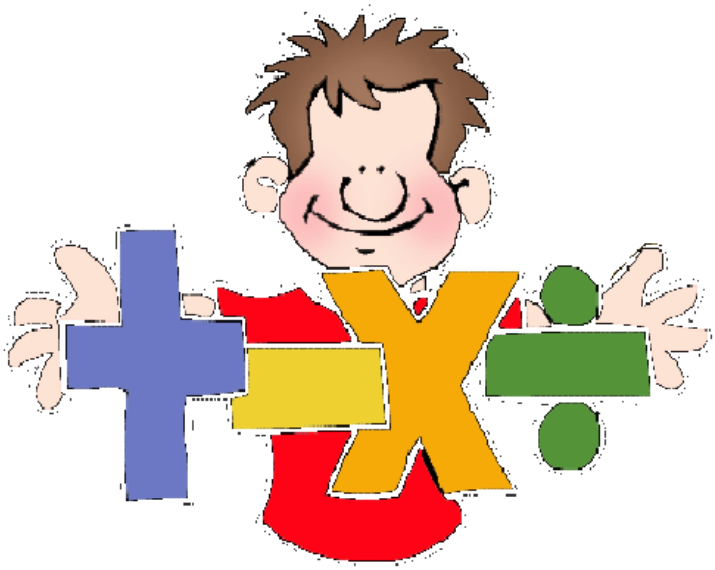
CALCULATION POLICY (2014)



How addition, subtraction, multiplication and division are taught at Leighfield Academy

Introduction

At Leighfield Academy we follow the new 2014 National Curriculum for mathematics and base our teaching of calculation on the statutory Programmes of Study (Key Stage 1 and Key Stage 2) and the non-statutory guidance:

https://www.gov.uk/government/publications/national-curriculum-in-england-mathematics-programmes-of-study

This booklet, written in consultation with teaching staff and governors, aims to help parents and carers to see and understand how mathematics is taught in the modern classroom. It outlines the methods taught by our staff to help children make progress in addition, subtraction, multiplication and division. The children will be taught a range of methods and will apply them to a wide variety of problem solving situations.

The children will use the 'four operations' (addition, subtraction, multiplication and division) to solve mathematical problems linked to real life. They will calculate using both whole and decimal numbers.

We feel it is most important that our children learn how to look at mathematical problems carefully, to choose and use the most effective and efficient method they have to solve it. This may include pure mental maths strategies, making quick jottings, estimating or going through the more formal steps of calculation as outlined in this booklet.

P.S - We teach calculations, not sums!
Sums are only addition calculations! ☺

Leighfield Academy is a member of the Affinity Teaching School Alliance (ATSA) and took part in meetings to help develop an ATSA Calculation Policy. Further guidance, models and teaching videos, for staff or parents, can be accessed at the following website:

http://www.affinitytsa.co.uk/index.php/training/national-curriculum/national-curriculum-3

Addition

The children are taught that addition can be done in any order but it is usually easier to put the largest number in their head and to count on. They are taught and encouraged to use mental strategies to solve addition calculations. When the numbers involved become too big to hold in the head, two main processes are developed to record calculations:

- Informal pencil and paper or whiteboard jottings to support, record or explain thinking – including estimation.
- More formal written methods.

Written progression in Addition

1. The empty number line

The first steps in addition can be recorded on a number line. The steps often bridge through a multiple of 10.

8 + 7 = 15

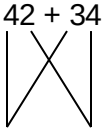
48 + 36 = 84

or:

2. Partitioning

This is when numbers are split into tens and units/ones (partitioned) to make them easier to add. They are then added together (recombined).

