Porters Grange Primary and Nursery School

Calculations Stages

February 2016

Addition

To add successfully, children need to be able to:

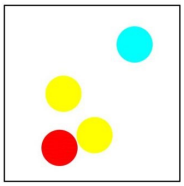
- recall all addition pairs to 9 + 9 and complements to 10
- be able to split numbers to make complements to 10 and use the left over i.e. know that 8 + 6 is the same as 8 + 2 + 4
- add mentally a series of one-digit numbers, such as 5 + 8 + 4
- add multiples of 10 (such as 60 + 70) or of 100 (such as 600 + 700) using the related addition fact (6 + 7) and their knowledge of place value
- partition two-digit and three-digit numbers into multiples of 100, 10 and 1 in different ways.
- sum is related only to addition and should be used only in relation to addition

It is essential to continue to use mental methods constantly in your OMS

Addition Pre-Stage 1:

Children begin to relate addition to combining two groups of objects

Through practical physical opportunities children recognise numbers of objects so that they are able to conserve number (not have to count from 0 each time).

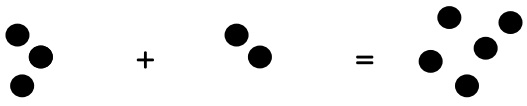
Through practical physical opportunities children develop their ability to subitise (recognise small groups as a number i.e  is 4)

Through use of number tracks and in games children should be given the opportunity to count on from a given point and recognise 1 more than the previous number.

Be given practical opportunities to count on and make the link that a number is more than the starting number.

Use songs and rhymes to aid counting and number recognition.

Begin to record numbers and number sentences following on from practical activity i.e.



3 + 2 = 5

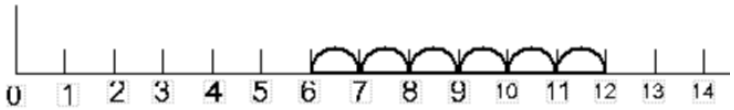
Use the language of one more when adding one to a group

Through out the early teaching be very clear about the vocabulary that is being used. For example 3 apples and 2 oranges makes 5 fruits not 5 apples or oranges.

Addition Stage 1:

Adding by counting on a marked number line

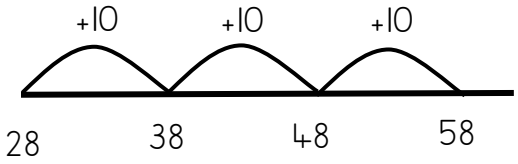
6 + 6 = 12



'Put your finger on number six and count on six.'

Adding 10s on a blank number line

28+30=



Use a 100 square to help support the children's addition.

Addition Stage 2:

Partitioning into 10s and 1s and recombining i.e. 24 + 32 =

20+30=50

4+2=6

50+6=56

Partitioning into 100, 10s and 1s 243+136=

200+100=300

40+30=70

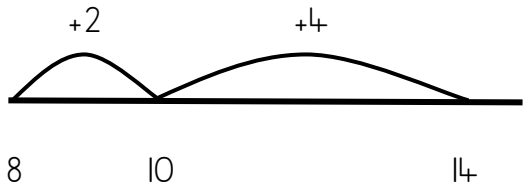
3+6=9

300+70+9=379

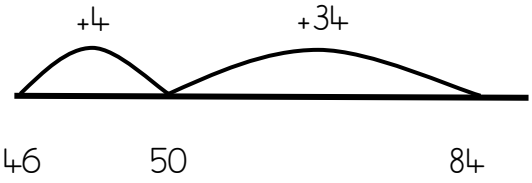
Partitioning can be used for any numbers but much beyond 1000s it becomes inefficient and so should only be taught up to 4-digit numbers. Remember you can bridge through 10s, 100s and 1000s using partitioning.

Addition Stage 3:

Using a blank number line bridging through ten. For example 8 + 6



Moving onto 46 + 38



Alternatively you could split the 34 into a 30 and a 4 to reach 84.

Addition stage 4:

Extended columns by adding the most significant numbers first i.e.

34+25=

```
 34
+25
 50
  9
 59
```

67+82=

```
 67
+82
140
  9
149
```

356+232=

```
 356
 232
+500
  80
   8
 588
```

457+362=

```
 457
+362
 700
 110
   9
 819
```

Remember that you would want the children at this stage to be able discuss how numbers can be made 10 or 100 times smaller and then larger when answering these questions. For example 50+60 = to (5+6)x10 in example 4.

