MATHEMATICS WRITTEN CALCULATION POLICY
Marchwood Junior School
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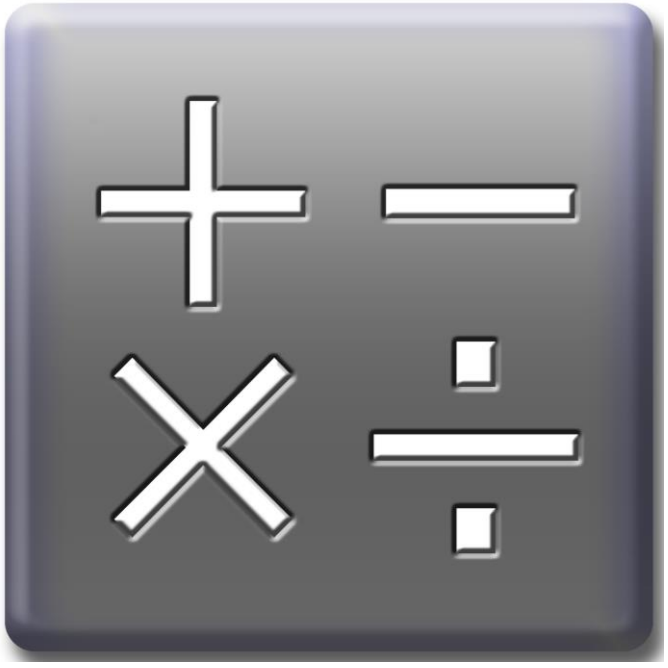


Progression towards a standard written method of calculation

Introduction

This calculation policy has been written in line with the programmes of study taken from the 2014 National Curriculum for Mathematics. It provides guidance on appropriate calculation methods and progression. The content is set out in yearly blocks under the following headings: addition, subtraction, multiplication and division. Statements taken directly from the programmes of study are listed at the beginning of each section. A separate mental maths policy outlines mental calculation strategies, including the use of jottings, vocabulary to be developed and the key number facts that children will need to know. Children are encouraged to use mental methods when appropriate, but for calculations that they cannot do in their heads, they will need to use an efficient written method accurately and with confidence. Written methods (from this document) are the methods children should be retrieving during daily maths meeting sessions but only after they have been introduced during class maths.

Aims of the policy

• To ensure consistency and progression in our approach to calculation
• To ensure that children develop an efficient, reliable, formal written method of calculation for all operations
• To ensure that children can use these methods accurately with confidence and understanding

How to use this policy

• Use the policy as the basis of your planning but ensure you are referring to previous year's guidance. Links should be made to previous methods when introducing new methods
• Always use Assessment for Learning (AfL) to identify suitable next steps in calculation for groups of children
• A me, us, you approach should be used; worked examples and remember to statements should be available for children to refer to when completing independent practice
• Children should be given enough time to rehearse efficient methods before they are applied in a variety of ways, e.g. non-contextual and contextual problems
• Methods should be broken down into small steps when first introduced. Scaffolding approaches such as part complete examples should be used as appropriate.
• If, at any time, children are making significant errors, return to the previous stage in calculation
• Refer to the mental maths policy for guidance on key facts, key vocabulary and mental methods and ensure these are
• Use a concrete, pictorial, abstract approach. Always use suitable resources, models and images to support children's understanding of calculation and place value, as appropriate and when required
• Encourage children to make sensible choices about the methods they use when solving problems

Addition (+)

Ensure children are confident using the methods outlined below before progressing to Year 3 objectives (to be reviewed 2023 following MIS meetings).

Addition - Year 1 and Year 2

It is important that children:

Know and learn by heart which pairs add to 10 and to numbers within 10.

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

Know and learn by heart pairs of numbers that add up to and including 20.

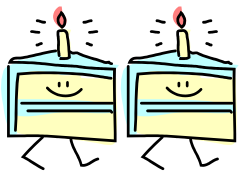
14 + 3 = 17	13 + 3 = 16
12 + 3 = 15	11 + 3 = 14

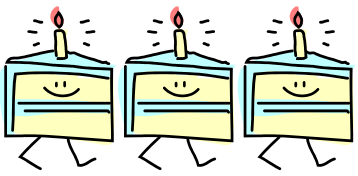
Addition and subtraction are very closely linked and should be taught as inverse operations.

1 + 9 = 10	9 + 1 = 10
10 – 1 = 9	10 – 9 = 1

Adding Using Pictures or Objects

At a party I eat 2 slices of cakes and my friend eats 3 slices of cake. How many slices of cake did we eat altogether?





2 and 3 makes 5 altogether

This may be recorded as 2 + 3 = 5

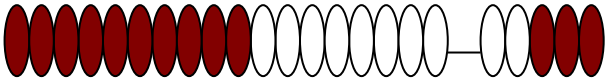
Addition using symbols

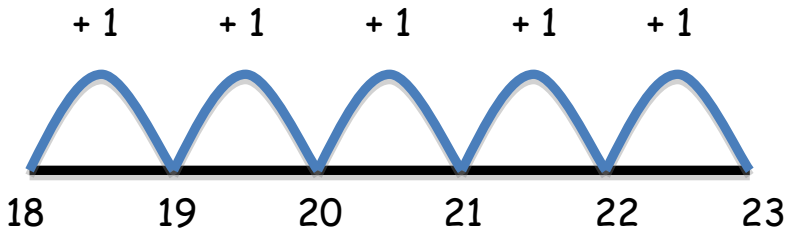
8 people are on the bus. 5 more get on at the next stop. How many people are on the bus now?

This may be recorded as 8 + 5 = 13

Addition by counting on in jumps of 1 (using beads and a number line)

18 + 5 = 23

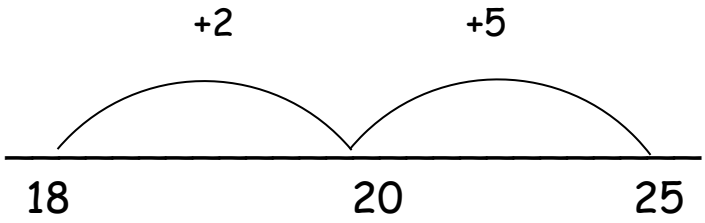




Addition TO + O using efficient jumps

Number lines help children to understand the steps being made in answering questions (encourage them to use number bonds they know).

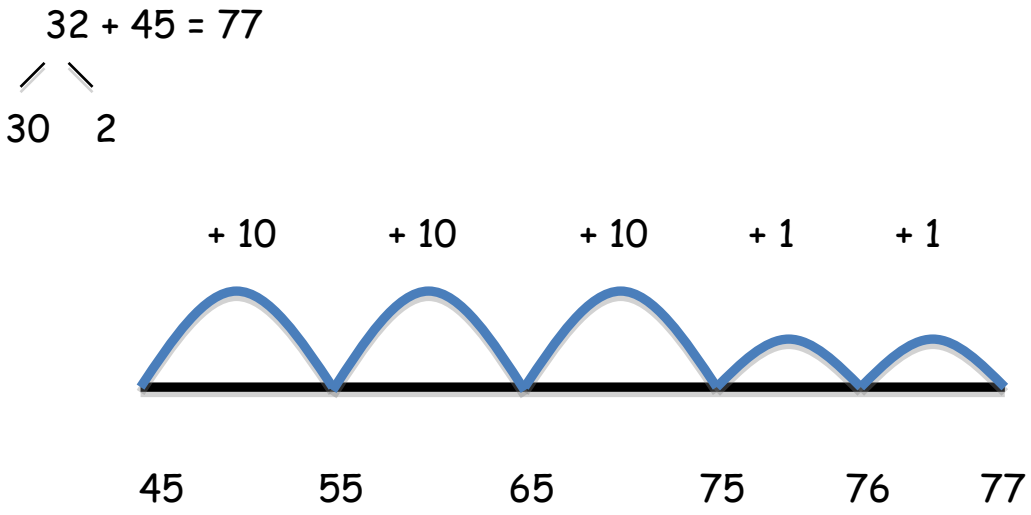
18 + 7 = 25



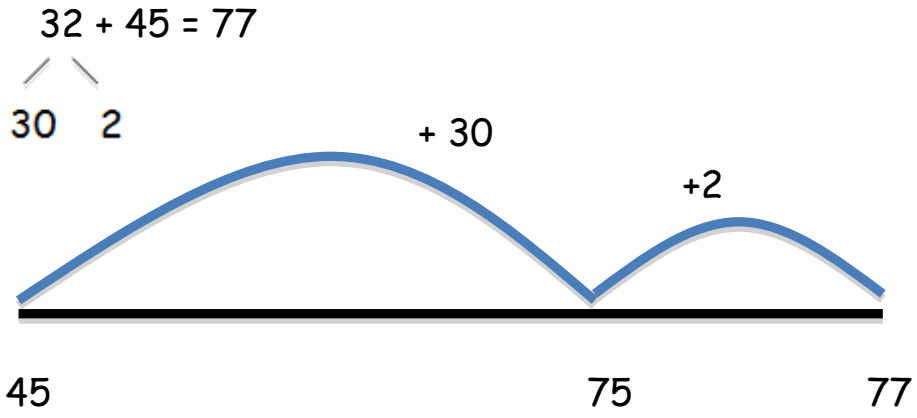
Addition TO + TO counting on using a number line

Children always count on from the largest number and should partition the smaller number.

