



# **Bury Schools Partnership**

## **Foundation, KS1 and KS2 Calculation Strategies**

### **A Guide for Parents**

This booklet is designed to help you understand the calculation strategies your child will encounter in maths and to help you support them with their learning.

It explains some of the strategies used for mental and written calculations in schools within the Partnership from The Early Years Foundation Stage to Year 6. A selection of maths websites are included which children may enjoy using at home.

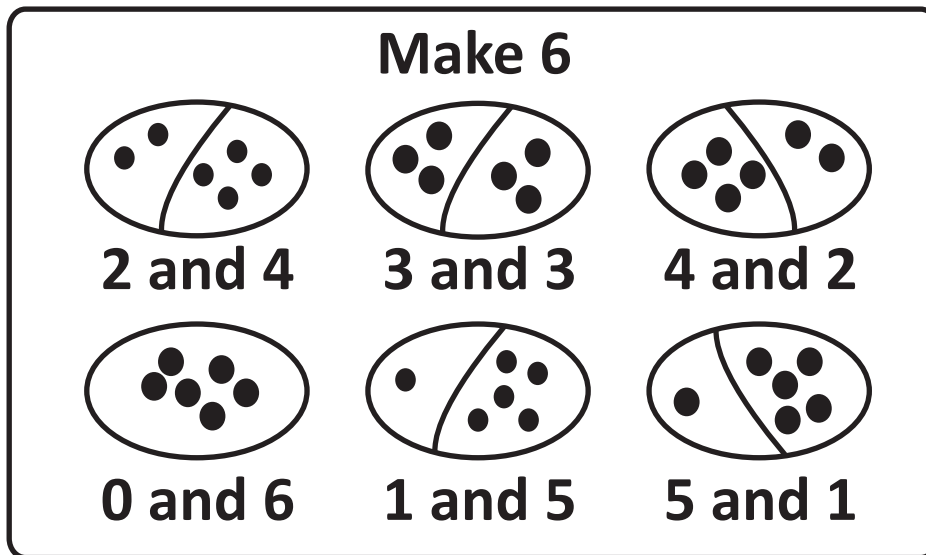
By the end of year 6, children will be taught a range of these calculation strategies, both mental and written. They progress through each step when they are ready and confident to do so.

Children should be encouraged to estimate their answers before calculating them. It is also important that they are encouraged to consider whether they can use a mental strategy to solve a calculation before using a written method.

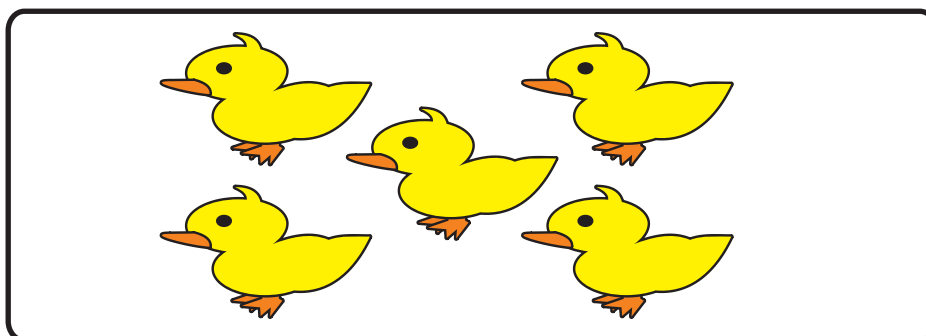
This strategy has been updated in line with the New National Curriculum 2014.

# Addition - Mental Methods

Step 1: Children are encouraged to develop a mental picture of numbers. They develop ways of recording calculations using pictures and drawings.

