Mathematical Calculations

Shirenewton Primary School
Ysgol Gynradd Shirenewton

A Guide for Parents / Carers

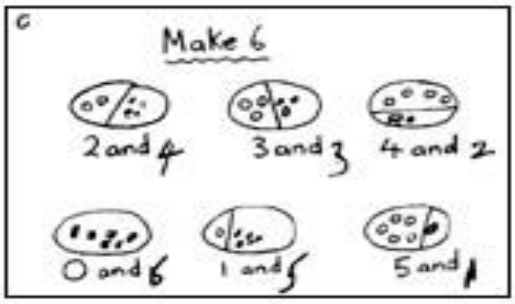
Calculation Vocabulary

Addition	Subtraction
- add - more than - total - sum - plus - increase - altogether - ... and ... - combine	- take away - less than - difference - minus - subtract - decrease - count back
Multiplication	**Division**
- lots of - groups of - times - multiply - product	- share / sharing - share equally - group - divide - quotient

Addition

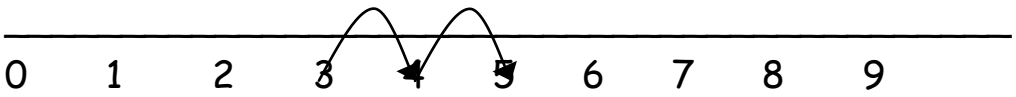
Year R and Year 1

Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They develop ways of recording calculations using pictures, etc.



They use number lines and practical resources to help them with their calculations.

3 + 2 = 5 +1 +1

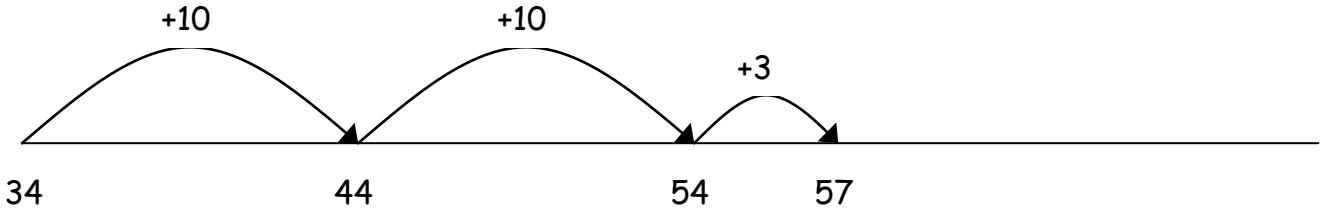


In Year 1 children initially add 2 collections to 10, then 20. To do this they use counting on strategies starting with the largest number using numbers lines, number squares and bead bars. Children then record theses as conventional sums. Children will also use practical equipment; mentally calculating when both collections are visible when one is hidden and when both are hidden.

Year 2

The children use number lines and hundred squares to count on in tens and then units, starting with the larger number.

34 + 23 = 34 + 20 + 3
= 54 + 3
= 57



Year 3

Children break down both numbers into their place value (hundreds, tens and units). This is called **PARTITIONING**; so 67 becomes 60 + 7.

36 + 53 = 50 + 30 = 80 + 9 = 89
6 + 3

Moving towards:

67		267	
+ 24		+ 185	
80	(60 + 20)	300	(200 + 100)
+ 11	(7 + 4)	140	(60 + 80)
91		+ 12	(7 + 5)
		452	

Year 4

Children continue to build on the method introduced in Year 3, moving on to adding the least significant digits first (the units are added first, then the tens etc) in preparation for 'carrying'.

267	
+ 185	
12	(7 + 5)
140	(60 + 80)
+ 300	(200 + 100)
452	

Using similar methods, children will:

- ✓ add several numbers with different numbers of digits;
- ✓ begin to add two or more three-digit sums of money;
- ✓ know that the decimal points should line up under each other, particularly when adding mixed amounts, e.g. £3.59 + 78p.