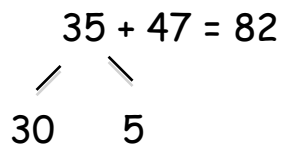
Take care to ensure the units being added initially DON'T cross ten boundaries.

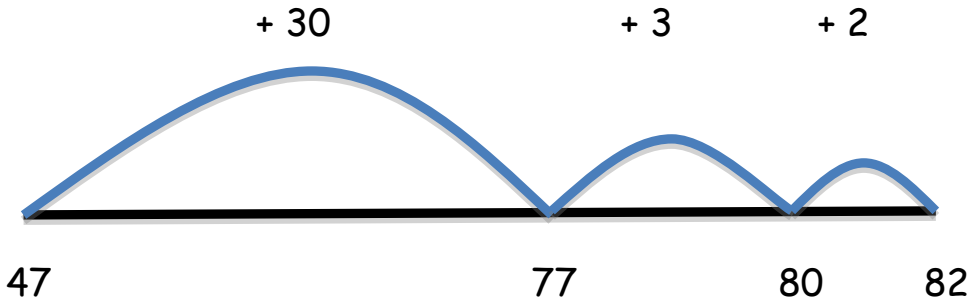


'Jumps' will then become more efficient



And demonstrate understanding of number bonds when crossing ten boundaries





<u>Addition TU + TU by partitioning</u>

Children MUST be taught to only partition the smaller number in both subtraction and addition.

35 + 47 =

47 + 30 = 77
77 + 3 = 80
80 + 2 = 82

or

47 + 30 = 77
77 + 5 = 82

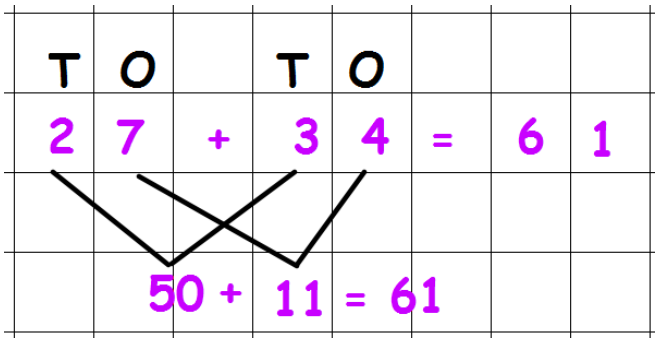
Addition - Year 3

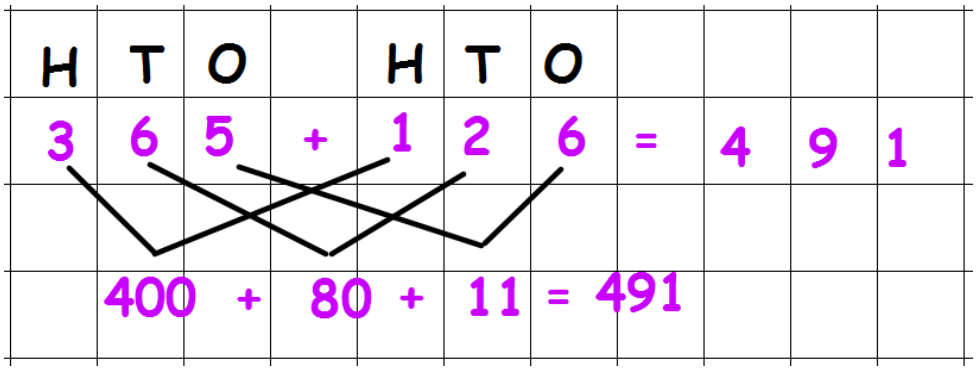
- **Add numbers up to 3 digits using an expanded method of columnar addition.**

Children should have lots of experience partitioning numbers in different ways (using place value counters and dienes) and master mental maths knowledge such as O + O and adding multiples of 10.

Addition TO + TO leading into HTO + (H)TO using the 'W' Method

Use place value counters and dienes initially alongside to support understanding.





Add the ones by joining the lines from the O digits. Say five ones add six ones equals eleven ones
Add the tens by joining the lines from the T digits. Say sixty add twenty equals eighty (it is also useful for children to understand 6 tens add 2 tens equals 8 tens).
Add the hundreds by joining the lines from the H digits, Say three-hundred add one-hundred equals four-hundred.
Add the partitioned parts together.
Write the final answer.

Expanded Written Method

The expanded method is very similar to the W method and can now be used in a vertical calculation. The smallest parts of the numbers are added first and the largest parts of the numbers added last. It is now vital that children keep digits in the correct columns.

e.g. 148 + 286 =

```
 148
+286
 14
```

add the ones first by saying **eight ones** add **six ones equals 14 ones** might be helpful initially to write (8+6) alongside

```
 148
+286
 14
120
```

add the tens by saying **forty** plus **eighty** is **one hundred and twenty** (4 tens plus 8 tens is 12 tens which is 1 hundred and 2 tens) might be helpful initially to write (40+80) alongside

```
 148
+286
 14
120
300
```

add the hundreds by saying **one hundred** plus **two hundred** is **three hundred-** might be helpful initially to write (100+200)

```
 148
+286
 14
120
300
434
```

total the numbers 14 + 120 + 300

Addition - Year 4

- **Add numbers up to 4 digits (including decimals) using the formal method of columnar addition where appropriate.**

NB *Ensure that children are confident with the methods outlined in the previous year's guidance before progressing. Further develop the formal written method of addition, with three and four-digit numbers. Revisit the expanded method and draw comparisons.*

Standard Compact Written Method (Vertical & Compact)

This can then lead to a more compact method involving carrying between columns where necessary:

e.g. 148 + 286=

148 +286 4 1	add the ones eight ones plus six ones is fourteen ones (1 ten and 4 ones) **put one ten under the tens column and 4 in the ones column**
148 +286 **34** 1 1	add the tens: **four tens (40) plus eight tens (80)** is twelve tens (120) plus one **ten (10)** underneath, is **thirteen tens (130);** ***put three tens in the tens column and one hundred under the hundreds column***
148 +286 434 1 1	add the hundreds; **one hundred** plus **two hundred** is **three hundred**. Plus **one hundred underneath is four hundred;** ***put the four hundreds in the hundreds column***

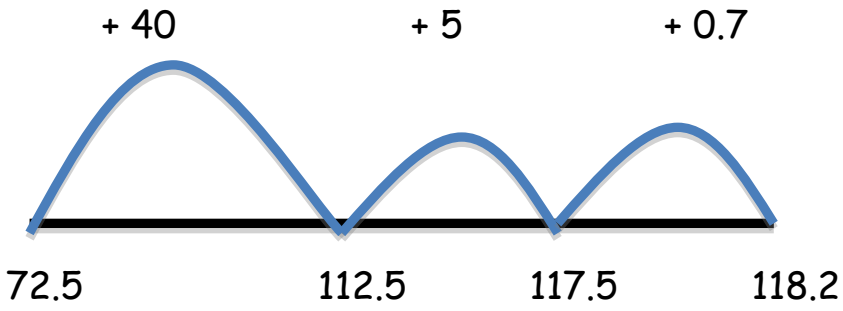
Addition with decimals (up to 4 digits)

```
   O.th
   £3.75
+  £2.53
  ------
   £6.28
  ------
    1
```

Once children are secure working with a compact method with integers they can be introduced to decimals. Money allows an ideal context for this to be first introduced, followed by other measures contexts. Ensure children are using the language of place value.

Children may also return to a numberline to help develop their mental understanding of integers and decimal numbers. Children should initially be exposed to questions in the context of measure and money.