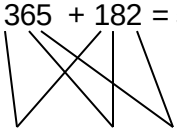
42 + 34 = 76



70 + 6

Or:

365 + 182 = 547



400 + 140 + 7

3. Simple vertical addition

Children will be taught that:

67+24= means the same

$$\begin{array}{r} 6\ 7 \\ +\ 2\ 4 \\ \hline \end{array}$$

as

$$\begin{array}{rl} 6\ 7 & \\ +\ 2\ 4 & \\ \hline 1\ 1 & (7+4) \\ 8\ 0 & (60+20) \\ \hline 9\ 1 & \end{array}$$

It is important to recognise that this is **60+20** not 6+2, as **0** is an important **place holder**.

Children will be taught to take the **units first.**

Once this is secure, children will move on to…

4. Column Method

This can be started as the children develop their understanding

$$\begin{array}{r} 358 \\ +\ 73 \\ \hline 431 \\ 1\ 1 \end{array}$$

The children are taught that addition is the inverse (opposite) of subtraction and are encouraged to check their answers by using the inverse operation:

67 + 24 = 91

So if 91 - 67 = 24, then the sum must be correct.

Year Six children work with numbers up to 7-digits and down to numbers of 2 or 3 decimal places.

Subtraction

Children are taught that subtraction is the inverse (opposite) of addition and they are encouraged to check calculations using the inverse operation.

They are encouraged to use mental strategies first to decide which the right strategy would be, e.g.

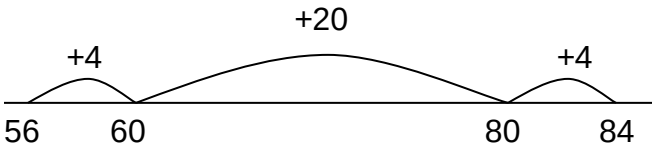
Counting on
To calculate 45 – 42 the children would be taught to put 42 in their head and *count on* 3 units *up* to 45.

Counting back
To calculate 45 – 3 the children would be taught to put 45 in their head and *count back* 3 units *down* to 42.

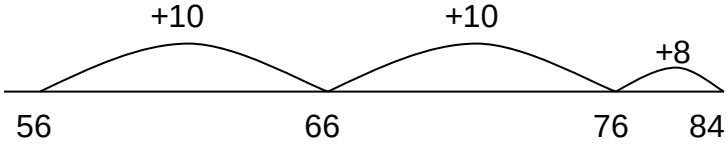
Written progression in Subtraction

1. Counting on an empty number line

e.g. 84 – 56 =
Start at the lowest number and count on:



As the children become more confident they will vary the size of the jumps.

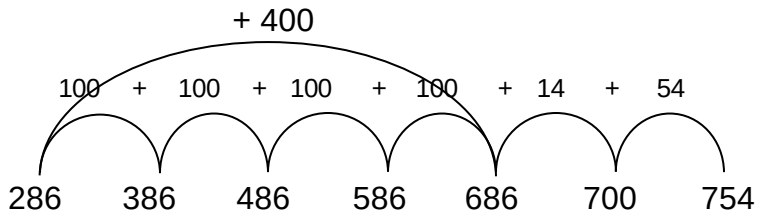


84 – 56 = 28

We feel strongly that children should be using this method for as long as possible as it helps with their understanding of mental maths and leads to fewer errors.

Or:

754 – 286



100+100+100+100+14+54 = 468
so 754 – 286 = 468

We aim to reduce the number of steps to the fewest possible
e.g. **400 + 14 +54 = 468**

2. Decomposition

Children should understand how this method works before they use it. It can provide an important stepping-stone before children move towards the more traditional "contracted" method.

e.g. **754 – 286 =**

700 + 50 + 4
200 + 80 + 6
} changes to

700 + 40 + 14
- 200 + 80 + 6
} changes to

600 + 140 + 14
- 200 + 80 + 6

400 + 60 + 8

= 468

Once children are secure in the above methods of subtraction they will adopt the contracted method below. It is crucial for children to fully understand 'why' they are altering numbers before moving on to this strategy.