Year 5

There are 2 informal methods for Addition;

1. Add the smallest value digit first; similar to Year 4 method.

```
2384 +
 729
  13
 100
1000
2000 +
3113
```

2. Compensation:

```
 865 +
 278
1165 -  (865+300)
  22    (300-278)
1143
```

Children in Year 5 will begin to 'carry' digits below the line and extend to at least four digit numbers.

```
  587
+ 475
 1062
  1 1
```

```
  3587
+  675
  4262
  1 1 1
```

This is also known as 'formal written method'.

Using similar methods, children will:

- ✓ add several numbers with different numbers of digits;
- ✓ begin to add two or more numbers with up to three decimal places;
- ✓ know that decimal points should line up under each other, particularly when adding mixed units of measure, e.g. 3.2 m – 280 cm.

Year 6

Children consolidate and extend the carrying method to numbers with any number of digits.

7648	6584	42
+1486	+ 5848	6432
9134	12432	786
1 1 1	1 1 1	3
		+ 4681
		11944
		1 2 1

Using similar methods, children will:

- ✓ begin to add two or more decimal numbers with up to four decimal places;
- ✓ know that decimal points should line up under each other, particularly when adding mixed amounts, e.g. 401.2 + 26.85 + 0.71.

By the end of Year 6, children will have learnt a range of mental and written calculation methods. How they choose their calculation method will depend on the numbers involved and their personal preference for a particular strategy.

An important note…

At Shirenewton we know that children's mathematical understanding develops at different speeds. Children will not be pushed onto the next stage if they are not ready.

Children will be encouraged to:

- approximate their answers first, before carrying out their calculations.
- check their answers using an alternative method or the inverse operation.
- consider if a mental calculation would be appropriate before using written methods.

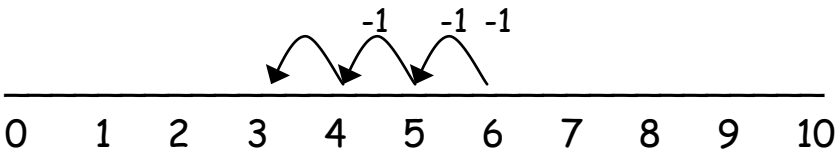
Subtraction

Year R and Year 1

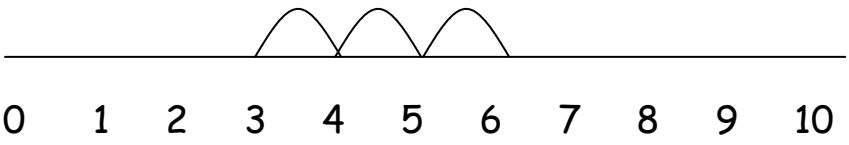
As with addition, children are encouraged to develop a mental picture in their heads to help them calculate. They record these through pictures.

They will use number lines and other practical resources to support their calculations.

6 – 3 = 3

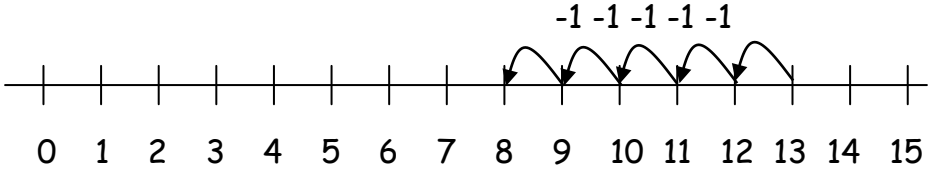


The number line may also be used to show that 6 - 3 means the 'difference between 6 and 3' or 'the difference between 3 and 6' and how many jumps they are apart.



Children will then begin to use numbered lines to support their calculations - using a numbered line to count back in ones.

13 – 5 = 8



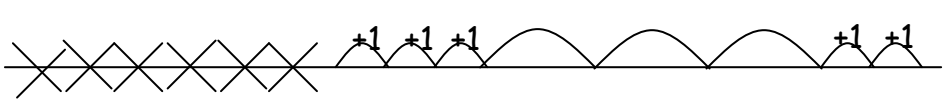
In Year 1 children initially subtract from 10 and build to subtracting from 20. Again, children will use practical equipment; mentally calculating when both collections are visible, then when one is hidden.