72.5 + 45.7 = 118.2




```
  7 2 . 5
+ 4 5 . 7
---------
1 1 8 . 2
---------
  1
```

Addition - Year 5

- **Add whole numbers and decimal numbers with more than 4 digits, including the use of columnar addition.**

NB *Ensure that children are confident with the methods outlined in the previous year's guidance before moving on. Continue to teach the use of empty number lines with larger numbers (and decimals), as appropriate. Continue to develop the formal written method for addition with larger numbers (and decimal numbers) and with the addition of three or more numbers. Return to the expanded method if necessary.*

Standard Compact Written Method (Vertical & Compact)

21848 + 1523 = 23371

```
  21848
+  1523
 23371
   1 1
```

Continue to use the language of place value to ensure understanding. Ensure that the digits that have been 'carried' are recorded under the line in the correct column.

Formal written method for the addition of decimal numbers

£154.75 + £233.82 = £388.57

```
  154·75
+ 233·82
  388·57
     1
```

Continue to use the language of place value to ensure understanding. Ensure that the decimal points line up.

137.2 + 65.894 = 203.094

```
  137.200
+  65.894
  203.094
```

Use 0 as a place value holder when necessary.

Addition - Year 6

No objectives have been included in the programmes of study explicitly related to written methods for addition in Y6. However, there is an expectation that children will continue to practise and use the formal written method for larger numbers and decimals and use these methods when solving problems, when appropriate (see previous year's guidance for methods). Our aim is that by the end of Y6, children use mental methods (with jottings) when appropriate, but for calculations that they cannot do in their heads, they use an efficient formal written method accurately and with confidence.

Subtraction (-)

Ensure children are confident using the methods outlined below before progressing to Year 3 objectives.

Subtraction - Year 1 and Year 2

It is important that children:

know and learn by heart subtraction facts up to 10,

10 – 8 = 2 8 – 3 = 5 6 – 4 = 2

know and learn by heart, subtraction facts up to 20,

20 – 8 = 12 18 – 3 = 15
16 – 4 = 12 12 – 5 = 7

Subtraction and addition are very closely linked and should be taught as inverse operations.

20 – 8 = 12 20 – 12 = 8
12 + 8 = 20 8 + 12 = 20

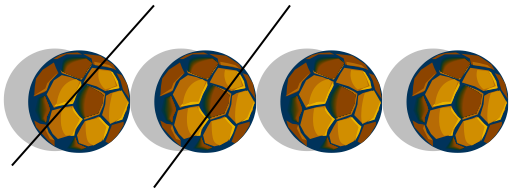
Subtraction can be thought of as:

- taking away / counting back
- finding the difference / counting on

Children will be taught both ways. When they are secure with both methods they will be asked to justify which method is most appropriate to use in different circumstances.

Subtracting using pictures/objects

I have 4 balls and 2 roll away, how many do I have now?



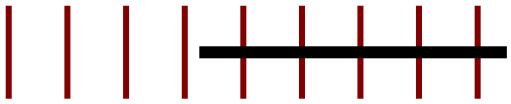
4 take away 2 makes 2 altogether.

This may be recorded as: 4 – 2 = 2

Subtraction using symbols

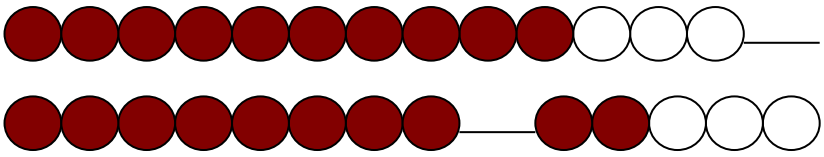
Mum baked 9 biscuits. I ate 5. How many were left?

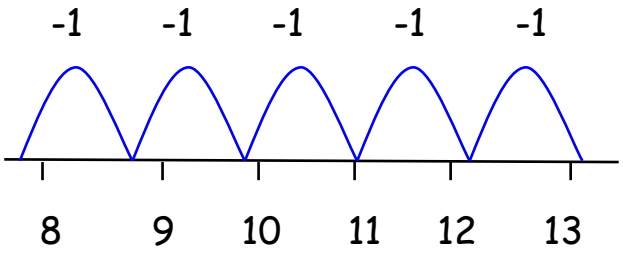
This may be recorded as 9 – 5 = 4



Subtraction by taking away in jumps of 1 (using beads and number lines)

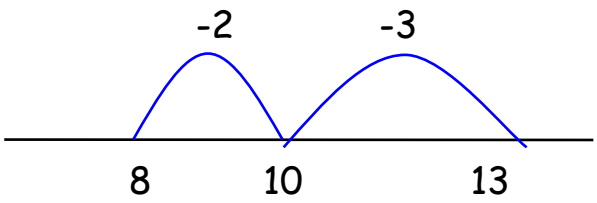
13 – 5 = 8





Subtraction TU – U using efficient jumps

13 – 5 = 8



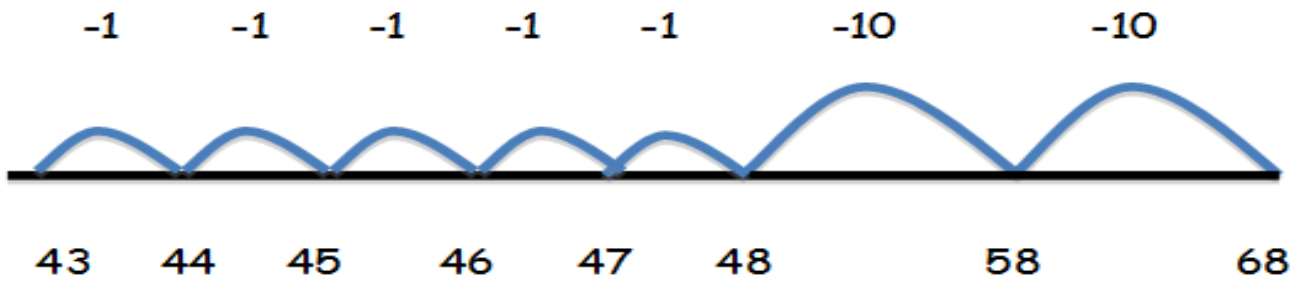
Subtraction TU – TU counting back using a number line

Begin by subtracting 'teen' numbers before moving on to multiples of 10.

Take care to ensure the units being subtracted initially don't cross ten boundaries.

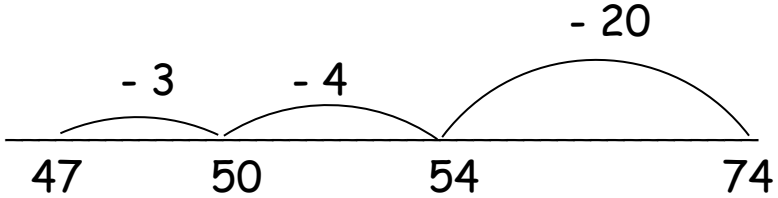
68 – 25 = 43

20 5



The method becomes more efficient if children have understood previous steps:

74 – 27 = 47



Subtraction TU – TU by partitioning

Children MUST be taught to only partition the smaller number in both subtraction and addition.

74 – 27 =

74 – 20 = 54
54 – 4 = 50
50 – 3 = 47

or

74 – 20 = 54
54 - 7 = 47

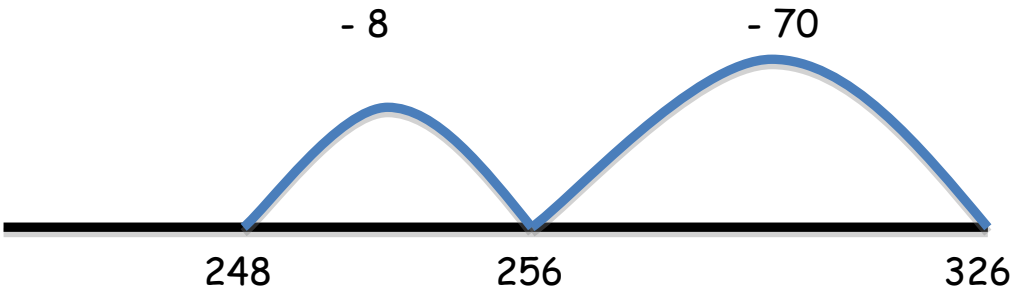
Subtraction - Year 3

- **Subtract numbers with up to 3 digits using an expanded method of columnar subtraction.**

NB Ensure that children are confident with the methods outlined in the previous year's guidance before moving on. Further develop the use of the empty number line with calculations that bridge 100. You may also want to deepen the children's understanding by completing subtrcation calculations by counting on using a numberline.