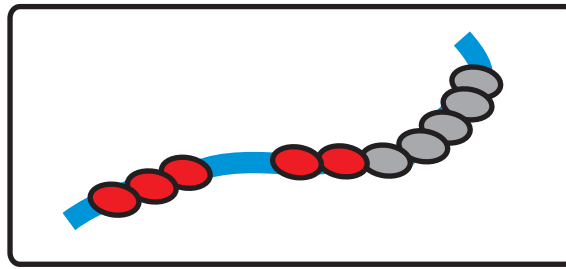


Practical resources and familiar objects are used to support addition skills. The children learn to count and add on in ones at this stage. They sing number songs, listen to stories and play games.



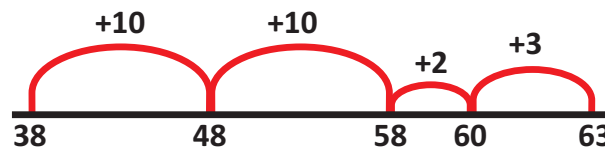
The children are introduced to the concept of place value and use equipment to understand that the 1 in 12 relates to 1 group of 10 and 2 units. Teachers demonstrate the use of the numberline.

Step 2: Children use one-hundred squares, numberlines, bead strings, and bead frames to help them count on. Children develop their knowledge of number bonds to 20, doubles to 10 and begin to use the numberline to count on to 100.



## Addition - Informal Written Methods

Step 3: Children will begin to use 'empty number lines' themselves, starting with the larger number and counting on in tens and units.

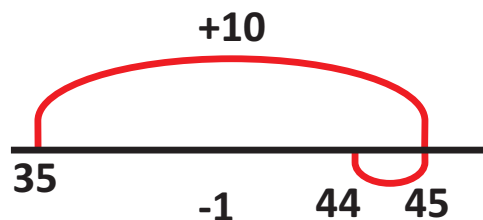


There are a number of addition strategies which can be used, for example, adding 9 or 11 by adding 10 and adjusting by 1.

Example

Add 9 by adding 10 and adjusting by 1

$$35 + 9 = 44$$



Step 4: Children learn the value of each digit in three-digit numbers and to partition the numbers into hundreds, tens and units to find a total.

$$312 + 426 =$$

Partition the numbers into hundreds, tens and units (or ones):

$$300 + 10 + 2 \quad + \quad 400 + 20 + 6$$

Add the hundreds together:

$$300 + 400 = 700$$

Add the tens together:

$$10 + 20 = 30$$

Add the units together:

$$2 + 6 = 8$$

Recombine the numbers to give the total:

$$700 + 30 + 8 = 738$$

# Addition- Formal Written Method

Step 5: Children use three- and four-digit numbers, decimals in the context of money, fractions and time.

Example: column addition without carrying

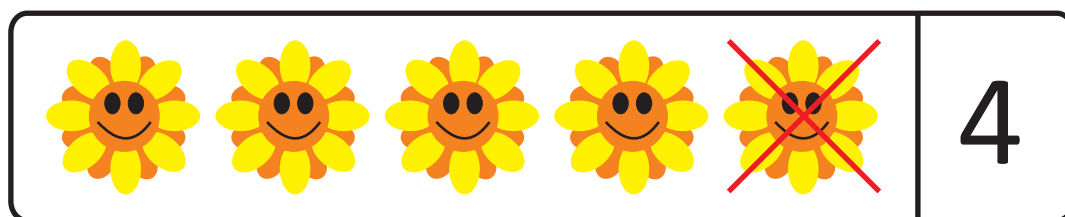
$$\begin{array}{r} 67 \\ + 24 \\ \hline 11 \quad (7 + 4) \\ \underline{80} \quad (60 + 20) \\ 91 \end{array}$$
$$\begin{array}{r} 267 \\ + 85 \\ \hline 12 \quad (7 + 5) \\ 140 \quad (60 + 80) \\ \underline{200} \\ 352 \end{array}$$

