Calculation
Methods and Guidance

The numerical value of a digit because of it's position within a number.

Children should understand that the value of a digit changes depending on where it is within a number.

E.g. 4
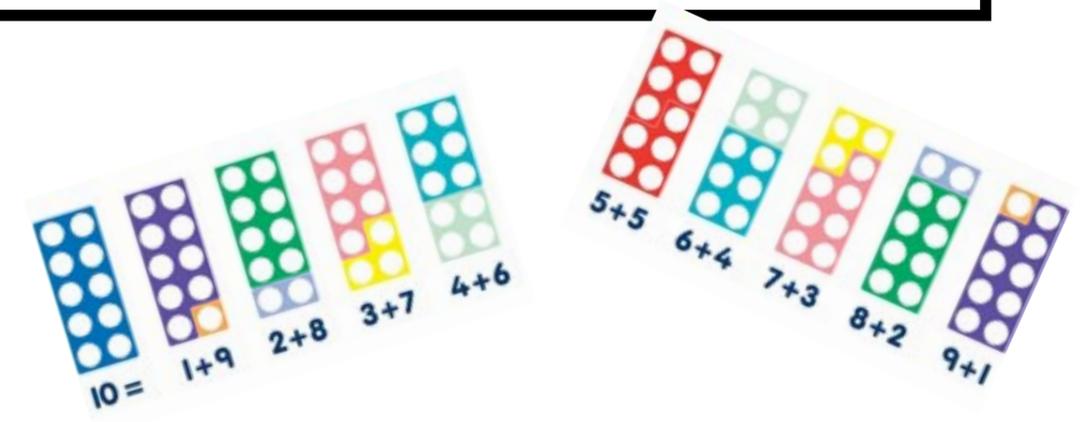In the number 14, 4 means 4 units / ones and has the value of 4.
In the number 1482, the 4 digit means 4 hundreds and has the value of 400.

At school all children will be involved in discussions about place value and what digits mean.

They will need to understand what the digits mean and why.

Children will spend time investigating numbers and making them using different things. This will ensure that children understand numbers and build up a visual picture of them. Having a mental image of what numbers look like will help as they move through the school and begin to work with larger numbers.
It will also enable children to understand the links between numbers e..g that 200 is double 100 because you can picture two lots of it. and that 1000 is 10 lots of 100 because you can see 10 sets of 100 objects.

Some examples of what yr 4 and 5 saw when they thought of 100.

Number bonds

Children will investigate, explore and recognise pairs of numbers which when combined make a set number.

They should use existing number facts and mathematical equipment to help them understand these different pairs of numbers.

Some examples of number bonds to 10 using Numicon:

10 = 1+9 2+8 3+7 4+6

5+5 6+4 7+3 8+2 9+1

As children move through the school, they should be used to seeing and using place value grids to help them recognise the different parts of the number.

Below is an example of a place value grid from millions to decimal numbers. Children will use grids which are appropriate to the size numbers they are working with dependent on age, ability and understanding.

M	HTh	TTh	Th	H	T	O	●	h	th	

ADDITION
inverse of subtraction

Introducing addition

Children should be introduced to addition using the correct terminology and as a process of joining or combining two amounts or quantities.

This should be done in a 'hands on' and practical way.

Children could use cubes or Numicon to count and combine numbers or use cups or baskets to put the two quantities together and find the total.

Number lines

Children should begin by using *pre-numbered lines* to 'count on' to solve addition calculations.

0 1 2 3 4 5 6 7 8 9 10

Children should then move onto *un-labelled number lines* either laminated lines or children should learn to draw their own and label the end with one number from the addition they are solving.

+10   +10   +6

21   31   41   47

Jumps should be made on the number lines in tens and ones dependent on the confidence and understanding of the child.

Formal Written Method
'Column method'

245
+ 349
___
1   ← Space for carrying
___
594   ← Answer

Expanded Column Method

After learning the partitioning method, children should progress onto a expanded column method where they still separate the different parts of the answer but it begins to look more like a traditional column addition

For example: 24 + 37 =

24

37

11 (add the units)

50 (add the tens)

61 (recombine)

Partitioning Column Method

Children are taught to partition the numbers they are adding together. They should apply their knowledge and understanding of place value to help them with this.

24 + 37 =

20 + 4

30 + 7

50 + 11   recombined = 61

Introducing subtraction

Children should be introduced to subtraction as the opposite of addition and learn the term inverse meaning opposite. Subtraction should be explained as a method of taking items away and removing objects. Where possible, word problems should be used to develop children's understanding of the language. Children should use mathematical equipment to help their understanding e.g. cubes, numicon or drawings.

Early number

Introducing children to counting songs which decrease would be a nice link to subtraction in EYFS and KS1.
Props or images could be used to enable children to visualise that things are being taken away.

Number lines

Children should begin by using *pre-numbered lines* to 'count back' to solve subtraction calculations.

0 1 2 3 4 5 6 7 8 9 10

Children should then move onto *un-labelled number lines* either laminated lines or children should learn to draw their own. They can label these and work out how to count back or count on to find the answer to their calculation.

21-7 =

-6   -1
14   20   21

Children should use their understanding of knowledge and place value to jump back in ones or use number bonds to help them.

SUBTRACTION
inverse of addition

'you can't do it'

When we are using written methods or multiplication and the number at the top is smaller than the number on the bottom. It is easy to say "we can't do it". Children should understand that you could do this however it would result in a negative number and create another subtraction.