Year 2

Once the children are confident with counting back using number lines and hundred squares they move towards finding the difference between two numbers by starting with the smallest. For example:

82 - 47

Children count on from 47 to 82 in jumps of 10 and jumps of 1.



0 47 48 49 50 60 70 80 81 82

+10 +10 +10

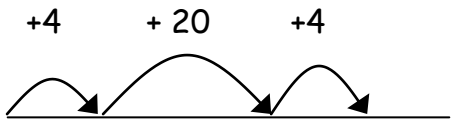
= 30 + 5

= **35**

Year 3

Children in Year 3 consolidate using number lines to count on. They will also use other resources like 100 squares to help them. They will become more efficient at counting on by counting on in larger jumps:

84 – 56 = 28



56 60 80 84

= 4 + 20 + 4

= 28

Other methods which are taught to assist mental calculations:

1. Rounding up or down to nearest 10 and adjusting the answer:
   34 – 19 = (34 – 20 = 14) + 1 = 15

2. Splitting the number into place value parts (partition):
   49 – 31 = (49 – 30 = 19) – 1 = 18

Year 4

The children move on to column subtraction in Year 4. This begins with the children **partitioning** the numbers by breaking them down into place value parts.

89	=	80	+	9		
- 57	=	50	+	7		
32		30	+	2	=	32

This method encourages the children to gain an understanding of the value of the

When confident with this, they'll move on to more complex calculations involving decomposition:

			40			
258	=	200	+	~~50~~	+	18
- 139	=	100	+	30	+	9
119		100	+	10	+	9

Here we discourage the children from saying they are 'borrowing' from the tens, as this implies that they will give it back at some point.
Instead we say that we are 'exchanging' a ten and adding it to our units.

Using this strategy children will:

- ✓ be able to subtract numbers with different numbers of digits (HTU – TU);
- ✓ begin to work with decimal amounts through the context of money. They will know that decimal points should line up under each other.

				0.8				
£8.95 =		8	+	~~0.9~~	+	0.15		
-£4.38	-	4	+	0.3	+	0.08		
£4.57		4	+	0.5	+	0.07		

Year 5

Children in Year 5 will consolidate the partitioning method from Year 4 and begin to work on two informal methods:

1. Counting up

   835 -
   267
   33 + (to make 300)
   500 (to make 800)
   35 (to make 835)
   568

2. Compensation

   835 -
   267
   535 + (835-300)
   33 (300-267)
   568

Year 5 pupils will then look at two different methods of decomposition:

1. 835 - = 800 + 30 + 5 = 800 + 20 + 15 = 700 + 120 + 15
   - 267 - 200 + 60 + 7 - 200 + 60 + 7 - 200 + 60 + 7
   500 + 60 + 8 = 568

2. 835 = $82^{1}5$ = $7^{1}2^{1}5$
   - 267 - 267 - 267
   568

Year 5 pupils will then be taught the formal written method for subtraction:

754 – 286:

614 1
~~7 5 4~~
- 286
468

Children will work on using this method to:

- ✓ be able to subtract numbers with different numbers of digits (ThHTU – HTU);
- ✓ begin to find the difference between two decimal numbers with up to three digits and the same number of decimal places, keeping the decimal points in line with each other.

Year 6

Children will consolidate the formal written method, extending their skills with more complex calculations involving decimals.

```
  5 13 1
  ~~6~~ ~~4~~67
- 2684
  3783
```

Children are then able to:

- ✓ subtract numbers with different numbers of digits;
- ✓ subtract two or more decimal numbers with up to three digits and either one or two decimal places, knowing that decimal points should line up under each other;
- ✓ add or subtract across zero (working with negative numbers).

Multiplication

Times Tables

In order for children to begin written calculations for multiplication, they must first have some knowledge of the times tables. At Shirenewton we encourage the children to learn the times tables in the following order: x2, x5, x10, x3, x4 x6, x7, x8, x9 through their 'learn its'.

Using and applying division facts.