Example: column addition with carrying

$$\begin{array}{r} 625 \\ + 48 \\ \hline 673 \\ \underline{1} \end{array}$$
$$\begin{array}{r} 3587 \\ + 675 \\ \hline 4262 \\ \underline{111} \end{array}$$
$$\begin{array}{r} 42 \\ 6432 \\ 786 \\ 3 \\ + 4681 \\ \hline 11944 \end{array}$$

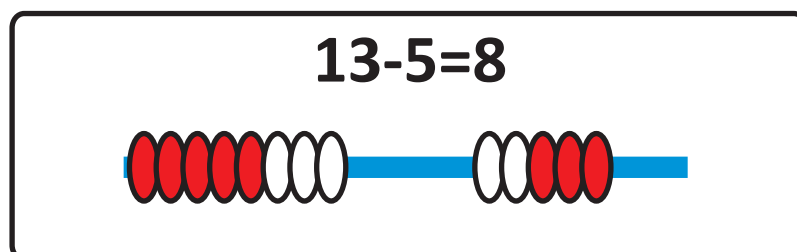
# Subtraction - Mental Methods

Step 1: Children are introduced to subtraction by counting physical objects and taking a specific number away. Children sing number songs, listen to stories and play number games. They count backwards from different starting points.

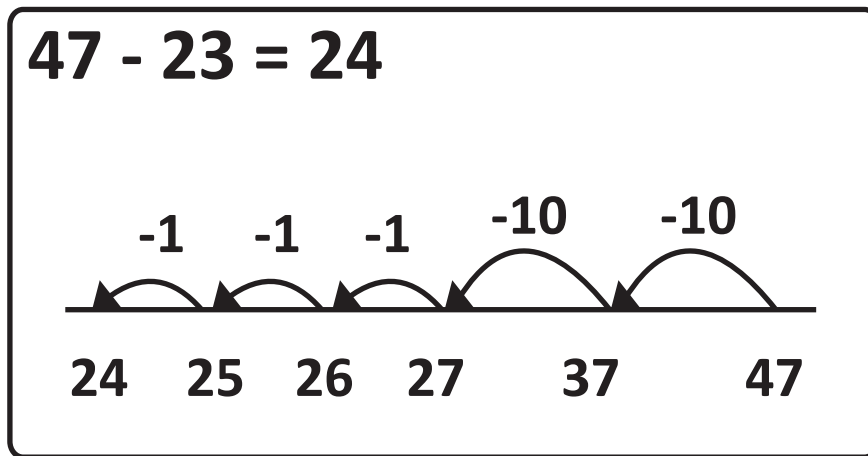


Teachers *demonstrate* the use of the numberline.

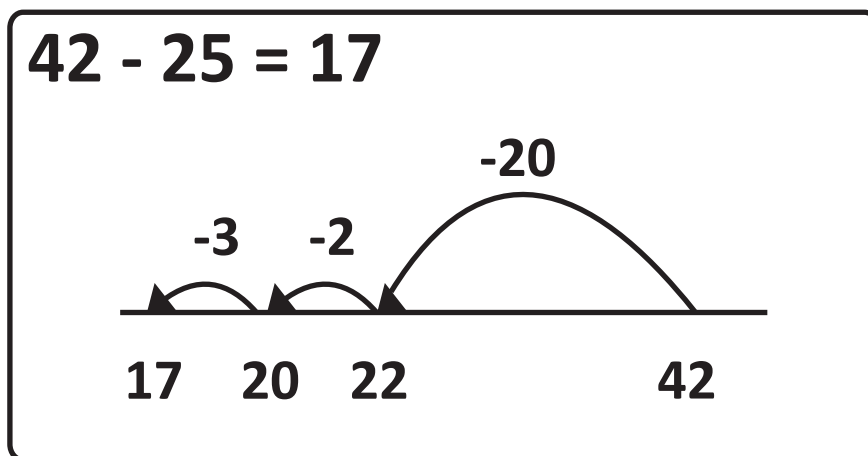
Step 2: Children use one hundred squares, numberlines, bead strings, and bead frames to help them count back, initially from 20 and then, from 100.



