Overview

The ability to calculate mentally lies at the heart of the mathematics taught at primary school. During Key Stage 1, emphasis will be placed upon developing mental calculations. Written recordings are used to support and develop these mental strategies.

Children will always be encouraged to look at a problem and then decide which method is the best to use. They should ask themselves…

'Can I do this in my head?'

'Can I do this using drawings or jottings?'

In **Year R**, children's understanding of mathematics develops through rich, child initiated play and first hand experiences.
We provide a mathematically rich environment, both indoors and outdoors where children are able to access resources independently all of the time. This is achieved by:

- Direct Teaching of number recognition, accurate counting skills, sharing, sequencing, shape recognition and pattern making through practical activities.

- Enhancing their play with topic based mathematics and role play. For example,

    - Learning about 'Me and my Family' lends itself to work on size and number.
    - A topic on 'Space' encourages counting backwards from ten to blast off, 3D shape rocket modelling and subtraction (one less).
    - A card shop when children are learning about 'Celebrations' provides opportunities for number recognition, pattern or shape work and of course, money exchange.
    -

- Maximizing the mathematical potential of classroom routines. For example,
    - How many children are having red/green school dinners?
    - How many altogether?
    - Chairs are stacked in piles of six. This stack has three, how many more can you put on?

In **Year 1** and **Year 2** the children's understanding of the properties of numbers is developed, this vital understanding gives the children a range of strategies, from which to choose the most effective to solve all kinds of number problems, for example:

- Learning all the pairs of numbers that make 10:
  0+10, 1+9, 2+8, 3+7, 4+6, 5+5. We call these number bonds.

- Learning all addition doubles to 10: 1+1, 2+2 etc to 10+10 and then the corresponding halves: half of 10, half of 8, etc

- Learning what each digit is in a two digit (and then three digit) number represents: 24 is two tens and four ones, etc

- Learning to add and subtract 1 and then add and subtract 10.

- In Year 2 children will begin to learn their times tables.

When teaching these key skills, whenever possible, they are taught in context, for example using money or units of measure and presented to the children as a problem to solve. The children are encouraged to think of ways to solve a problem and to notice any patterns as they are working.

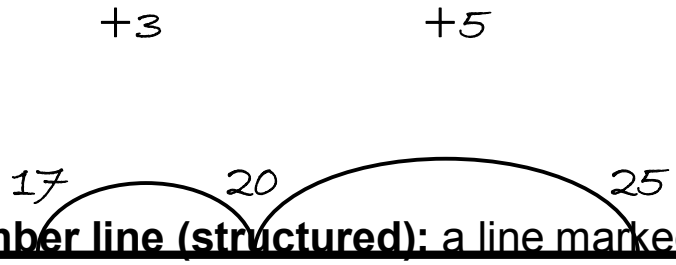
Children first work practically and are encouraged to use a large range of apparatus (not just fingers!), then they record using pictures and finally record using more formal number sentences.

As the children become more confident they are expected to explain to others how they have solved a problem.

Teachers will challenge and extend the children's understanding by asking them further questions as they work.

Glossary of mathematical terms

Bridging: when children cross a boundary e.g. multiples of 10, 100, 1000. We refer to this as bridging e.g. adding 8 onto 17 children will add 3 to 20 then add 5 (the children have partitioned 8 into 3 and 5 and used 20 as a bridge).



Number line (structured): a line marked with numbers.

Number line (unstructured): a blank line that numbers can be written on.

Number sentence: mathematical sentence written in numerals and mathematical symbols e.g.
3 x 7 = 21, 6 + 3 = 9, 10 – 2 = 8, 15 ÷ 3 = 5

Partition: to partition a number means, 'breaking the number up in different ways.' The most common way to partition in primary school is into hundreds, tens and ones e.g. 472 = 400 + 70 + 2 but numbers can also be partitioned in different ways e.g.
8 = 7 + 1, 6 + 2, 5 + 3, 4 + 4.

Place value: the value of a digit depending on its place in a number e.g. 35<u>4</u> the value of the 4 is four ones*, whereas in the number <u>4</u>35 the 4 has a value of four hundreds.
*Please note that we no longer use the term 'units' but say 'ones' instead.

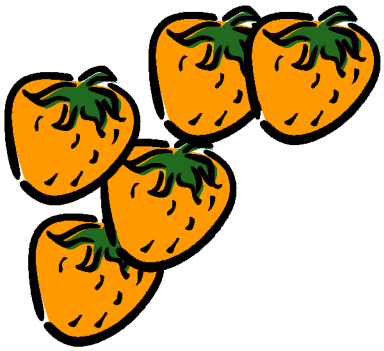
Single-digit numbers: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 are single-digit numbers.

Word problem: a calculation put into a context e.g. 5 + 10 as a word problem could be, *'Mary has a 5 pence coin and a 10 pence coin. How much does she have altogether?*

Addition

Stage 1. Counting objects.

Always in the context of a problem/story:



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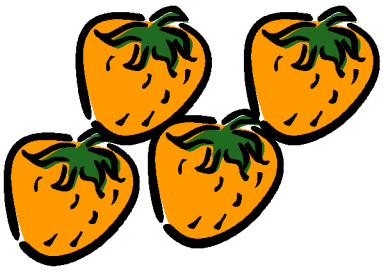


5 **4**

Begin by counting the objects first. Count out the objects: 1, 2, 3, 4, 5… 1, 2, 3, 4
Then put them all together and count the objects again, from the start: 1, 2, 3, 4, 5, 6, 7, 8, **9**