Subtraction HTU – (H)TU counting back using a number line

326 – 78 = 248



Subtraction HTU – (H)TU by partitioning

Children MUST be taught to only partition the smaller number in both subtraction and addition.

326 – 78 =

326 – 70 = 256
256 – 6 = 250
250 – 2 = 248

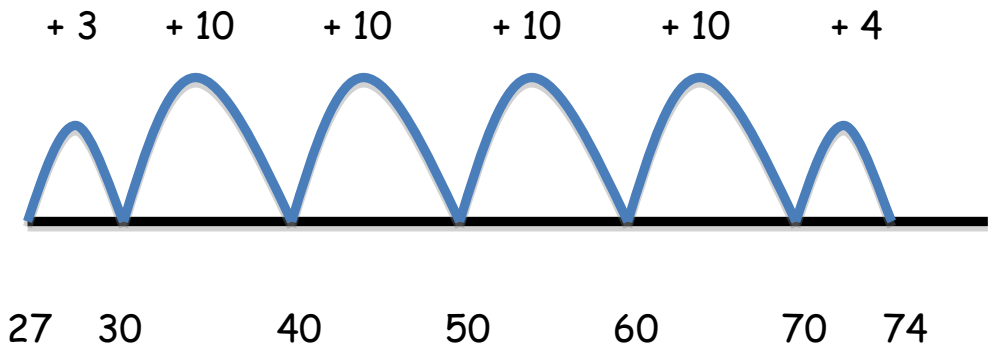
or

326 – 70 = 256
256 - 8 = 248

Subtraction by counting on using a number line

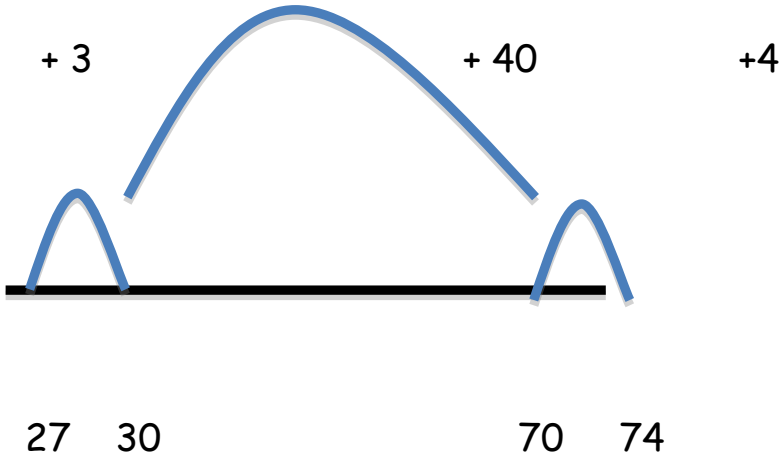
If children have a secure understanding of number and the processes taught so far they should make rapid progress through the steps set out below:

74 – 27 = 47

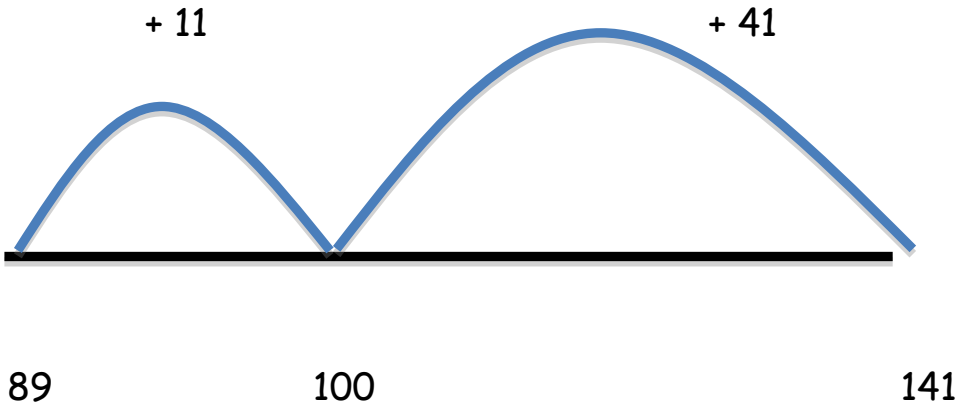


Children then add the 'jumps' to calculate the answer of 47

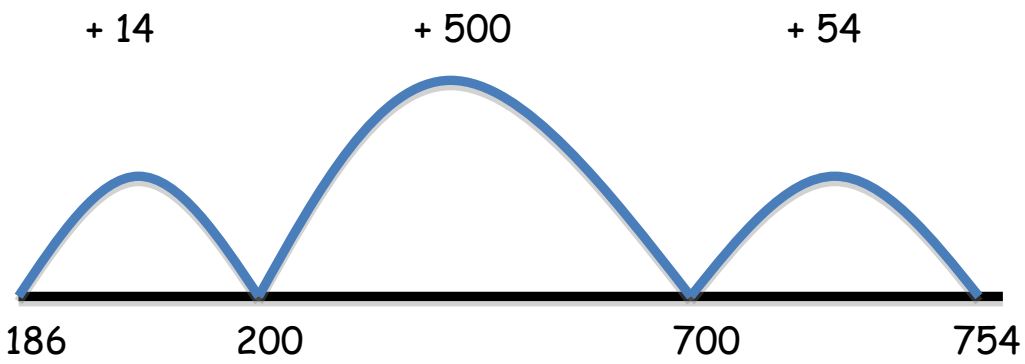
74 – 27 = 47



141 – 89 = 52



754 – 186 = 568



Expanded Written Method – Decomposition

We can also use ideas of partitioning to take away when subtracting. This method partitions each number and takes each part of one number away from each part of the other number. e.g. 331 – 122

Each number is partitioned into hundreds, tens and ones and set out in this way:

300	30	1
-100	20	2

Starting with the ones, take 2 away from 1. There isn't enough, so we need to borrow one ten to add to the ones column.
The tens column becomes ten less and the ones column become ten more:

300	**20**	**11**
-100	20	2

We can now take 2 away from 11:

300	20	**11**
-100	20	**2**
		9

Move to the tens column; can we take twenty from twenty? Yes.

300	**20**	11
-100	**20**	2
	0	9

Move to the hundreds column; can we take one hundred from three hundreds? Yes.

300	20	11
-100	20	2
200	0	9

The numbers are put back together (recombined) to give the answer.

331 – 122 = 209

Subtraction - Year 4

- **Subtract numbers up to 4 digits (including decimals) using the formal method of columnar addition where appropriate.**

NB Ensure that children are confident with the methods outlined in the previous year's guidance before moving on. Continue to teach the use of empty number lines with three and four digit numbers, as appropriate. Continue to develop the formal written method of subtraction by revisiting the expanded method first, if necessary. Continue to use base -ten materials to support understanding.

Standard Compact Written Method

This expanded written method then leads to a more compact method:
331 – 122 =

$$\begin{array}{r} {}^{2}\not{3}\,{}^{1}1 \\ -\,1\,2\,2 \\ \hline 2\,0\,9 \end{array}$$

WARNING: Whilst this is an efficient method, it needs to be carefully taught to ensure mathematical understanding. It is vitally important that children are not moved on to this method until they are ready and it is initially taught alongside the expanded method. Include examples whereby 0 is used in the tens column. E.g. 503 - 278 so children have to exchange a hundred for 10 tens before they can complete the calculation.

$$\begin{array}{r} {}^{4}\not{5}\,{}^{9}\not{0}\,{}^{13}\not{3} \\ -\,2\,7\,8 \\ \hline 2\,2\,5 \end{array}$$

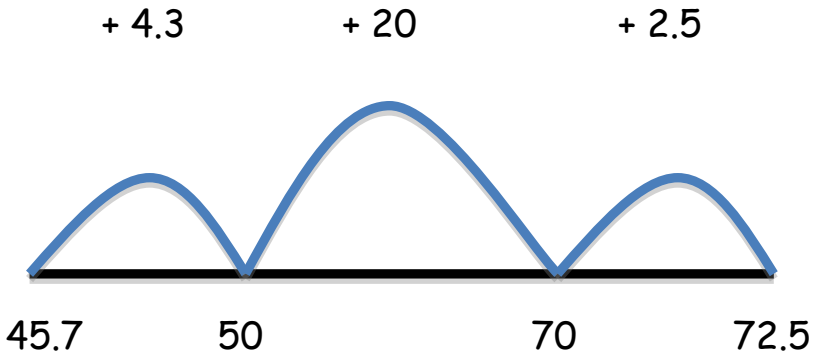
Subtraction with decimals

Once children are secure working with a compact method with integers they can be introduced to decimals. Money allows an ideal context for this to be first introduced, followed by other measures contexts. Ensure children are using the language of place value.

$$\begin{array}{r} {}^{3}\cancel{4}{}^{1}\cancel{.}{}^{1}\cancel{1}5 \\ -\ £3.27 \\ \hline £0.88 \end{array}$$

Children may also return to a numberline to help develop their mental understanding of integers and decimal numbers. Children should initially be exposed to questions in the context of measure and money.