Addition Stage 5:

Standard compact method adding the least significant numbers first and carrying below the line:

36+45=

```
  36
 +45
 ---
  81
  1
```

137+45=

```
  137
   45
 ----
  182
   1
```

348+257

```
  348
 +257
 ----
  605
  11
```

3725+4556=

```
  3725
 +4556
 -----
  8281
  1 1
```

Once taught, children can use the column method to add decimals. It is efficient when adding larger numbers but remember mental methods must not be neglected merely because a child knows how to use columns!

+ +

+ +

Subtraction

To subtract successfully, children need to be able to:

- recall all addition and subtraction facts to 20;
- subtract multiples of 10 (such as 160 – 70) using the related subtraction fact (16 – 7) and their knowledge of place value;
- partition two-digit and three-digit numbers into multiples of one hundred, ten and one in different ways (e.g. partition 74 into 70 + 4 or 60 + 14).

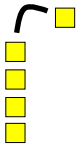
It is essential to continue to use mental methods constantly in your OMS

Subtraction Pre-Stage 1:

Children begin to record in the context of play or practical activities.

Removing objects from a group, i.e.

'I have 5 apples and I take one away, how many are left?'

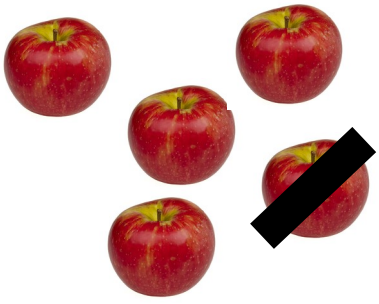
Using the language of one less by taking one away from a group,, e.g. tower of cubes 

Singing rhymes and songs that involve things being taken away e.g. "Five little men in a flying saucer"

Use number tracks to relate to and identify one less than. 

Using stories and role play to encourage the language of subtraction e.g. '4 people were on the bus, one got off, how many were left?'

Drawing a picture representation of a subtraction sentence.

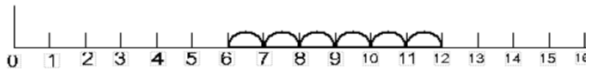


5 takeaway 1 equals 4

Subtraction Stage 1:

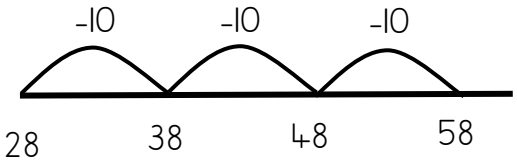
Counting back on a marked number line

12 - 6 = 6



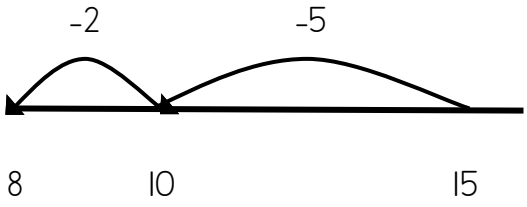
'Put your finger on number twelve and count back six.'

Counting back in tens on a number line.

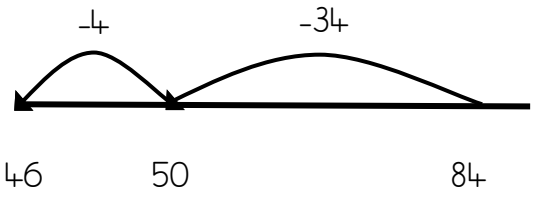


Subtraction Stage 2:

Using a blank number line counting back (taking away). i.e. 15-7=



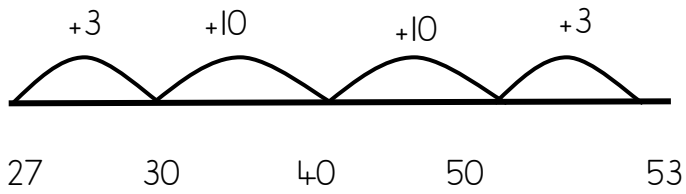
Moving onto larger numbers i.e. 84-38



This is the least efficient method but it does make clear that numbers are being reduced in size by the subtraction.