Step 3: Counting back in tens and units using an empty numberline.



Progressing to:



## Subtraction: Formal Written Methods

Step 4: Children learn to partition by splitting the number into its place value parts, such as tens and units. The units are subtracted from the units, and the tens from the tens.

$$\begin{array}{r} 89 \\ - 57 \\ \hline \end{array} = \begin{array}{r} 80 + 9 \\ - 50 + 7 \\ \hline 30 + 2 = 32 \end{array} \quad \text{(without exchange)}$$

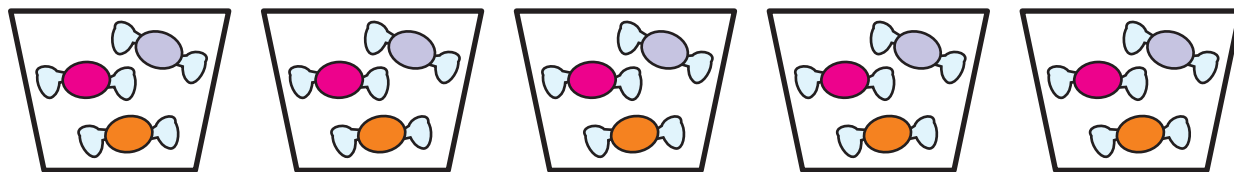
In the example below, 1 unit is less than 6 units, so you have to exchange 70 + 1 into 60 + 11. In the past, this was called 'borrowing', but the term 'exchange' is now used.

$$\begin{array}{r} 71 \\ - 46 \\ \hline \end{array} = \begin{array}{r} \overset{60}{70} + \overset{1}{1} \\ - 40 + 6 \\ \hline 20 + 5 = 25 \end{array} \quad \text{(with exchange)}$$

These formal methods will extend to using three- and four-digit numbers and decimal numbers in the context of money and measures.

# Multiplication- Mental Methods

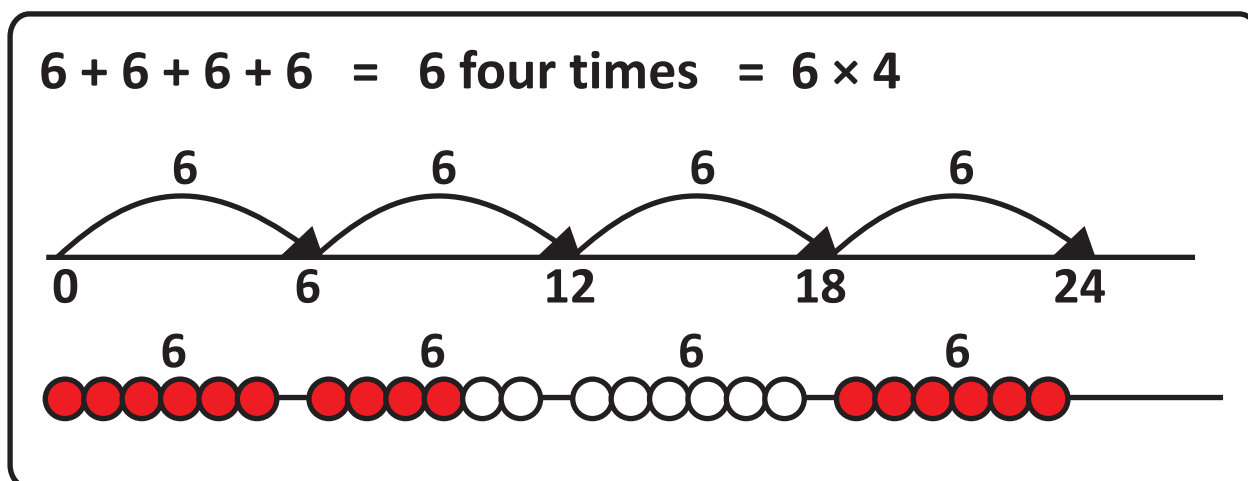
Step 1: Children count equal groups of objects and repeated groups of the same size.