72.5 – 45.7 = 26.8



$$\begin{array}{r} 6\ 11\ \ 1 \\ \cancel{7}\ \cancel{2}\ .\ 5 \\ -\ 4\ 5\ .\ 7 \\ \hline 2\ 6\ .\ 8 \end{array}$$

Children must be exposed to opportunities when they are able to recognise that either counting on or counting back is a more efficient method whether they are working mentally or using informal methods.

Subtraction - Year 5

- **Subtract whole numbers and decimal numbers with more than 4 digits, including the use of columnar subtraction.**

NB Ensure that children are confident with the methods outlined in the previous year's guidance before moving on. Continue to teach the use of empty number lines with larger numbers and decimals, as appropriate. Continue to develop the formal written method for subtraction with three and four digit numbers (see Y4 guidance), returning to an expanded method and using base ten materials, if necessary. Only when children are confident extend with larger numbers (and decimal numbers).

12731 – 1367 = 11364

$$\begin{array}{r} {\scriptstyle 6\ \ 12\ 11} \\ 1\,2\,\cancel{7}\,\cancel{3}\,\cancel{1} \\ -\ \ 1\,3\,6\,7 \\ \hline 1\,1\,3\,6\,4 \end{array}$$

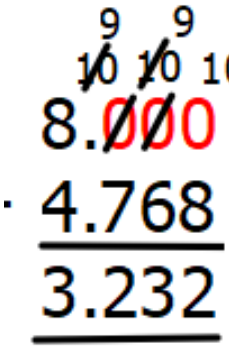
In this example it has been necessary to exchange from the tens and the hundreds columns. If children are making significant errors, provide calculations where only one exchange is required.

£166.25 - £83.72

$$\begin{array}{r} {\scriptstyle 16\ \ 5\ \ 12} \\ \cancel{1}\,\cancel{6}\,\cancel{6}\cdot\cancel{2}\,5 \\ -\ 8\,3\cdot 7\,2 \\ \hline 8\,2\cdot 5\,3 \end{array}$$

Introduce subtraction of decimals, initially in the context of money and measures. Ensure the decimal points line up.

8 - 4.768= 3.232



Use 0 as a place value holder to help line up the numbers correctly when appropriate.

Subtraction - Year 6

No objectives have been included in the programmes of study explicitly related to written methods for subtraction in Y6. However, there is an expectation that children will continue to practice and use the formal written method for larger numbers and decimals and use these methods when solving problems, when appropriate (see previous years' guidance for methods). Our aim is that by the end of Y6 children use mental methods (with jottings) when appropriate, but for calculations that they cannot do in their heads, they use an efficient formal written method accurately and with confidence.

Multiplication (x)

Multiplication facts

x 2, x 5, x 10	(Year 2 objectives)
x 3, x 4, x 8	(Year 3 objectives)
x 6, x 7, x 9, x 11, x 12	(Year 4 objectives)

This is the order we teach multiplication facts

Multiplication and division are very closely linked and should be taught as inverse operations.

6 x 3 = 18	3 x 6 = 18
18 ÷ 3 = 6	18 ÷ 6 = 3

Progression through the strategies on the following pages must tie in with progression through mental strategies that enables them to be successful.

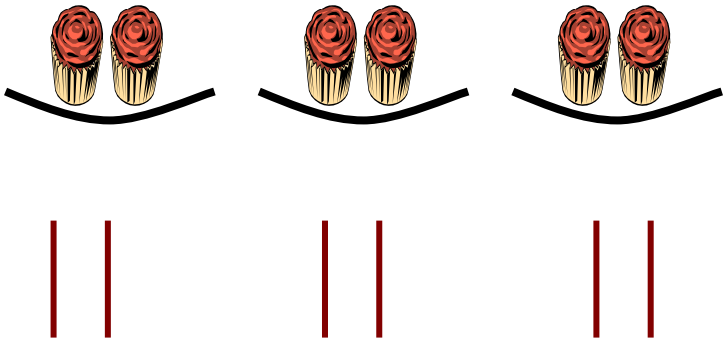
Ensure children are confident using the methods outlined below before progressing to Year 3 objectives.

Multiplication - Year 1 and Year 2

Early multiplication skills begin with counting in different steps and repeated addition
e.g. 2 + 2 + 2 = 6 which is the same as 2 x 3 = 6 or 3 x 2 = 6.

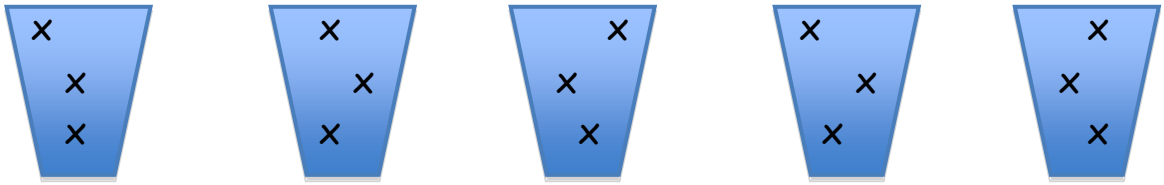
Multiplication using pictures, objects or symbols

There are three plates with two cakes on each place



This may be recorded as 3 x 2 = 2 + 2 + 2 = 6

There are three sweets in one bag. How many sweets are there in five bags?

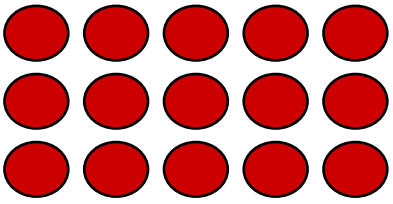


This may be recorded as 5 x 3 = 3 + 3 + 3 + 3 + 3 = 15

Multiplication using a visual groups or arrays

One way to make the idea of groups or sets clearer, is to draw them:

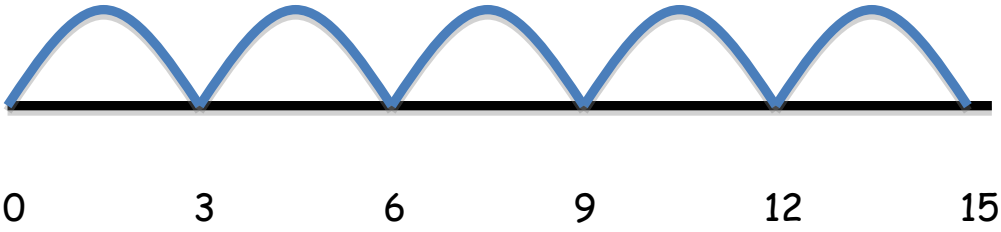
e.g. 3. x 5 =



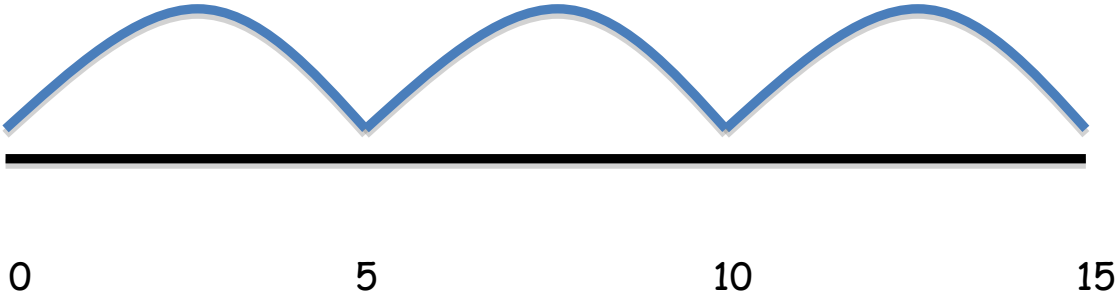
This allows the children to see how it can be thought of as 5 groups of 3, but also 3 groups of 5.