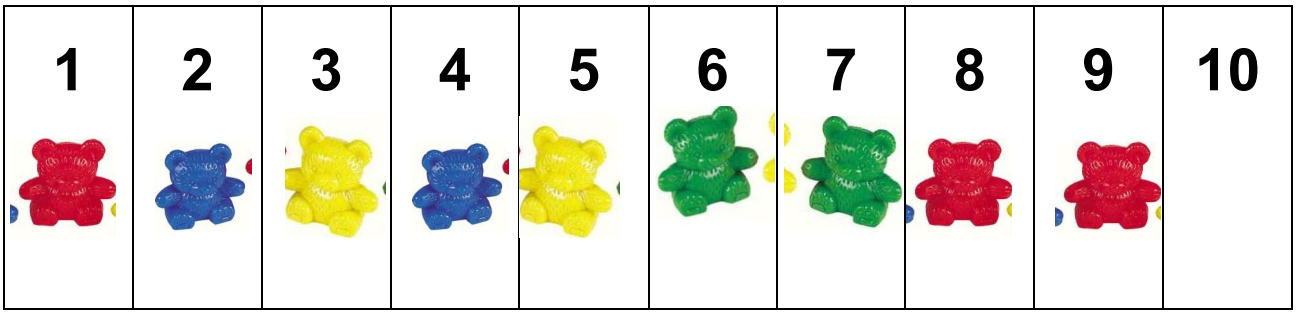
The next step will be to start at the first number they have and then count on (so for 4 + 5, children could start from the smaller number): e.g. 4… 5, 6, 7, 8, **9**

The next step would be to recognise that 5 is the larger number and to count on 4 from there: 5... 6,7,8,**9**

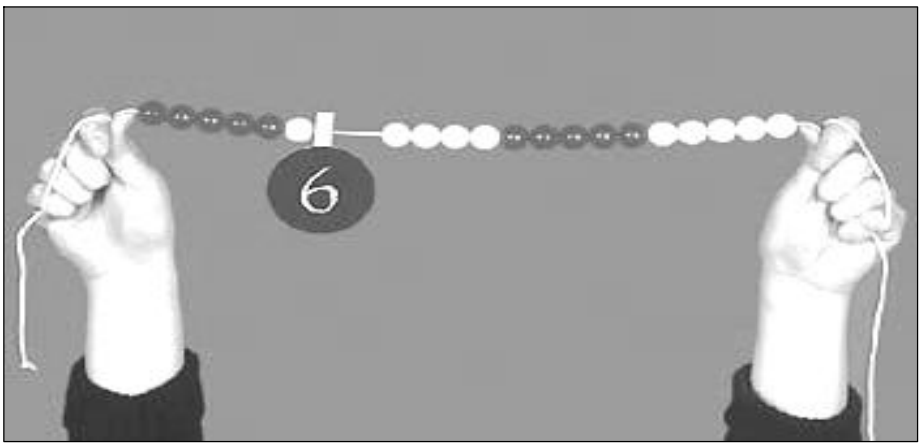
Addition

Stage 2. Using a number track/ number line.

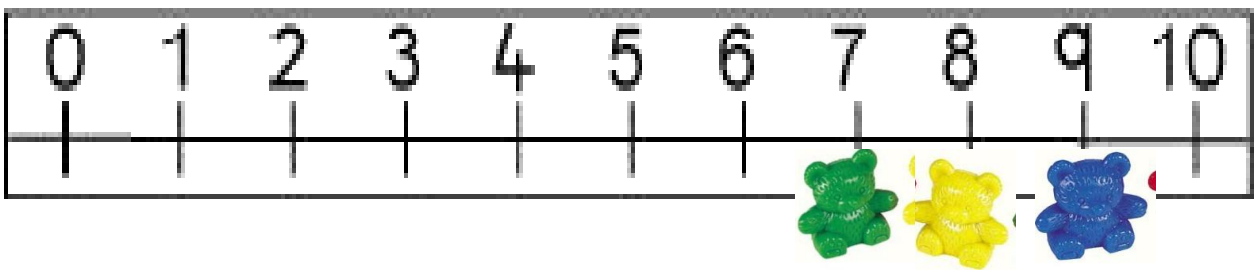
Using a number track/floor tiles, children will put objects onto it, counting objects on each square.



They will also count using other objects, like a bead string. Below six beads have been counted and marked with a peg.



Next, they will move to a structured number line, placing objects on the line to show what we count on: e.g.
6 teddies + 3 teddies, find 6 on the number line, then place the objects to show **what we are adding**.

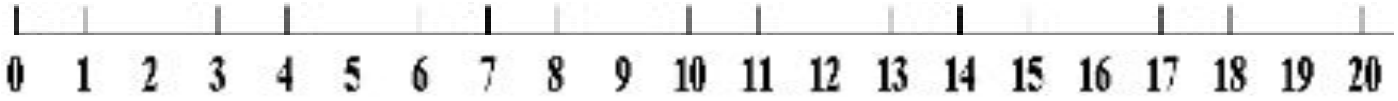


Addition

Stage 3. Using structured and unstructured number lines.

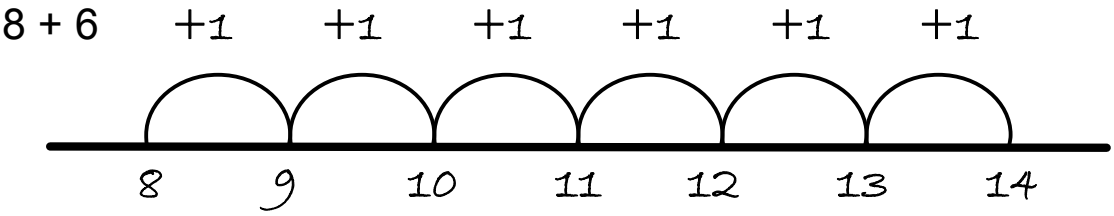
7 + 11

Start with the biggest number on a structured number line, then count the jumps:



7 + 11 = 18

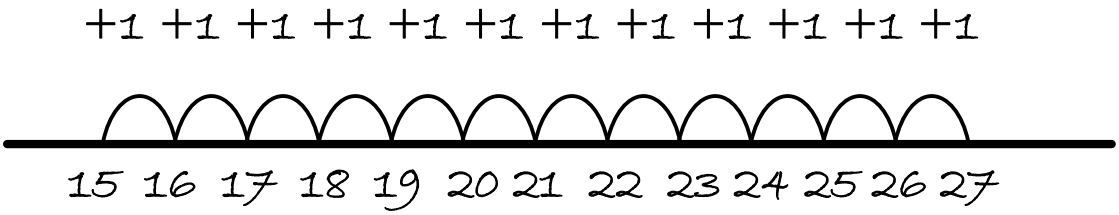
Eventually, children will draw their own empty number lines to do this.