E.g. 13—7 =

```
   10  3
-      7
   10 -4
```

Column method (standard written method)

Children use their understanding of place value and the partitioning method to move onto a more traditional column method.

```
   17
-  13
    4
```

Or when borrowing is required

```
  1 13
  2 3
-  14
    9
```

Children borrow from the column to the left. Strike through and write the new digit above. In this example, the tens digit decreases from a 2 to a 1. Children should be encouraged to write the new value above and then move (borrow) into the column e.g. The 3 changes from a 3 to 13.

Partitioning Column Method

Children are taught to partition the numbers they are subtracting. They should apply their knowledge and understanding of place value to help them with this.

214—103 =

```
   200  + 10 + 4
-  100  +  0 + 3
   100  + 10 + 1 recombined = 111
```

Borrowing

214—107 =

```
                0 +14
   200  + 10 + 4
-  100  +  0 + 7
   100  +  0 + 7
   recombined = 107
```

Introducing multiplication

Children first come across multiplication as doubling and having two lots of a group. This should be done practically so children can see they have two sets of objects, and that both together is called double.

This could also be linked with repeated addition and seeing they are adding two sets of the same amount.

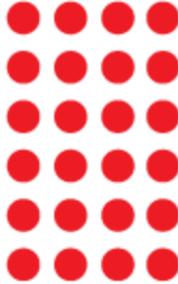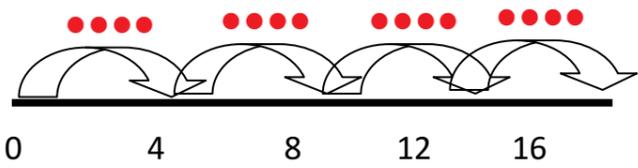## Arrays

Arrays are a visual way for children to see numbers and understand what is happening as numbers are multiplied.

1 X 4 = 4 we have 1 row of four dots or 1 lot of four.

This then moves onto having larger arrays.

In this array children can see they have 6 rows or 4 dots or 6X4
This can be calculated by counting up in fours or counting the dots.

These arrays or groups of 4 could be put onto a number line to show how the numbers are increasing.

| 0 | 4 | 8 | 12 | 16 |

MULTIPLICATION
inverse of division

Standard Written Method

Once secure with expanded standard written method, children should be moved onto Standard Written Method.

16 X 4 =

```
    16
X    4
     2
    64
```

Expanded Standard Written Method
Once children are confident with multiplying 2 and 3 digit multiples of 10 and they have a good understanding of the place value system they move onto an 'expanded' written method.

16X 4 =

```
    16
X    4
    24   (4 X 6)
+   40   (4 X 10)
    64
```

1.2X 4 =

```
    1.2
X    4
    0.8   (4 X 0.2)
+   4     (4 X 1)
    4.8
```

Grid method
Children use their understanding of place value to help them partition the number in order to multiply successfully. They then use their method for addition to add up the parts of the answer.
(This method can be set out horizontally or vertically—although children should be familiar with both ways)

24 X 3 =

X	20	4
3	60	12

124 X 3 =

X	100	20	4
3	300	60	12

62 X 34 =

X	60	2
30	180	60
4	240	8

Introducing division

Children should be introduced to division as sharing or splitting an amount equally. They should understand that it has to be even or fair. The concept of some numbers not sharing should be approached early and it should be discussed

e.g. "I have 7 cakes, can we share them between the two of us?"
Encourage the children to share them out until there is one left in the middle. "What could we do with this one?"
Explain that there is either going to be one left over or we could cut it into 2 pieces or half it.

Short division

Children are taught to use short multiplication to find answers to questions. They should be confident to display remainders as decimals and fractions.

$432 \div 5$ becomes

$$\begin{array}{c} \quad\; 8 \quad 6 \quad r\,2 \\ 5\,\overline{\smash{)}\,4\;\;3\;\;^3 2} \end{array}$$

Answer: 86 remainder 2

Chunking

Children should be used to using number lines to divide on. They should use a vertical number line as they move into upper key stage.
Chunking is a method of long division. Chn are taught to take groups (or chunks) off the number being divided. These groups are then recombined at the end (when chunks have got the number down to 0) to give an answer.

$$\begin{array}{r} 4\,\overline{\smash{)}\,1304} \\ -400 \\ \hline 904 \\ -400 \\ \hline 504 \\ -400 \\ \hline 104 \\ 40 \\ \hline 64 \\ 40 \\ \hline 24 \\ 24 \\ \hline 0 \end{array} \quad \begin{array}{l} 100\times4 \\ \\ 100\times4 \\ \\ 100\times4 \\ \\ 10\times4 \\ \\ 10\times4 \\ \\ 6\times4 \end{array}$$

Children should apply their grouping understanding to add up the groups of 4 which have been 'chunked' off.

DIVISION
inverse of multiplication

Arrays

Arrays are not only brilliant for multiplication but they provide a visual way of seeing numbers and how they could be split.

E.g. Looking at this array children can see the link of 4 X 6 = 24. When thinking bout the 24, they can see that it is arranged into rows of four and columns of 6. IT can be equally split into groups of 4 or 6.

Some children may spot that the number could be split into two groups as well.

Number line and repeated subtraction

As with multiplication and repeated addition being linked, children should explore and use the relationship between division and repeated subtraction.
Again arrays may be used to allow children they are taking groups off.

$$16 \div 4 = 4$$

| -4 | -4 | -4 | -4 |

0   4   8   12   16

In the example above children should subtract four off each time and then look at how many groups of four they took away.

Number lines and remainders

Number lines can be a good way to see reminders or how many are left over at the end of the number line.

| -4 | -4 | -4 | -4 |

1   5   9   13   17