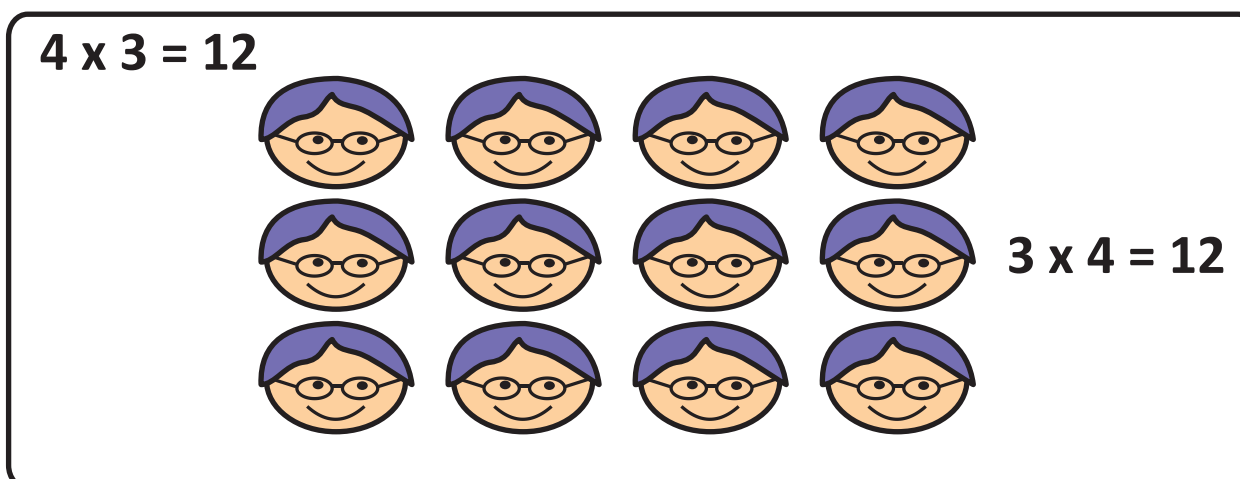
They count in 2s, 5s and 10s and work on practical problem solving activities involving equal sets or groups. They can say whether sets are the same, larger or smaller.

Step 2: Repeated Addition and Arrays

Repeated addition:



Arrays:



This is an array. It shows 4 3 as three rows of four or four columns of three.

Children use number lines or beads to support their understanding. They need to be able to recall and use multiplication facts for the 2, 5 and 10 times tables.

# Multiplication- Formal Written Method

## Step 3: Grid Method

Split the two-digit number into tens and units and then multiply each of them by the single digit number. The children use their knowledge of tables to do this. If they know that  $3 \times 7 = 21$ , then they should know that  $30 \times 7 = 210$ . This method progresses to calculations using three- and four-digit numbers and decimals.

$$23 \times 8$$

<b>x</b>	<b>20</b>	<b>3</b>
<b>8</b>	<b>160</b>	<b>24</b>

So

$$\begin{array}{r} 160 \\ + 24 \\ \hline 184 = (23 \times 8) \end{array}$$

$$72 \times 38$$

<b>x</b>	<b>70</b>	<b>2</b>
<b>30</b>	<b>2100</b>	<b>60</b>
<b>8</b>	<b>560</b>	<b>16</b>

So

$$\begin{array}{r} 2100 \\ 560 \\ 60 \\ + 16 \\ \hline 2736 = (72 \times 38) \end{array}$$

Since  $49 = 4.9 \times 10$ , do  $49 \times 3$ , then adjust

$$4.9 \times 3$$

<b>x</b>	<b>40</b>	<b>9</b>
<b>3</b>	<b>120</b>	<b>27</b>

So

$$\begin{array}{r} 12 \\ + 27 \\ \hline 147 = (49 \times 3) \end{array}$$

$$147 \div 10 = 14.7$$

The grid method provides a clear and flexible approach to multiplication which is easier for children to understand and apply than the vertical methods. Children need to be able to recall and use knowledge of 3, 4, 6 and 8 times tables progressing to multiplication facts up to  $12 \times 12$ .