And, that's right folks; this is probably the one method you remember most from when you were at school! ☺

3. Contracted Method

$$\begin{array}{r} {}^{6}7^{14}5^{1}4 \\ -\ 2\ 8\ 6 \\ \hline 4\ 6\ 8 \end{array} \qquad \begin{array}{r} {}^{\ 9\ 9} \\ {}^{1}2\ {}^{1}0\ {}^{1}0\ {}^{1}2 \\ -\ 1\ 3\ 8 \\ \hline 1\ 8\ 6\ 4 \end{array}$$

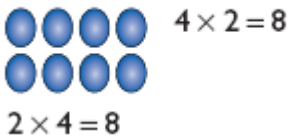
Multiplication

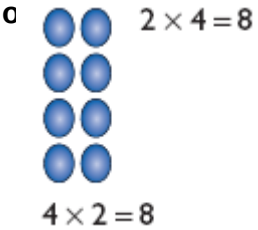
By the time children enter Year Five, they are expected to be able to derive and recall multiplication facts up to 12 × 12 (showing precision and fluency in their work) and the corresponding division facts, e.g. **6 x 7 = 42,** so **42 ÷ 7 = 6** and so on.

Written progression in Multiplication

1. Arrays

Arrays provide children with a visual image of multiplication. Depending on the arrangement of the array, the calculation can be read differently
e.g:





2. 'Short Division'

We teach the children to estimate before calculating and use mental maths strategies to decide how best to tackle a calculation.

E.g. **56 × 27 is approximately 60 × 30 = 1800.**

A more formal written method for multiplying by two or more digits may look like this:

```
   56
 × 27
 1000    50 × 20 = 1000
  120     6 × 20 =  120
  350     50 × 7 =  350
   42      6 × 7 =   42
 1512
   1
```

And will eventually lead to this formal method of long multiplication:

```
   56
 x 27
  392
   4
 1120
  1
 1512
```

It is most important that children are able to use 'common/known facts' to find ways to solve a calculation and if they can solve problems through informal jottings, then this is often the best method

e.g: **45 x 32**

If we know 100 x 32 = 3200 then we know that
50 x 32 = 1600 we now need to subtract 5 x 32 from this
10 x 32 = 320 so 5 x 32 = 160

So **1600 – 160 = 1440**

This shows the kind of links we aim for your children to be able to see between numbers.

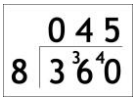
Division

In the Foundation Stage and throughout Key Stage One, division is taught through very practical, informal methods based on the concept of sharing and grouping. There is a page attached to the end of this booklet showing what these ideas look like (please see pg 10).

Children are taught that division is the inverse (opposite) of multiplication and encouraged to check calculations using the inverse operation.

In Key Stage Two, the main written method taught for division (where the divisor is a single digit) is based on the 'bus stop' method. Once pupils are confident with this method, they will progress to the 'chunking' method in Year 6, in order to divide larger numbers by a divisor of two or more digits.

1. **'Bus Stop' Method:**



2. **'Chunking' Method:**

480 ÷ 12 =

482
- 480 12 x **40**
002

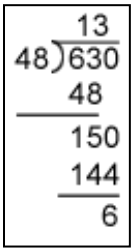
= 40 r 2

Working space

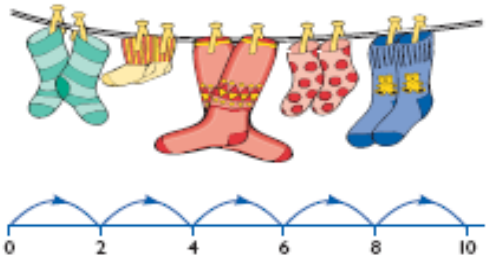
12 x 10 = 120
12 x 5 = 60
12 x 20 = 240
12 x 2 = 24

Once children are secure in this method, pupils *may* be shown a 'traditional' method for long division and have the opportunity to choose the method they find most efficient and effective:

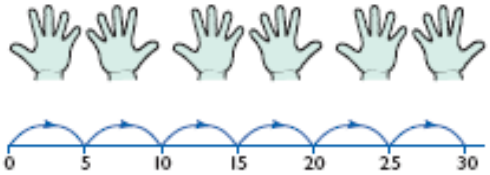
3. **'Traditional' Long Division:**



These models and images show initial teaching of division linked to multiplication.