Multiplication using repeated addition on a number line

5 x 3 or 3 x 5 can be solved in this way:

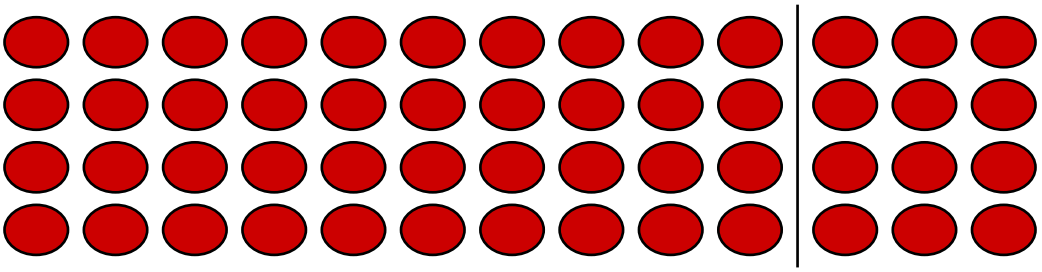


or



Multiplication using arrays linked to expanded grid method

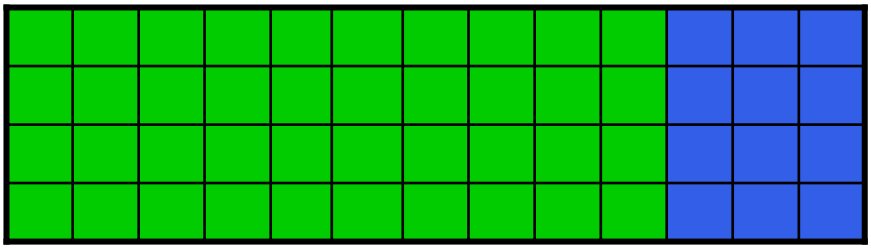
13 x 4



Children need to be able to see this and explain it as

10 x 4 = 40
3 x 4 = 12
13 x 4 = 52

The array is a good visual link to the expanded grid method.



13 x 4 = 52
10 x 4 = 40
3 x 4 = 12

Multiplication - Year 3

- **Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables (revise 2x, 5x and 10x).**
- **Using the 2, 5, 10, 3, 4 and 8 x-tables multiply TU by U using an expanded method of short multiplication.**

NB *Ensure that children are confident with the methods outlined in the previous year's guidance before moving on. Continue to use number lines and arrays to support multiplication, as appropriate.*

Multiplication using the compact grid method

Children need to have secure understanding of place value, partitioning and recall of multiplication facts for this method.

Children will begin multiplying teens by units before moving on to TU by U.

13 x 4 = 52

X	10	3
4	40	12

40 + 12 = 52

43 x 8 =

X	40	3
8	320	24

320 + 24 = 344

Multiplication using the expanded short multiplication method

When multiplying by a single digit number, another way of setting out multiplication is as a vertical calculation e.g. 23 x 3. Links should be made between the grid method and expanded short multiplication, with both methods initially being used alongside each other.

23	
x4	
12	(3 x 4) Multiply the ones
80	(20 x 4) Multiply the tens saying **twenty** times 4
92	Total the columns

Multiplication - Year 4

- **Recall multiplication and division facts for multiplication tables up to 12 × 12**
- **Multiply two-digit and three-digit numbers by a one-digit number using short multiplication**

NB *Ensure that children are confident with the methods outlined in the previous year's guidance before moving on. Continue to use empty number lines, arrays or the grid method as appropriate (see Y3 guidance). Further develop the expanded short multiplication method for two and three-digit numbers multiplied by a one- digit number.*

Multiplication using the compact written method

When multiplying by a single digit number, a more compact method can also be used than the expanded method. Initially, both methods should be used alongside each other.

23 x 7

23	Seven times 3 is twenty one.
x**7**	Put the **twenty** under the tens column
1	and the one in the ones column
2	

23	Seven times **twenty** is one hundred
x**7**	and forty plus the **twenty** underneath
161	makes **one hundred and sixty.**
2	Put the **sixty** in the tens column and the **one hundred** in the hundreds.

This then progresses on to HTU x O. Again both methods should initially be used alongside each other.

127 x 6 = 762

```
  1 2 7
x   6
-------
    4 2   (6x7)
+ 1 2 0   (6x20)
  6 0 0   (6x100)
-------
  7 6 2
-------
```

```
  1 2 7
x   6
-------
7 6 2
-------
1   4
```

Use the language of place value to ensure understanding. Ensure that the digits 'carried over' are written under the line in the correct column.

Remember, the grid method can be used to multiply combinations of numbers of any size, all that happens is that the size of the grid changes. If at any stage children are making significant errors do not hesitate to return to the expended method or grid method as these are clear and flexible approaches to multiplication which are much easier for children to understand and apply.

127 x 6 = 762

x	100	20	7
6	600	120	42

600 + 120 + 42 = 762 (add the partial products)

Possible use of columnar addition to add partial products when appropriate.

Multiplication - Year 5

- **Multiply numbers up to 4 digits by a one or two-digit number using short or long multiplication.**

NB *Ensure that children are confident with the methods outlined in the previous year's guidance before moving on. Build on the work covered in Y4 with the formal method of short multiplication (two-digit number multiplied by a one-digit number). When children are confident introduce multiplication by a two-digit number. If necessary, return to the expanded method and/or grid method first.*

Using the expanded long multiplication method

23 x 13 = 299

```
  2 3
X 1 3
    9   (3 x 3)
  6 0   (3 x 20)
+ 3 0   (10 x 3)
2 0 0   (10 x 20)
2 9 9
```

This leads into the compact long multiplication method

23 x 13 = 299

```
  2 3
X 1 3
+ 6 9   (3 x 23)
2 3 0   (10 x 23)
2 9 9
```

Use the language of place value to ensure understanding. Add the partial products. Initially provide examples with no 'carrying' within the partial products.

Extend to larger two digit numbers whereby digits are carried over in the partial products. Use the language of place value to ensure understanding.

56 x 27 = 1512

```
   5 6
 x 2 7
 -----
   3 9 4 2   (7x56)
+ 1 1 1 2 0  (20x56)
 -----------
   1 5 1 2
   1
```

When children are confident with long multiplication extend with three-digit numbers multiplied by a two-digit number, returning to the expanded or grid method first, if necessary.

124 x 26 = 3224

```
     1 2 4
 X     2 6
 -----------
     7 1 4 2 4   (6x124)
+ 2 4 8 0       (20x124)
 -------------
   3 2 2 4
   1 1
```

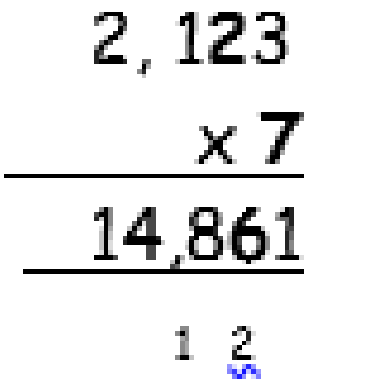
Multiplication - Year 6

- **Multiply multi-digit numbers (including decimals) up to 4 digits by two digit whole numbers.**

NB Ensure that children are confident with the methods outlined in the previous year's guidance before moving on. Continue to practise and develop the formal short multiplication method and formal long multiplication method with larger numbers and decimals throughout Y6. Return to an expanded forms of calculation initially (including grid method), if necessary (see Y5 guidance).

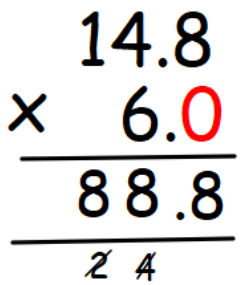
Short multiplication (including decimals)

Children should continue to rehearse using short multiplication for whole numbers up to 4 digits by 1 digit.

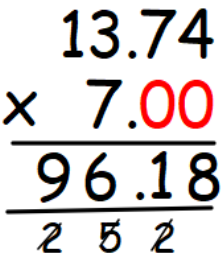


Children can be extended to decimal numbers. Option to include the 0 is optional. May help children to line numbers up correctly.

14.8 x 6 = 88.8



13.74 x 7 = 96.18



Formal long multiplication, including decimals

Children should continue practise multiplying numbers up to 4 digits by 2 digit numbers (as Year 5 guidance) before progressing to decimal numbers.

