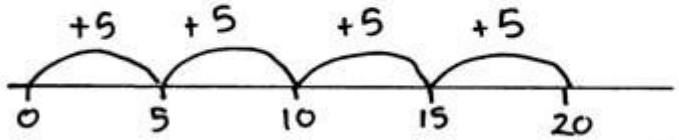


Pictorial jottings may accompany number line jottings



5x4 = 20

5 cakes in each box. 4 boxes equals 20 cakes altogether.



5x4=20

Children are also taught to use and see **'arrays' to describe multiplication.**

An array is simply an arrangement of number in rows.

Eventually children will not need to handle resources such as cubes/ counters to make arrays but will be able to draw their own number line to work out x sums. This goes alongside learning tables by rote.

By the end of KS1 children should **know multiplication facts for the 2 and 10 times table and begin to know the 5x table.**

Eventually children will not need to handle resources such as cubes/ counters to make arrays but will be able to draw their own number.

By using arrays as visual representations of multiplication, children soon see that multiplication is commutative i.e **4 x 3** is the same answer as **3 x 4**
By the end of KS1 children should know multiplication facts for the 2 and 10 times table and begin to know the 5x table.

Division

Foundation Stage

Some of the 'pre-skills' developed in Reception / year 1 would be 'sharing' / 'matching' activities to develop an understanding of 'equal amounts' and sharing equally. This would be done from a very practical and 'real life' aspect e.g. sharing fruit at fruit time, putting out equal amounts of food on plates for parties, looking at 'pairs' of shoes/ socks etc.

Example

How many pairs of socks are there in the 'launderette'?
Children handle and talk about sharing / grouping in a real life context. **8 socks, but four pairs or 'groups of 2'.**

KS1

There are two aspects to division.

- **Sharing** -21 ÷7 means 21 *shared between* 7 e.g. people
- **Grouping**- 21÷ 7 means 21 *grouped* into sets of 7

Initially children are taught the concept of **sharing**. Children physically share e.g. *15 sweets between 5 bowls and record how many each?* 15 sweets shared between 5 bowls gives 3 for each bowl.

15÷5=3

The symbol for division is introduced at this stage. **÷**

Links are also made to multiplication. In just the same way as children are taught to see the link between addition and subtraction, the link between multiplication and division is made explicit.

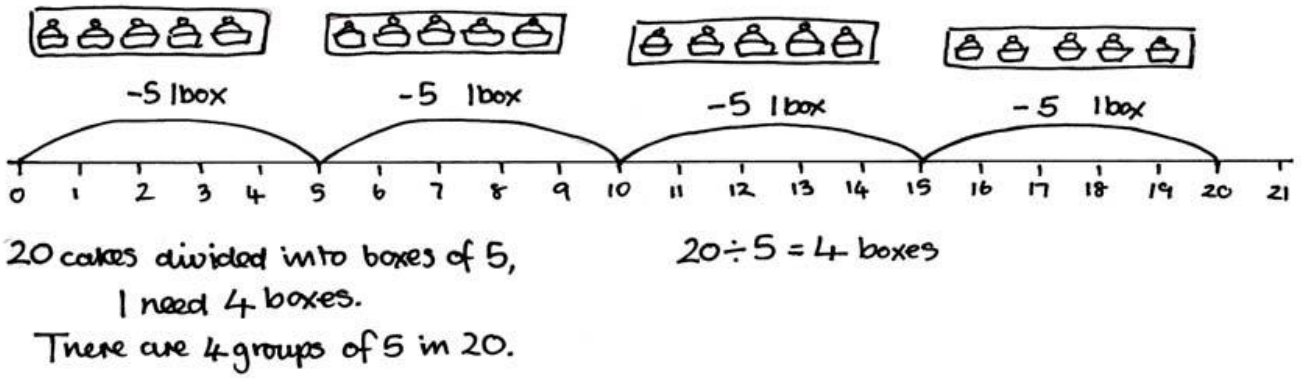
Example

So:

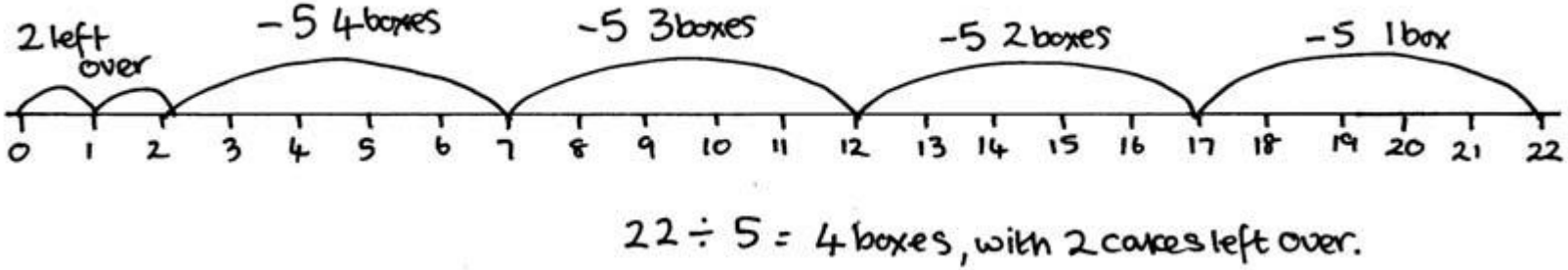
4x2=8 8 ÷ 2=4

2x4=8 8÷ 4=2

(8 grouped into 2s)



By the end of KS1 and start of KS2 children continue to use a number line or their own 'drawings' to tackle **simple division with remainders.**



How to Support Your Child

1. Counting (not just 1, 2, 3, 4…)
2. Number facts (pairs to 10, then tables)
3. Partition numbers e.g. 34 = 30 + 4
4. Ordering numbers (positioning)
5. Language of maths