#### Step 4: short multiplication

$$\begin{array}{r} \text{H T U} \\ 463 \\ \times \quad 8 \\ \hline 3704 \leftarrow \text{Answer line} \\ \hline 52 \end{array}$$

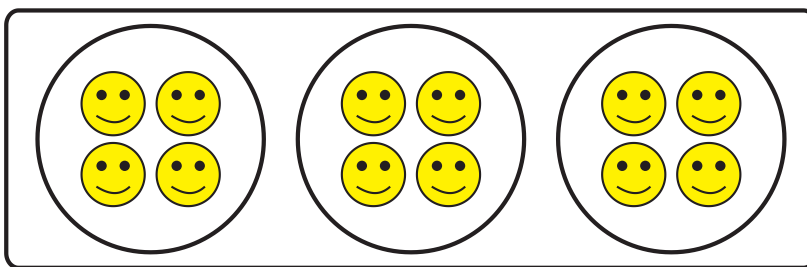
#### Step 5: long multiplication

$$\begin{array}{r} 286 \\ \times 29 \\ \hline 2574 \quad (9 \times 286 = 2574) \\ 5720 \quad (20 \times 286 = 5720) \\ \hline 8294 \\ 1 \end{array}$$

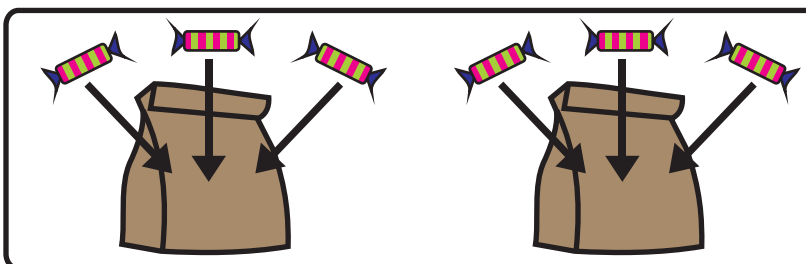
## Division- Mental Methods

#### Step 1: Sharing

Children count how many objects in each group, recognise equal groups and share items out in play and problem solving.

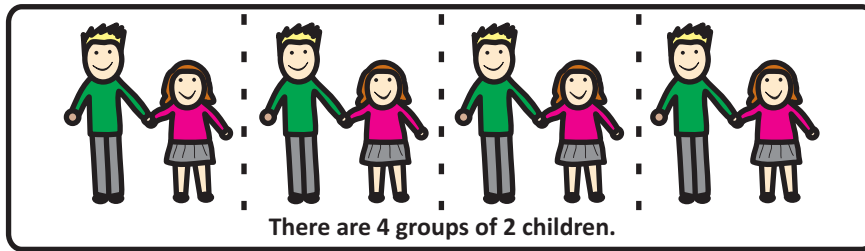


Six sweets are shared equally between 2 people. How many sweets does each child get?



## Step 2: Grouping

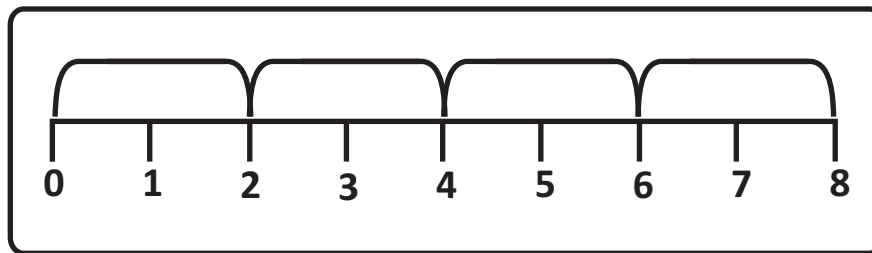
If there are 8 children how many groups of 2 are there?