124 x 26 = 3224

```
   1 2 4
 X   2 6
 -------
   7 1 4 2 4   (6x124)
+ 2 4 8 0      (20x124)
 -------
   3 2 2 4
   1   1
```

```
     5 3·2
 x   2 4·0
 ---------
   2 1 1 2·8   (53·2 x 4)
 1 0 6 4 ·0    (53·2 x 20)
 ---------
 1 2 7 6 ·8
```

It is an option to include ·0 in this example, but not essential.

The prompts (in brackets) can be omitted if children no longer need them.

Division (÷)

Ensure children are confident using the methods outlined below before progressing to Year 3 objectives.

Division - Year 1 and Year 2

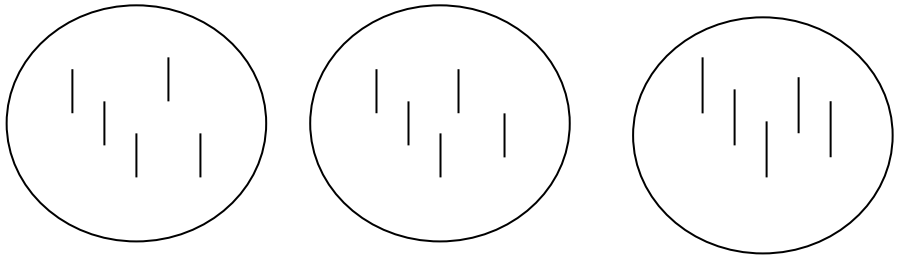
Early division begins with sharing in practical activities. It is important, however, that children go on to recognise that division has another meaning besides sharing. For example, 15 ÷ 3

Can mean 15 **shared** between 3 (3 lots of 5)
But it can also mean 15 **grouped** into 3s (5 lots of 3)

For written calculations, it is the idea of division as grouping which is used. This can be shown as repeated addition or subtraction e.g. 15 – 3 – 3 – 3 – 3 – 3. This shows that 3 has been taken away from 15 five times and can be shown on a number line.

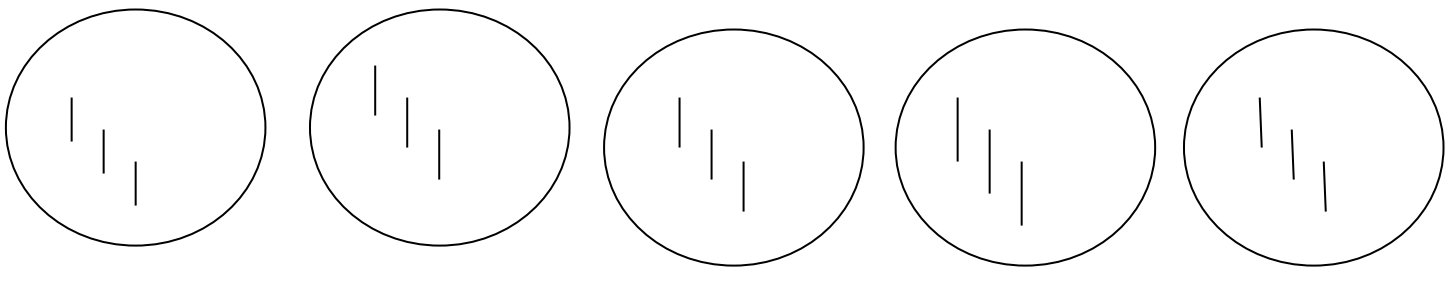
Grouping and sharing

Drawings can be used to help children visualise what they are doing, and can be used for both sharing and grouping.
e.g. 15 ÷ 3 = 5 (sharing between 3)



Here the children count how many are in each array to find the answer.

e.g. 15 ÷ 3 = 5 (grouping in 3s)



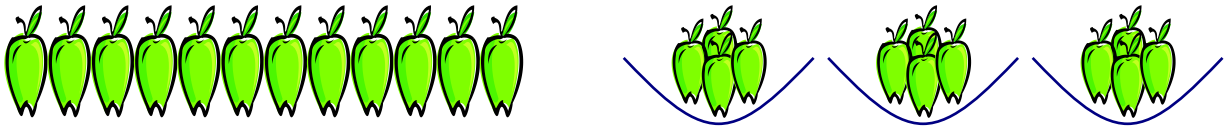
Here the children count how many arrays there are to find the answer

Sharing should be taught first, and then the children will be shown how to group, as it prepares them for grouping or chunking on a number line.

Children then apply this when solving simple problems:

Four eggs fit into a box. How many boxes would you need to pack 20 eggs?

12 apples are shared between 2 bowls. How many apples are in each bowl?

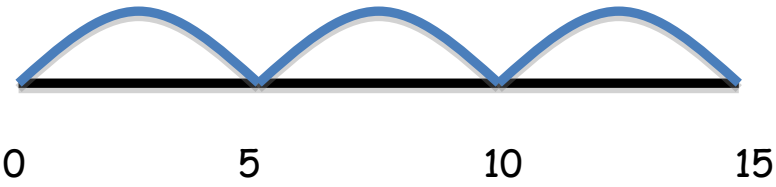


<u>Division using number lines and/or repeated addition</u>

As children become more competent and the numbers they work with get larger, the grouping and sharing method is refined.

This can be shown initially as repeated addition.

e.g 15 ÷ 5 = 3



This shows that there are 3 groups of 5 in 15.

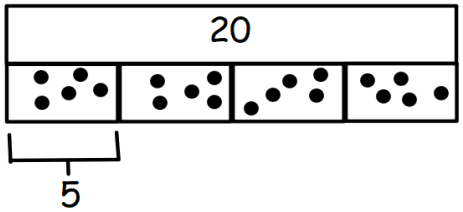
Division - Year 3

- **Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables (continue to practise the 2, 5 and 10 multiplication tables)**
- **Using the 2,5, 10, 3, 4 and 8 x-tables calculate mathematical statements. Use of jottings and / or a numberline to support chunking.**

NB Ensure that children are confident with the methods outlined in the previous year's guidance before moving on. Continue to use practical resources, pictures, diagrams, number lines, arrays and the ÷ sign to record, using multiples that they know, as appropriate. Children should develop their understanding of division as sharing and as grouping by using bar models. Children also use an empty numberline to count forwards and also jump back to make the link with repeated subtraction.

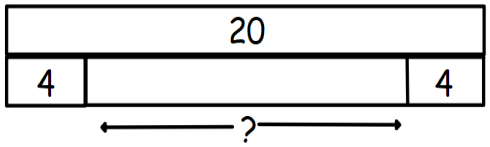
Bar Model to show division as sharing and grouping – use within contexts to show relationship.

Division to show sharing: 20 ÷ 4 = 5
E.g to show context. If 20 teddy bears are shared equally into 4 boxes, how many teddy bears will be in each box?



Product and number of groups are known, but group size is unknown. 'Share' 20 dots between the four groups. Count how many are in each group.

Division to show grouping: 20 ÷ 4 = 5
E.g to show context. If 20 teddy bears are to be packed 4 to a box, how many boxes are needed?

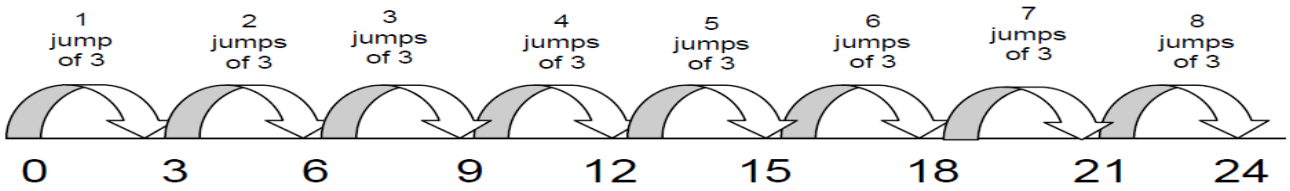


Product and group size is known. Number of groups are unknown. Draw in the groups of 4 until all 20 have been grouped. Count the groups.

Using an empty numberline to count forwards (grouping)...