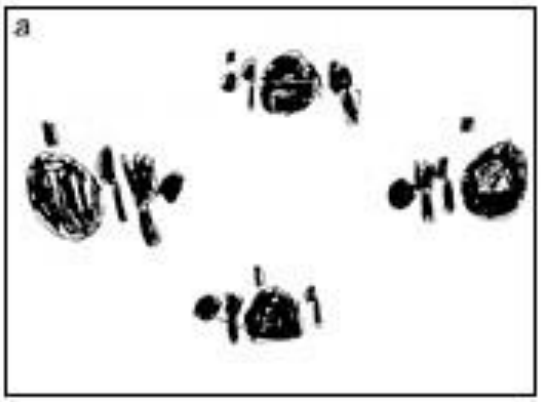
As your child learns their times table they should also be able to utilise their knowledge to derive other facts.

For example: If I know 7 x 3 = 21, what else do I know?

- 3 x 7 = 21
- 21 ÷3 = 7
- 21 ÷7 = 3

Year R and Year 1

Children will experience equal groups of objects and will count in 2s, 5s and 10s. They will work on practical problem solving activities involving equal sets or groups.



Year 2

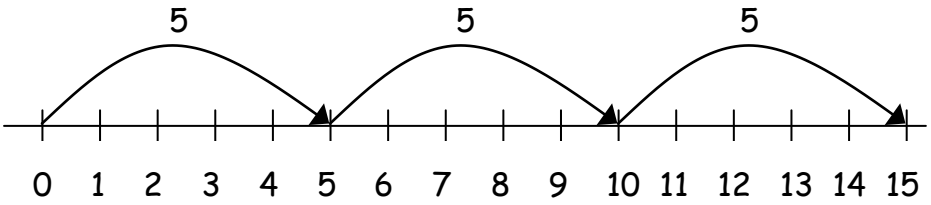
Children will develop their understanding of multiplication and use jottings to support calculation:

Repeated addition

3 times 5 is 5 + 5 + 5 = 15 or 3 lots of 5 or 5 x 3

They will use number lines to help them:

5 x 3 = 5 + 5 + 5



Arrays

Children should be able to model a multiplication calculation using an array. This knowledge will support with the development of the grid method.

5 x ○ ○ ○ ○ ○
○ ○ ○ ○ ○
○ ○ ○ ○ ○ 3 = 15

3 x 5 = 15

Partitioning

When partitioning, children will learn that they can partition into 10s and 1s:

So 15 x 2 = double 10 + double 5

10 + 5

20 + 10 = 30

Year 3

Children will continue to consolidate what they have learnt in Year 2; arrays, repeated addition and partitioning. When confident they will move on to the 'grid method'.

This method uses partitioned numbers:
35 x 2

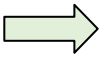
x	30	5
2	60	10

= 70

Year 4

During Year 4, children will expand on the grid method, working towards multiplying TU x TU:
34 x 21 =

X	30	4
20	600	80
1	30	4



600
80
30
\+ 4
714

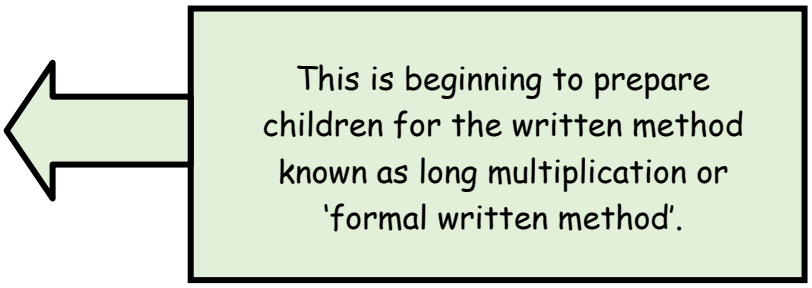
Year 5

By Year 5, children will be able to partition numbers and use the grid method to multiply. They may also partition horizontally. For example;

47 x 6 = (40 x 6) + (7 x 6)
= 240 + 42
= 282

As they become more confident they will move onto vertical multiplication, still using partitioning as a method of understanding the value of the numbers they are using.

```
  72
x 38
  60   (30 x 2)
2100   (30 x 70)
 560    (8 x 70)
  16    (8 x 2)
2736
 1
```



Short multiplication

```
 273
x  8
  24   (3x8)
 560   (70x8)
1600 + (200x8)
2184
1
```

Standard method

```
 273
x 8
2184
```

Year 6

Throughout Year 6 children will gain confidence and become more efficient with the grid method and long multiplication, partitioning the numbers as they go and extending this to work with decimals.