8 + 6 = 14

The next step comes when adding teen numbers. Initially, children will count on in ones.

15 + 12

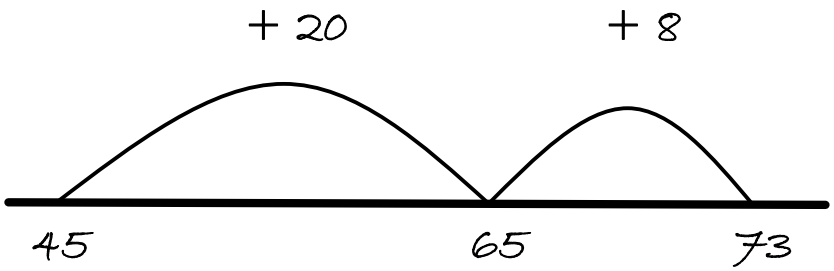


But then may be able to count on a ten and then the remaining ones:

Addition

Stage 4. The Number Line - partitioning

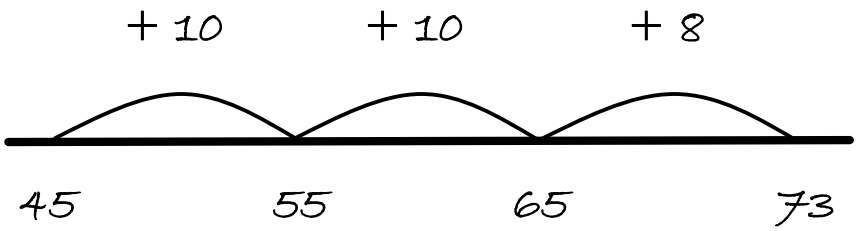
Start with the biggest number. Partition the smaller number into tens and units and add it on:
e.g. 45 + 28



45 + 28 = 73

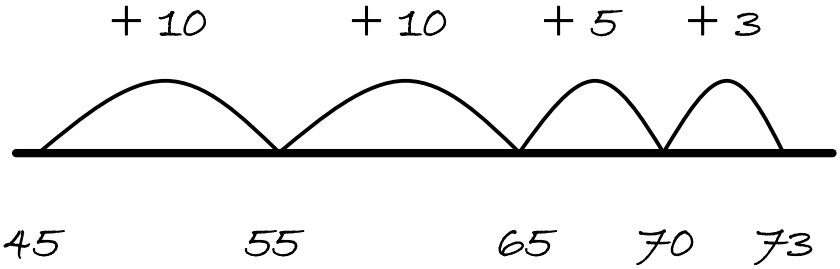
Sometimes, you might partition the tens number into a more manageable number.

e.g. 45 + 28 Partition **28** into **10 + 10 + 8**



Or even partitioning the units to help as well

e.g. 45 + 28 Partition **28** into **10 + 10 + 5 + 3**



45 + 28 = 73

Addition

Stage 5. Partitioning both numbers.

Split both numbers into tens and ones (and hundreds too!)

56 + 38

Partition the numbers **50 + 6** **30 + 8**

Add the tens **50 + 30 = 80**

Add the ones **6 + 8 = 14**

Now add the totals together **80 + 14 = 94**

For a three digit number:

259 + 174

Partition the numbers **200 + 50 + 9** **100 + 70 + 4**

Add the hundreds **200 + 100 = 300**

Add the tens **50 + 70 = 120**

Add the ones **9 + 4 = 13**

Now add the hundreds and tens **300 + 120 = 420**

Now add your answer to the ones **420 + 13 = 433**

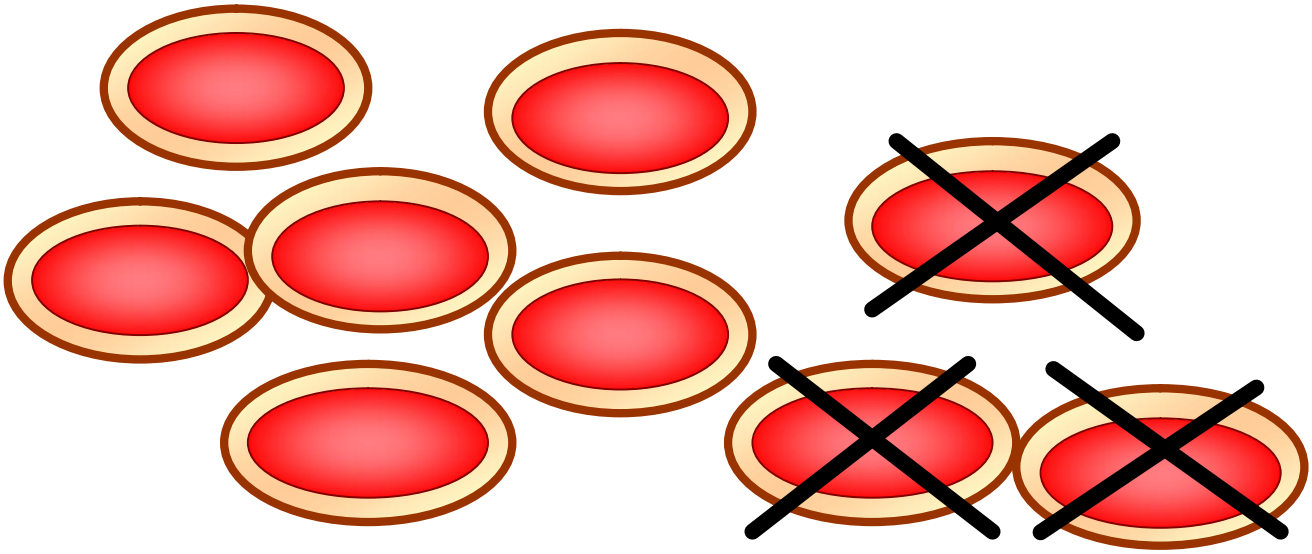
Subtraction

Stage 1. Taking Away using Objects.