Children need to use their knowledge of 2, 5 and 10 times tables to derive and recall related division facts.

## Division: Informal Written Method

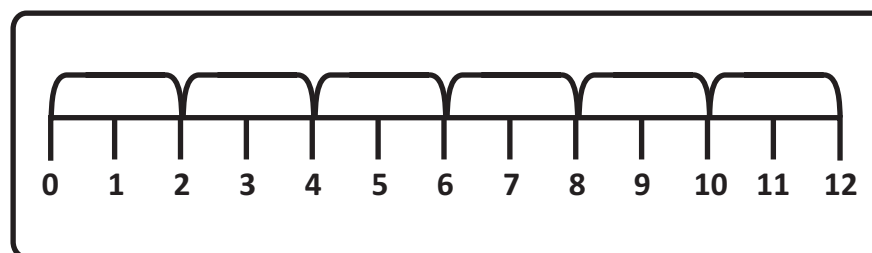
Step 3: Grouping can be shown more efficiently using a number line with repeated subtractions. For the example below, there are jumps back in groups of 2. To find the answer, count the number of jumps (i.e. 4 jumps, so  $8 \div 2 = 4$ )



### Repeated Subtraction

Repeated subtraction along a numberline is used to work out simple divisions.

For example  $12 \div 2$



In this method, the jumps back are in steps of 2. To find the answer, count the number of jumps. In this case, 6 jumps were required. So:

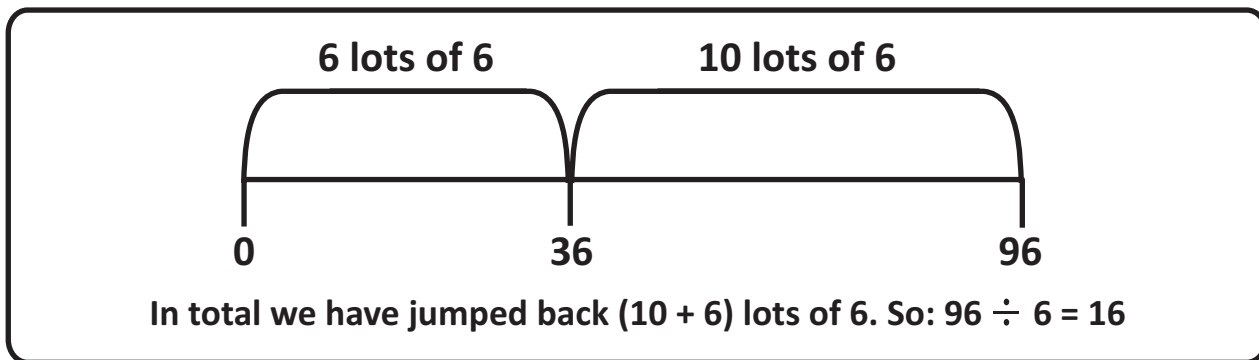
$$12 \div 2 = 6$$

Children are first introduced to division with remainders using the numberline. They need to use their knowledge of 2, 3, 4, 5, 6, 8 and 10 times tables to derive and recall related division facts first and then, for division facts relating to multiplication tables up to  $12 \times 12$ .