By the end of Year 6, children will have a range of mental and written calculation methods. How they choose which method to use will depend upon the numbers involved.

Children at Shirenewton are encouraged to approximate their answers before calculating and to consider if a mental calculation would be appropriate before using written methods.

Division

Year R and Year 1

In Reception and Year 1 the language of early division is taught when sharing out groups of objects such as: "Here are 9 sweets. Share them equally between the teddies."

Year 2

During Year 2, children will begin to gain an understanding of division through grouping objects. They will be able to count up to 100 objects and then learn that they can be grouped by counting in tens, fives and twos. They may even link this to their work on fractions; finding one half, one quarter and three quarters of shapes and sets of objects. A lot of their work will be done through stories and practical experimentation. For example:

6 ÷ 2 may be modelled as:

- If I have 6 strawberries how many people can have 2 each?
- How many 2s make 6?

12 ÷ 4 may be done physically:

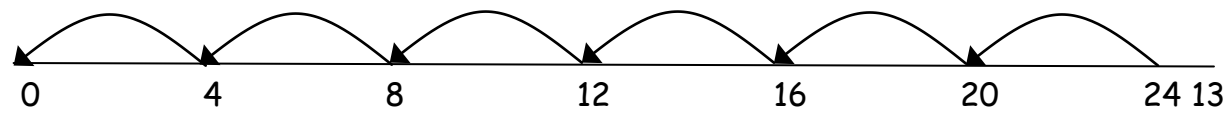
- 12 children get into teams of 4 to play a game.
- How many teams are there?

Year 3

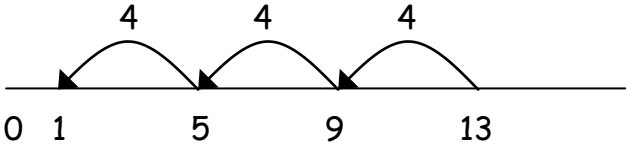
A practical approach to division is continued into Year 3. Children will explore division as sharing and grouping using counters, pencils, beads, unifix, and through role play, involving children, chairs and games. Through this method, children will be introduced to remainders.

They may use number lines to represent their calculations, this is also known as repeated subtraction.