Where possible subtraction problems are taught in context.

The Queen of Hearts made 9 jam tarts. She gave 3 to Alice. How many did she have left?

Count out the jam tarts, 1 to 9. Take away 3 and count how many are left: 1, 2, 3, 4, 5, 6.

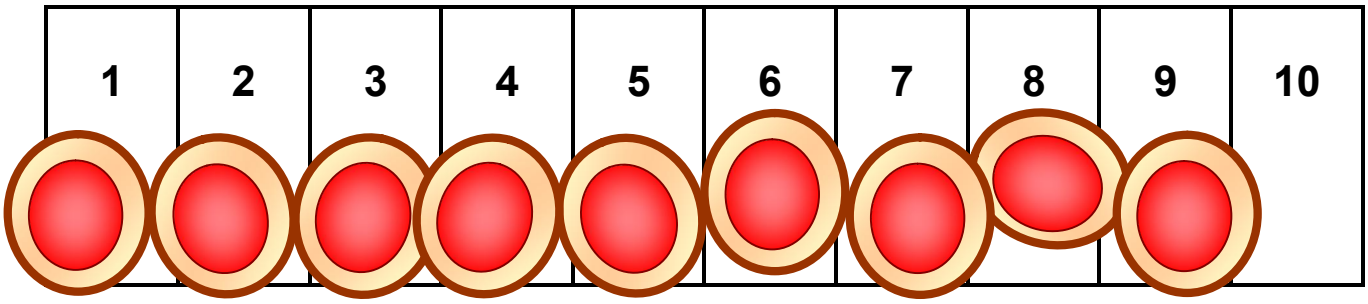


Subtraction

Stage 2. Using Objects on a Structured Number Line.

Still using objects, place them on a number line, then take the objects away (from the right hand side of the number line only – we want to build the idea of counting **back**) – to find our answer.

So, using the same problem where the Queen of Hearts has given 3 of her 9 tarts to Alice:



Count out the objects on the number line.

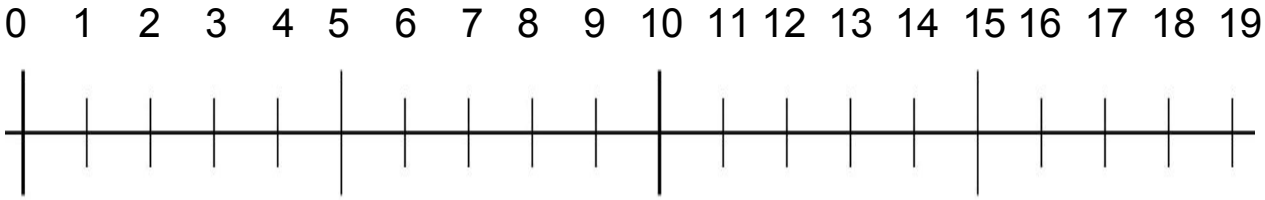
Take away the 3 tarts and count how many we have left.

Begin to count back from 9 as each jam tart is taken.

Subtraction

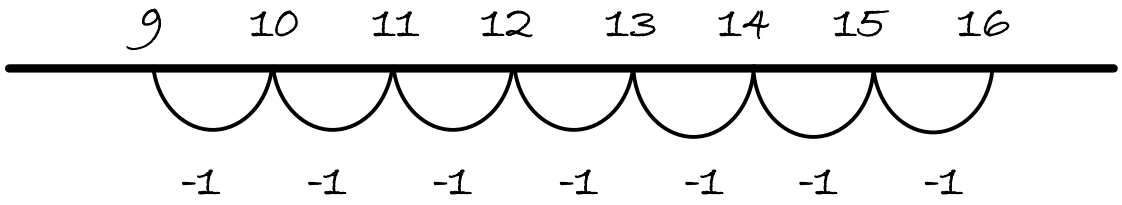
Stage 3. Counting Back on a Number Line.

Next, they will move to using a structured number line, without necessarily placing objects on it, but drawing the jumps counting back in ones.
e.g. The Queen of Hearts has 16 jam tarts, but the King takes 7. How many are left?

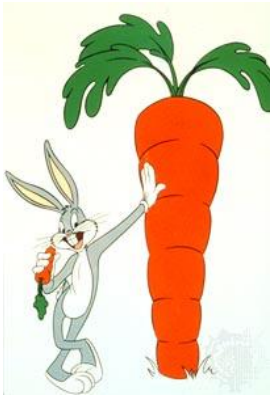


16 – 7 = 9 jam tarts left

As children progress they may be able to use unstructured number lines that they draw themselves for the same sort of calculations:



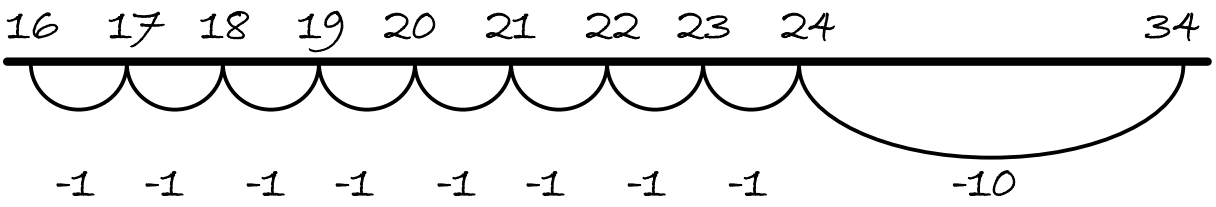
Subtraction



Stage 4. Counting back on a number line in tens and ones.

If Bugs Bunny has 34 carrots, but he eats 18 for lunch, how many will he have left?

Children may well still be drawing a number line and counting back in 18 steps of 1, but by then we would be encouraging children to partition the 18, which would be 10 and 8, and to count back 1 ten and 8 ones.