$2+2+2+2+2=10$
$2\times5=10$
2 multiplied by 5
5 pairs
5 hops of 2



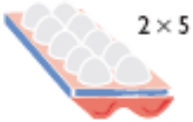
$5+5+5+5+5+5=30$
$5\times6=30$
5 multiplied by 6
6 groups of 5
6 hops of 5

$10p+10p+10p+10p+10p=50p$
$10p\times5=50p$
5 hops of 10

$4\times2=8$
$2\times4=8$

$5\times2=10$
$2\times5=10$

$2\times4=8$
$4\times2=8$



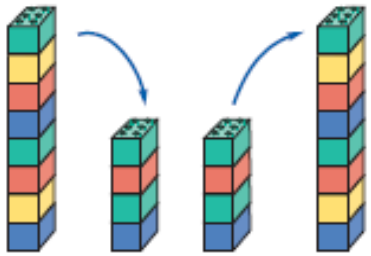
$2\times5=10$
$5\times2=10$

2 hops of 4

4 hops of 2

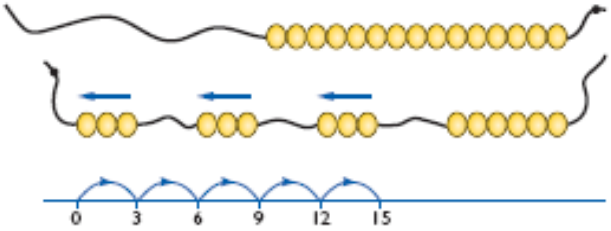
2 hops of 5

5 hops of 2



half of 8 is 4
$8\div2=4$

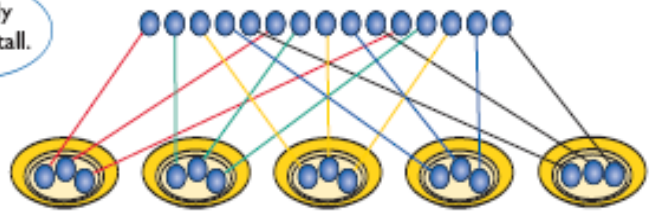
double 4 is 8
$4\times2=8$

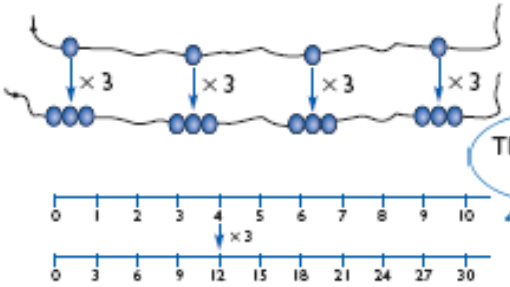


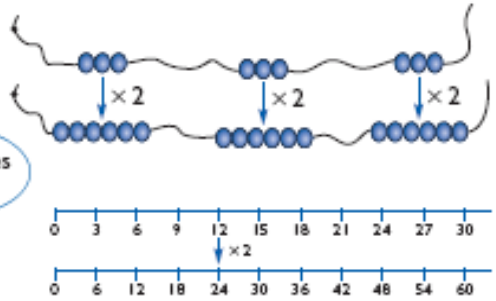
How many 3s in 15?

$15\div3=5$

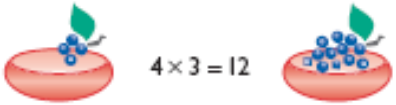
5 hops in 15. How big is each hop?
$15\div5=3$
15 shared between 5







$12\times2=24$



$4\times3=12$