24 ÷ 4 = 6



13 ÷ 4 = 3 r 1

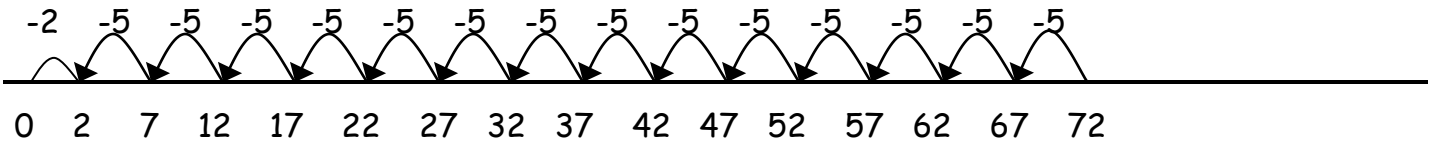


Year 4

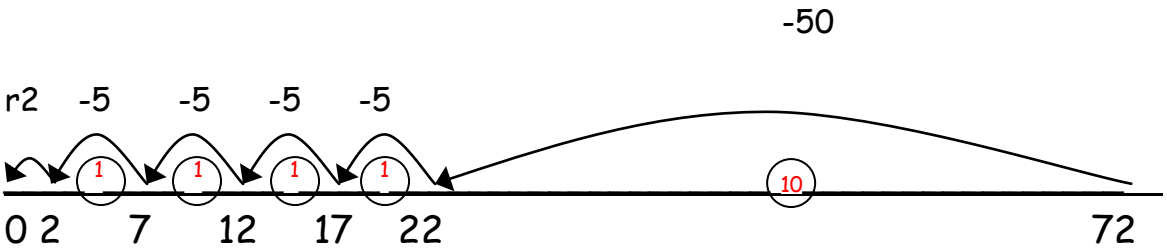
In Year 4, children will continue working through repeated subtraction. They will move on to subtracting multiples of the divisor (the number we're dividing by). So, instead of subtracting 5 ten times, they learn to subtract 50 in one large chunk (this is known as 'chunking').

This is referred to as the **'friendly number'** as it is 10x the divisor.

72 ÷ 5



Moving onto:



This will then be presented vertically:

74 ÷ 3

24 r 2
3) 74
- 30 (10 x 3)
44
- 30 (10 x 3)
14
- 6 (2 x 3)
8
- 6 (2 x 3)
2

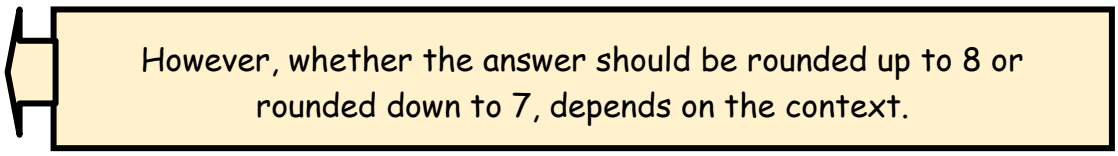
Answer : 24 r2

This is also known as CHUNKING: Children are subtracting multiples of the divisor to help speed up their calculation.

Remainders are always shown as a number.

When using division to solve problems, children in Year 4 are encouraged to make sensible decisions about rounding up or down after their calculation.

$62 \div 8 = 7$ r 6



For example:

- I have 62p. Sweets are 8p each. How many can I buy?
  Answer: 7 (the remaining 6p is not enough to buy another sweet)

- Apples are packed into boxes of 8. There are 62 apples. How many boxes are needed?
  Answer: 8 (the remaining 6 apples still need to be placed into a box)

Year 5

'Chunking' (or repeated subtraction) is continued throughout Year 5, but children will start to subtract (or chunk) larger multiples of the divisor:

196 ÷ 6

```
     32 r 4
6 )  196
   - 180      (30 x 6)
     16
   -  12      (2 x 6)
      4
```

Answer : 32 remainder 4 or 32 r 4

Here they will also express the quotient (answer to a division problem) as a decimal or fraction.

916 ÷ 6 =

- Remainder: 32 r 4
- Fraction: $32\ ^{4}/_{6}$
- Decimal: 32.66

Short Division

96 ÷ 5 = **19 r1**

1 9 r1 = **19 $^{1}/_{5}$**

5) 9 46 = **19.2**

Children who are ready will start expressing simple fractions and decimals.

Year 6

Children in Year 6 continue to use written methods to solve division TU ÷ U and HTU ÷ U but move on to dividing a 3 digit number by a 2 digit number.

Long division HTU ÷ TU using 'chunking'

972 ÷ 36

```
      27
36 ) 972
   - 720      (20 x 36)
     252
   - 252      (7 x 36)
       0
```

Answer : 27

Children will learn to express the quotient *(the answer to a division calculation)* as fractions and decimals. For example, when dividing 32 by 10, the quotient could be 3 r2 but rather than have a remainder, this is also shared out so the final answer is shown as $3\ ^{2}/_{10}$ or 3.2.

Children will also learn to write these in their lowest terms; so $3\ ^{2}/_{10}$ becomes $3\ ^{1}/_{5}$.

Dividing Decimals

Children will learn to divide numbers with up to two decimal places:

87.5 ÷ 7

```
    12.5
7 ) 87.5
  - 70.0     (10 x 7)
    17.5
  - 14.0     (2 x 7)
     3.5
  -  3.5     (0.5 x 7)
     0
```

Answer : 12.5