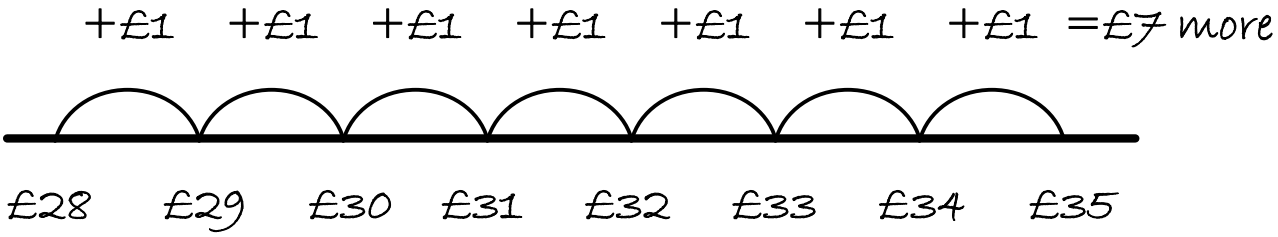


34 – 18 = 16 carrots left

Stage 5. Counting On using a number line:

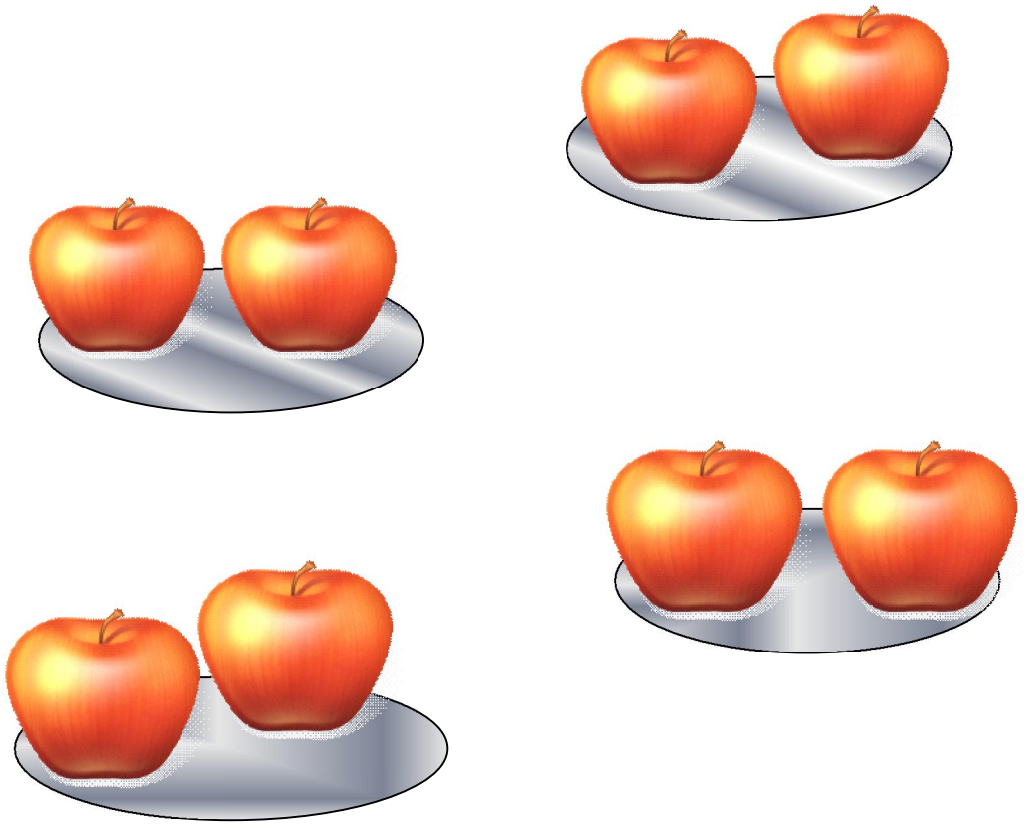
Only when children are ready can they begin counting on to solve subtraction problems. (They must be confident at adding tens from any number and counting on in ones). We start the children off by giving them calculations which are easier to solve by counting on rather than by counting back.

e.g. If Lucy has £35 in her account and Daniel has £28, how much <u>more</u> has Lucy saved?



Multiplication

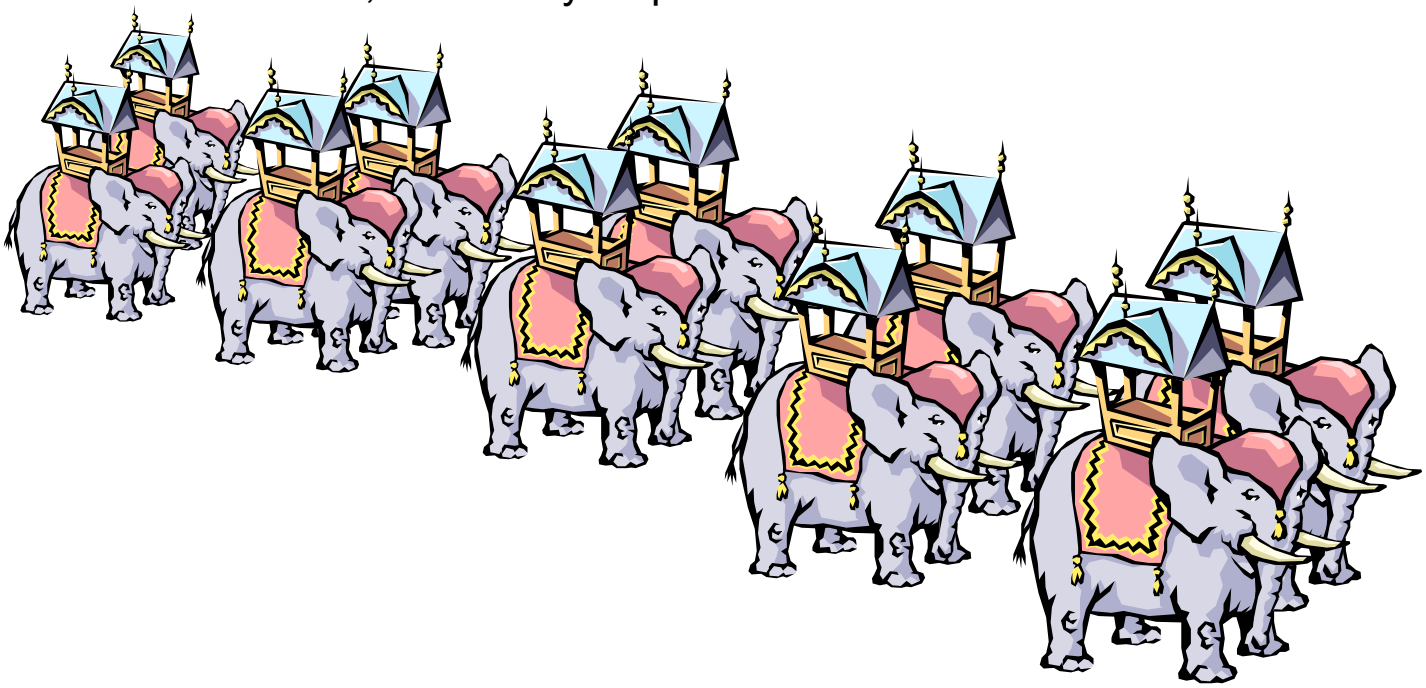
Stage 1. Counting objects… if there are two apples on each plate, how many have we got altogether?