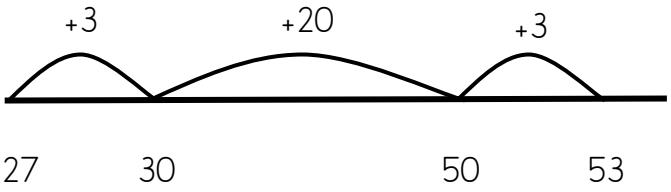
Subtraction Stage 3:

Using the blank number line to count up (the shop keeper method) i.e. 53-27=

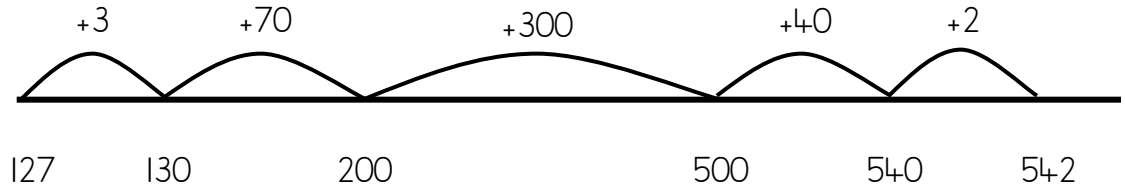


Then add the differences together. 10+10+3+3=26

This method can be applied to any number and as the children become more confident then the differences can grouped into multiples of 10 or if dealing with larger numbers multiples of 100.



542-127=



300+70+40+3+2=415

Subtraction Stage 4:

Column subtraction without decomposition i.e. 257-114=

$$\begin{array}{r} 257 \\ -\ 114 \\ \hline 143 \end{array}$$

Remember when teaching this method to be clear that it is still 50-10, 200-100, this can be modelled by using dienes to do physically and also pictorially.

Subtraction Stage 5:

Column subtraction with decomposition i.e. 253-114=

```
 4 1
2 5 3
1 1 4
1 3 9
```

Be very clear that when the number below is larger than the number above you must take a 10 (or 100, 1000, 10000 etc.) from the column next on the left, again this can be modelled by using dienes to do so physically and then drawn out to show pictorially. Ensure the children cross out the original digit and write above the new digit, then take the 10, 100 etc. and write it next to the number to make a new larger number.

However remember when completing a subtraction such as 1001-898 it would actually be more efficient to count on!

Multiplication

To multiply successfully, children need to be able to:

- recall all multiplication facts to 10 × 10
- partition number into multiples of one hundred, ten and one
- work out products such as 70 × 5, 70 × 50, 700 × 5 or 700 × 50 using the related fact 7 × 5 and their knowledge of place value
- add two or more single-digit numbers mentally
- add multiples of 10 (such as 60 + 70) or of 100 (such as 600 + 700) using the related addition fact (6 + 7) and their knowledge of place value
- add combinations of whole numbers using the column method.
- understand doubling
- understand that multiplication is commutative.

It is essential to continue to use mental methods constantly in your OMS

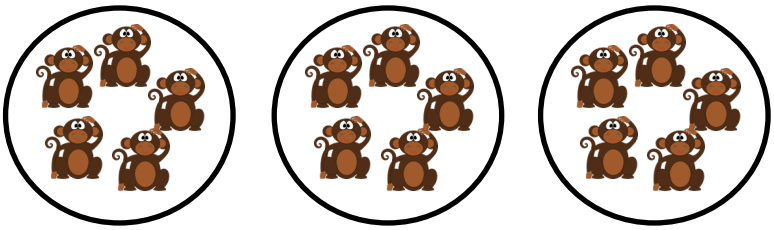
Multiplication Pre-Stage 1:

Children should begin to count in groups of 2s, 5s and 10s using practical objects, rhymes and songs.

Counting in groups of the same size e.g.

2 4 6 8

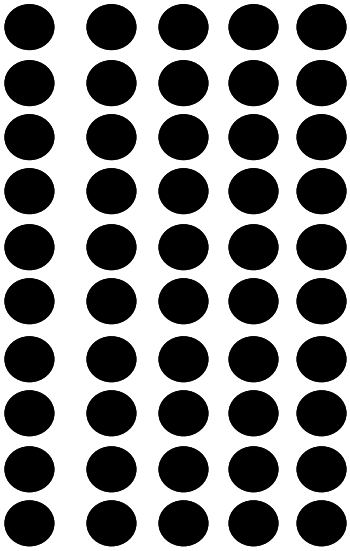
Giving the children practical resources in groups to count e.g. three groups of five monkeys to count in 5s



Singing counting songs

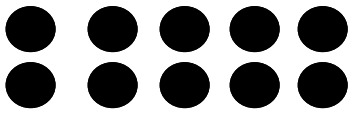
Multiplication Stage 1:

Use timetable knowledge linked to arrays, i.e. 12x5=60



10x5=50

5x10=50



5x2=10

2x5=10

Multiplication Stage 2:

Informal recording by:

Partitioning into 10s and 1s then recombining i.e.

16x4=

10x4=40

6x4=24

40+24=64

Or using Doubling and Halving i.e.