# Division Formal Written Methods

## Step 4: Chunking

A quicker approach subtracts known multiples of 6 each time (i.e. 10 lots of 6 followed by 6 lots of 6). This can be represented on a number line as:



In total, there are 16 (10 + 6) jumps back in lots of 6. So:  $96 \div 6 = 16$

## Division- Formal Written Method

Step 5: An alternative approach records the number line information vertically. How many times does 6 go into 96? (use 10, 5, 2 and 1 times tables to start).

$$\begin{array}{r} 6 \overline{) 96} \\ - \quad 60 \quad 10 \times \\ \hline \quad 36 \\ - \quad 36 \quad 6 \times \\ \hline \quad \quad 0 \end{array}$$

In total (10 + 6) lots of 6 have been taken out of 96 and the answer is the same, that is:

$$96 \div 6 = 16$$

By subtracting larger chunks, it is possible to calculate the answer quicker. This method, called **CHUNKING**, makes difficult division questions easy.

$$196 \div 6$$

$$\begin{array}{r} 6 \overline{) 196} \\ - \quad 180 \quad 30 \times \\ \hline \quad \quad 16 \\ - \quad \quad 12 \quad 2 \times \\ \hline \quad \quad \quad 4 \end{array}$$

In total (30 + 2) lots of 6 have been taken out of 196 with a remainder of 4.  
So:

$$196 \div 6 = 32 \text{ r } 4$$

The key to the efficiency of chunking lies in the estimate that is made before the chunking starts, that is, how many chunks of 6 would it be sensible to take away from 196 in the first place?

Step 6: Short Division/ The Bus Stop Method

$$963 \div 3$$

$$\begin{array}{r} 321 \\ 3 \overline{)963} \end{array}$$

To work this out, divide 963 by 3, one digit at a time, starting from the left.

$$252 \div 4$$

25 divided by 4 = 6

remainder 1

$$\begin{array}{r} 63 \\ 4 \overline{)252} \end{array}$$

12 divided by 4 = 3

Step 7: Long division

Children are taught long division using the chunking method.  
How many packs of 24 can we make from 560 biscuits?

The children start by multiplying 24 by multiples of 10 to get an estimate. As  $24 \times 20 = 480$  and  $24 \times 30 = 720$ , the answer lies between 20 and 30 packs. They start by subtracting 480 from 560.

$$\begin{array}{r} 24 \overline{)560} \\ 20 - \underline{480} \\ 80 \\ 3 \quad \underline{72} \\ 8 \end{array}$$

Answer : 23 R 8

Formal long division is taught in Key Stage 3.

## Useful websites

[www.sumdog.com](http://www.sumdog.com)

Free maths games, covering 122 numeracy topics which support the curriculum, split into 10 levels with increasing difficulty.

[www.mathletics.co.uk](http://www.mathletics.co.uk)

Mathletics covers the key stage 1 to A level National Curriculum Framework. There are lots of activities to support youngsters learning and live challenges.

[www.bbc.co.uk/schools](http://www.bbc.co.uk/schools)

This is the official BBC website for schools. It contains learning resources for children, parents and teachers including interactive games and revision guide.

[www.mathsphere.co.uk](http://www.mathsphere.co.uk)

A site dedicated to maths with fun games, activities and advice.

[www.mmp.maths.org](http://www.mmp.maths.org)

This project supports the mathematics education of people of all ages and abilities. The site links to: [www.nrich.maths.org](http://www.nrich.maths.org) - a monthly magazine containing maths puzzles, challenges and games for 5-18.

[www.funbrain.co.uk](http://www.funbrain.co.uk)

This is a great site with educational games for children of all ages (maths, grammar, science, spell, history).

[www.ictgames.co.uk](http://www.ictgames.co.uk)

This site provides a range of free theme based numeracy and literacy activities linked to the National Curriculum.

[www.mathszone.co.uk](http://www.mathszone.co.uk)

A very useful website full of free maths games, with links to many different learning websites and is easily accessed using images of games.

[www.crickweb.co.uk](http://www.crickweb.co.uk)

Free online education resources and games for maths, literacy and other curriculum areas.

<http://www.earlylearninghq.org.uk/>

Printable numeracy and literacy resources to use with children in Reception.

<http://resources.woodlands-junior.kent.sch.uk/>

Interactive maths activities on all areas of mathematics.