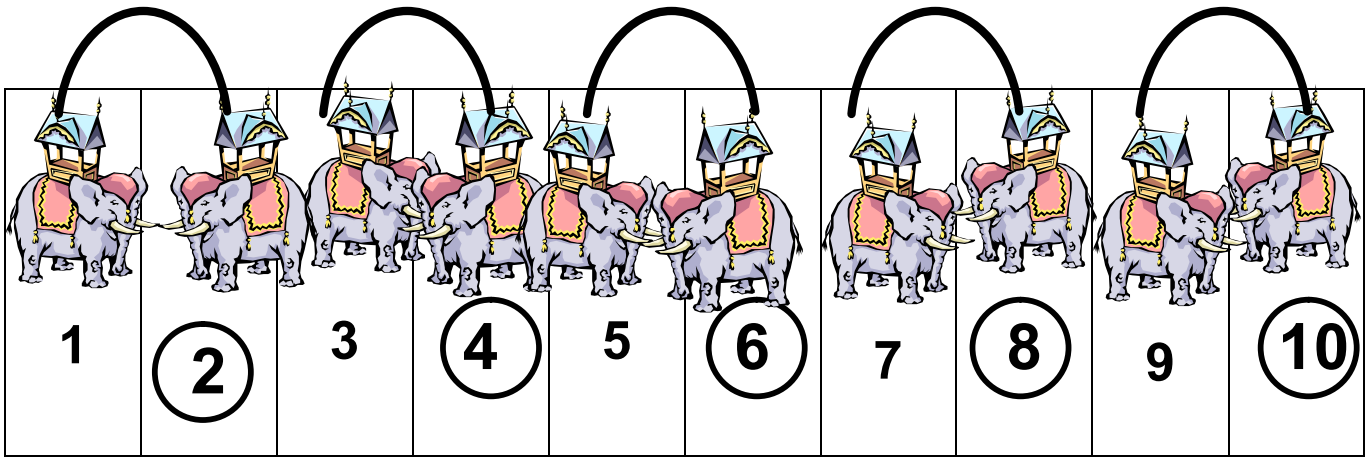
We use real objects we have in the classroom that the children may handle. Children can also draw their representations of the objects. They can then write the total number next to their drawings.
In terms of language, we talk about ‘groups of’ apples.

Multiplication

Stage 2. Repeated addition - Counting in groups of…
If the elephants came in two by two, if there were 5 groups of 2, how many elephants were there?



Still using the objects, we can place them on a number line and count the pairs, beginning to link to tables facts:



Children start to count up in 2s from this stage.

We can start to record this as 2 + 2 + 2 + 2 + 2 = 10

Multiplication

Stage 3. Arrays

Children arrange items in groups:

3 rows of 5 cakes

5 + 5 + 5

5 x 3 = 15 cakes

And explore other ways of arranging them:

5 rows of 3 cakes

3 + 3 + 3 + 3 + 3

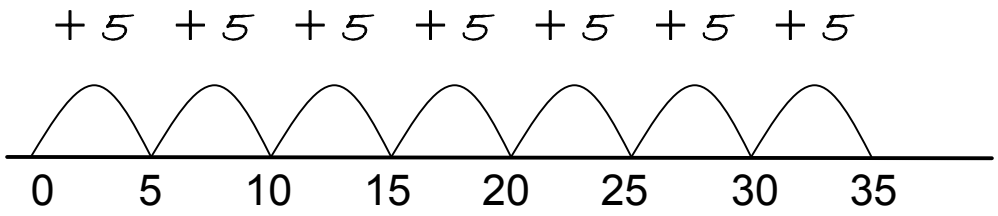
3 x 5 = 15 cakes

Multiplication

Stage 4. Using a Number Line

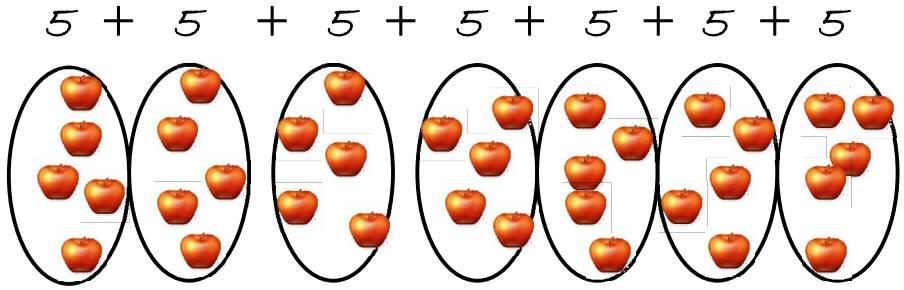
If Snow White gave the 7 dwarfs a bag of 5 apples each, how many apples would they have altogether?