15x6=

Double the 15 and halve the 6

15x2=30

6÷2=3

30x3=90

Multiplication Stage 3:

Partitioning into the grid method i.e.:

34x6=204

x	30	4
6	180	24

180
24
204
1

36x24=864

x	30	6
20	600	120
4	120	24

600
120
120
24
864

347x26=9022

x	300	40	7
20	6000	800	140
6	1800	240	42

6000
1800
800
240
140
42
9022

Multiplication Stage 4:

Standard written methods short and long multiplication i.e.

37x4=148

37
x 4
148
2

37x23=851

37
23
111
740
851

2 10s carried from 3x7 and added to the 3x30 answer.

0 as the place holder.

1, 100 carried from 20x7 =140

This is added to the 20x30 answer.

Division

To divide successfully, children need to be able to:

- recall multiplication and division facts to 10 × 10, recognise multiples of one-digit numbers and divide multiples of 10 or 100 by a single-digit number using their knowledge of division facts and place value
- understand halving
- partition two-digit and three-digit numbers into multiples of 100, 10 and 1 in different ways
- know how to find a remainder working mentally – for example, find the remainder when 48 is divided by 5
- understand and use multiplication and division as inverse operations to create number families
- need to be able to subtract using the columns method.
- understand and use the vocabulary of division – for example in 18 ÷ 3 = 6, the 18 is the dividend, the 3 is the divisor and the 6 is the quotient

Division Pre-Stage 1:

Children should be given the opportunity to practically share items such as their fruit at snack time.

Also through role play by sharing cake or pizza.

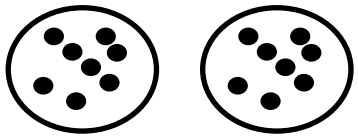
Sharing groups into 2 (halving)

Division Stage 1:

Sharing equally.

16÷2= 8

This can be expressed as sharing into 2 groups physically and then pictorially like so:

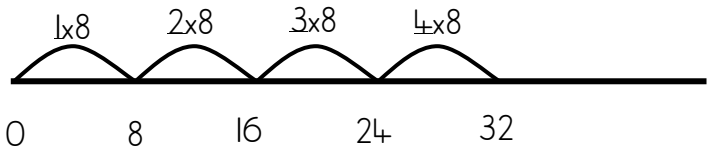


The children then count the number in each circle to find the answer. This method will also work with remainders as there will be a "left over"

Division Stage 2:

Grouping on a number line i.e.:

32÷8=4

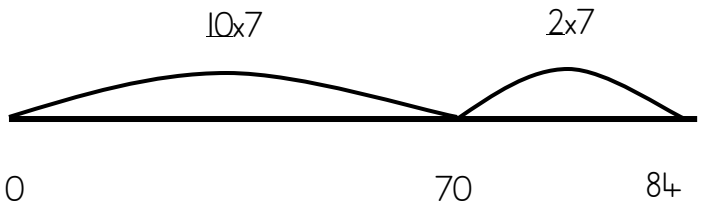


Children divide by single multiples of the divisor recording above the line, the final group is the answer. Give the children opportunities to use this method and find remainders.

Division Stage 3:

Chunking on the number line.

84÷7=12



Follow the rubric when chunking on the number line of 10x, 5x, 2x and 1x of the divisor.

Division Stage 4:

97÷9=

Chunking vertically

$$
\begin{array}{r|l}
9 & 97 \\
-\,90 & 9 \times 10 \\
\hline
7 &
\end{array}
$$

Answer: 10 R7

560÷24=

$$
\begin{array}{r|l}
24 & 560 \\
480 & 24 \times 20 \\
\hline
80 & \\
72 & 24 \times 3 \\
\hline
8 &
\end{array}
$$

Answer: 23 R 8

Division Stage 5:

And the standard compact method or the bus stop:

81÷3=27

$$\begin{array}{r} 27 \\ 3\overline{)81} \end{array}$$

This leads to long division where the answer is recorded above the line.

432÷15= 28r12

432 ÷ 15 becomes

$$\begin{array}{r} 28\ \text{r}\ 12 \\ 15\overline{)432} \\ 300 \\ \hline 132 \\ 120 \\ \hline 12 \end{array}$$

This can be turned into a fraction or decimal remainder

432 ÷ 15 becomes

$$\begin{array}{r} 28 \\ 15\overline{)432} \\ 300 \quad 15\times20 \\ \hline 132 \\ 120 \quad 15\times8 \\ \hline 12 \end{array}$$

$\frac{\cancel{12}}{\cancel{15}} = \frac{4}{5}$

432 ÷ 15 becomes

$$\begin{array}{r} 28.8 \\ 15\overline{)432.0} \\ 30 \\ \hline 132 \\ 120 \\ \hline 120 \\ 120 \\ \hline 0 \end{array}$$