Using a structured number line (with the numbers already on) we can draw jumps of 5:



Then, children can record their work on their own number lines

e.g. 5 x 7



5 x 7 = 35 apples

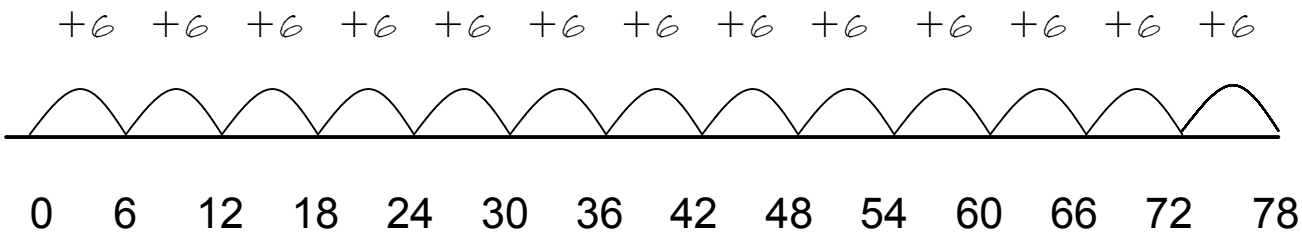
Multiplication

Stage 5. Unstructured Number Lines

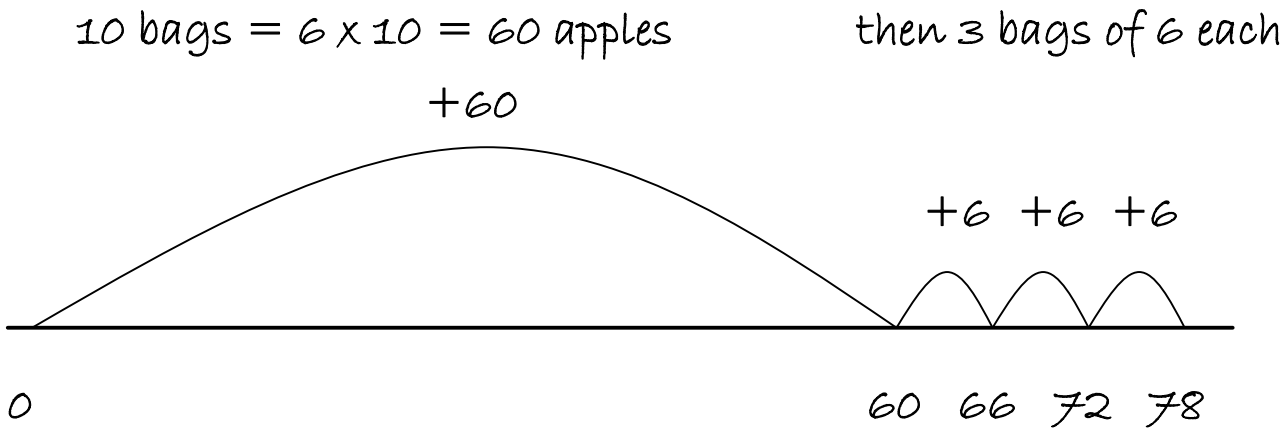
For larger amounts, we may wish to consider applying multiplication facts we know.
For example, if there are six apples in a bag, how many would there be in 13 bags?

Children draw their own number lines:

e.g. 6 x 13 Well, we could count 13 jumps of 6



Or we could say, 'I know that 10 lots of 6 is 60.'



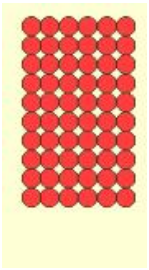
6 x 13 = 78 apples

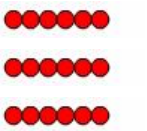
Multiplication

We could use jottings to explain our thinking, so

10 bags of apples + 3 extra bags of apples

6 x 10 6 x 3





6 x 10 = 60 6 x 3 = 18

So there must be 78 apples altogether.

Children may still need to **see** that 10 lots of 6 are 60…

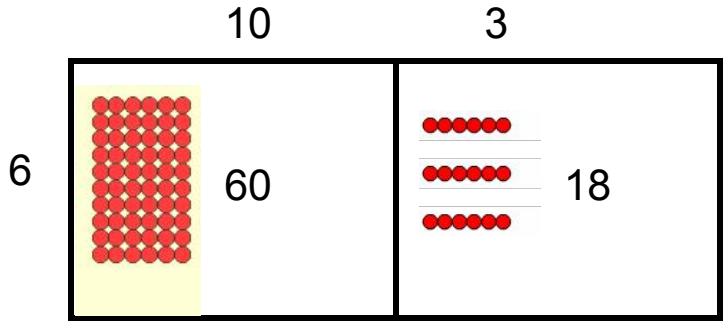
Eventually, with practice, this will lead on to…

Stage 6. Grid Method
The grid is a good way to organise the partitioning of numbers for multiplication.

If we stayed with Snow White's apples:

6 x 13 =

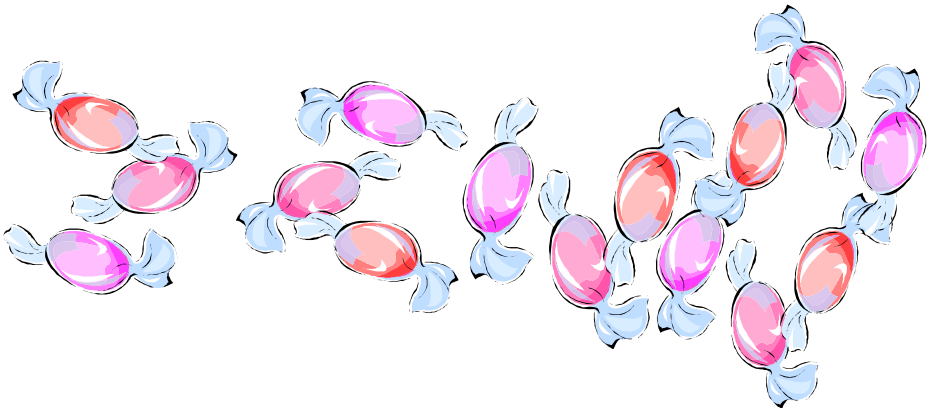
Draw a grid. Let's partition the 13 up into 10 and 3:



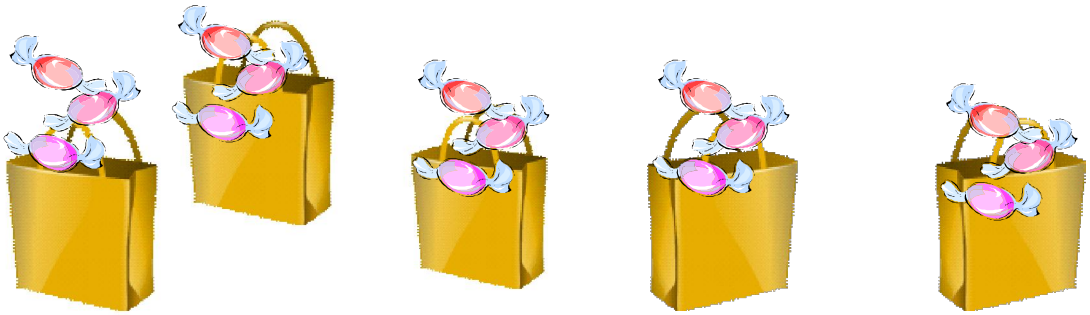
Division

Stage 1. Sharing into equal groups by counting out objects.

I have 15 sweets and share them equally into 5 party bags. How many in each bag?



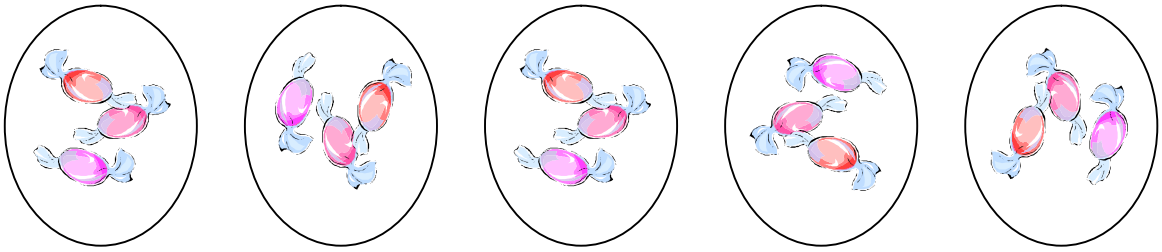
Counting out 15 sweets and then sharing, one by one, into five ‘bags’:



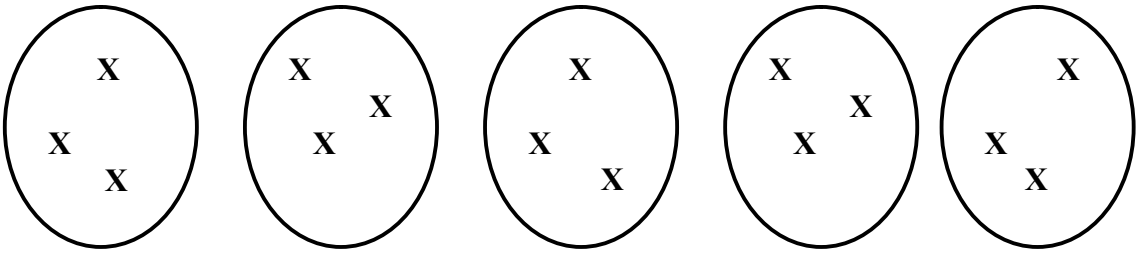
Division

Stage 1 continued. Sharing into equal groups by counting out objects.

Children may draw their bags of sweets:



or draw symbols for their sweets

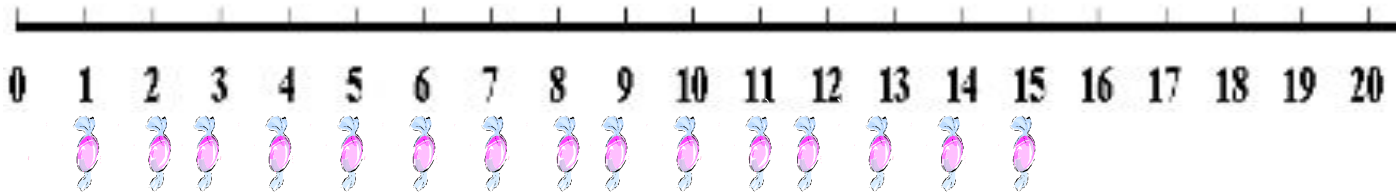


These sorts of calculations can have ‘remainders’: If I have 14 sweets and share them equally between 5 bags, how many would be in each bag?
We would need to talk through the concept of ‘fairness’, so that one bag would only have 2 sweets in when the others have 3.

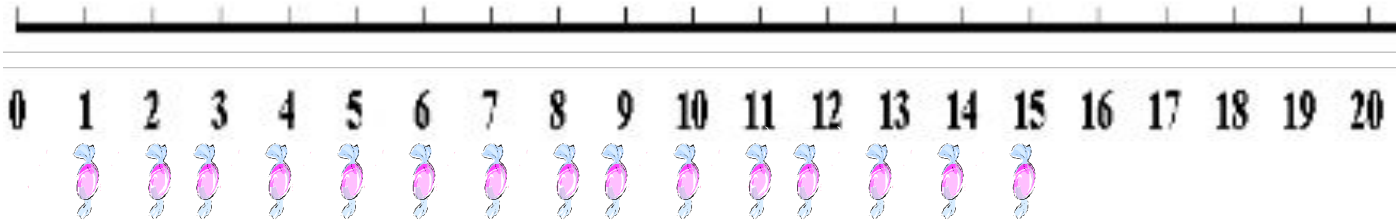
Division

Stage 2. Using a number line for grouping.

If there are 5 sweets to a bag, how many bags do I need for 15 sweets?



Or it can be recorded like this:



We introduce the ÷ symbol.

15 ÷ 5 = 3 bags needed.

What if there were 17 sweets to start with?
Here, children would have to think of the context of the question to consider that you would need a fourth bag for the extra 2 sweets.