24 ÷ 3 = 8

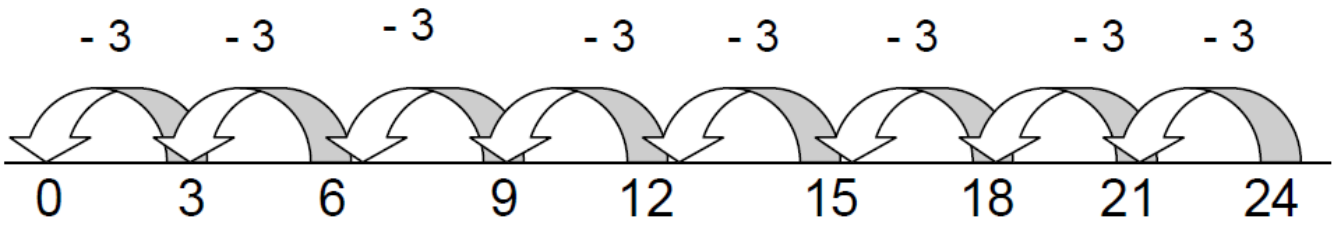
How many 3s in 24? Or how many groups of 3 in 24?



Children <u>may</u> also be taught to jump back to show the link with repeated subtraction (grouping)...

24 ÷ 3 = 8

How many groups of 3 in 24?

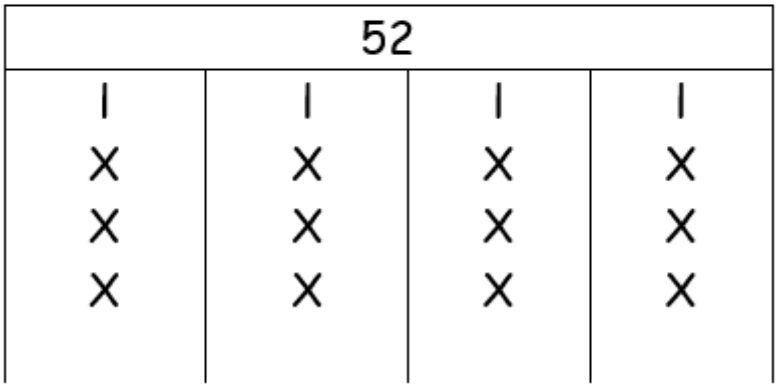


<u>Division by drawing dienes in a bar model (sharing)</u>

52 ÷ 4 = 13

40 ÷ 4 = 10

12 ÷ 4 = 3



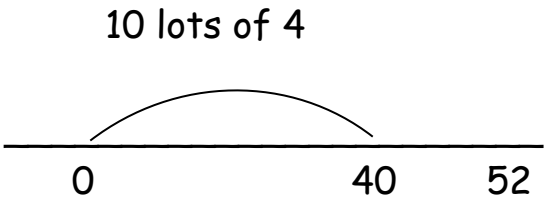
-Draw a bar model with the number you are dividing at the top. Don't draw a line across the bottom as you will be writing downwards.
- Split the bottom section of the bar model into the number you are dividing by.
- Using a line to show a 'ten stick', share out tens until you can not share out equally any more (write the number sentence if the method is understood).
- Count on in ones, using a cross for each one. Share out the ones until you reach the number you are dividing by (write the number sentence if the method is understood).

Division by chunking using a number line

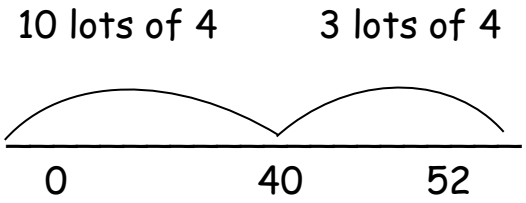
A method known as 'chunking' is introduced when the numbers to be divided start to get larger (first chunk being a multiple of 10). Children should be encouraged to chunk mentally in their heads and use jottings to support their chunks. Children will needs lots of practice of this.

52 ÷ 4

Draw a number line and using tables knowledge, start to count up from zero in chunks of 4. Again, it is most useful to use 'chunks' that are multiples of 10 wherever possible:-



Work out how many are left and, using tables knowledge, work out how many lots of 4 this is equal to:



Count up the lots of 4: 10 + 3

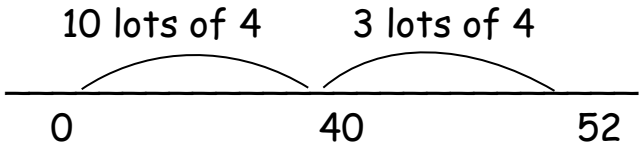
52 ÷ 4 = 13

Jottings

Alongside the methods for multiplication and division, the children will be encouraged to makes jottings to help them use their method. This will often be writing out the times table that will help them:

e.g.

52 ÷ 4



4
8
12
16
20
24
28
32
36
40
44
48
52 (13 lots of 4)

Division using partitioning and chunking (link with a numberline)

Partition 65 into 50 and 15
Children will need to practise partitioning in a variety of ways.

65 ÷ 5 = 13

65 = 50 + 15

50 ÷ 5 = 10
15 ÷ 5 = 3
10 + 3 = 13

Children should also write and calculate mathematical statements for division using the 2, 5, 10, 3, 4 and 8 multiplication tables.
E.g. 32 ÷ 8 = 4.

Division - Year 4

- **Recall multiplication and division facts for multiplication tables up to 12 × 12**

- **Divide two or three-digit numbers by a one digit number using expanded short division.**

NB *Ensure that children are confident with the methods outlined in the previous year's guidance before moving on. Continue to write and calculate mathematical statements for division using the multiplication tables that the children know. E.g. 32 ÷ 8 = 4.*

Introduce the formal layout using multiplication / division facts that the children know:

24 ÷ 3 = 8

This can be recorded as...

$$3\overline{)\,24}\quad 8$$

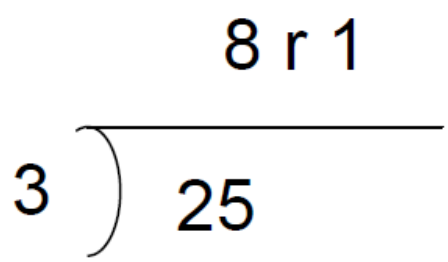
'Twenty four divided by three equals eight.'

'How many threes are there in twenty four?'

If significant errors are made return to the use of a numberline.

Continue using the formal written layout, introducing remainders:

25 ÷ 3 = 8 r1



This could be modelled using concrete materials and / or an empty number line, if necessary showing eight jumps of 3 from zero to twenty four ('and one left over makes 25')

Division using partitioning and chunking

Children may have been introduced to this in Year 3 using the times tables they were familiar with; however, as children progress through Year 4 times tables known and used in practice will widen.

98 ÷ 7 = 14

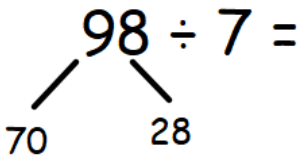
Partition 98 into 70 and 28
Children will need to practise partitioning in a variety of ways.

98 = 70 + 28

70 ÷ 7 = 10
28 ÷ 7 = 4
10 + 4 = 14

This could be modelled on an empty number line to further develop understanding. See Year 3 division objectives for counting up in chunks.

This leads into the expanded short division method

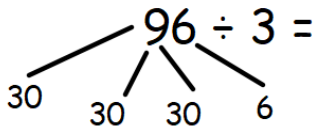


'We have partitioned 98 into 70 and 28 (90 = 70 +28).

Seven 'goes into' 70 ten times and seven 'goes into' 28 four times. Ten add four equals 14'

$$7 \overline{)\ 70 + 28}$$

$$10 + 4 = 14$$



$$3 \overline{)\ 30 + 30 + 30 + 6}$$

$$10 + 10 + 10 + 2 = 32$$

515 ÷ 5 = 103

100 3= 103

5 | 500 15

- Partition the number you are dividing into multiples of the number you are dividing by (you might need to partition into more than one group – see example at the bottom of the page)
-Write the number you are dividing by next to the "bus stop"
-Use times tables knowledge to partition the number you are dividing into multiples of the number you are dividing by e.g. 98 can be partitioned into 70 + 28 when dividing by 7 (10 lots of 7, 4 lots of 7)
-Write how many lots of that number goes into the partitioned values
- Repeat until you have fully divided the starting number and you can't chunk away any more
-Add up how many lots of the number fit into the partitioned value
-This is your answer.

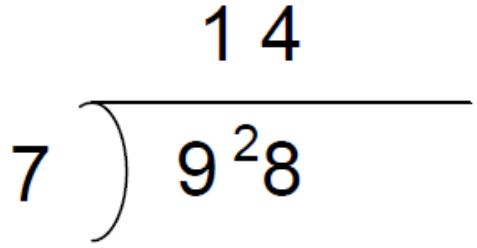
Division - Year 5

- **Divide numbers up to 4 digits by a one-digit number using short division and interpret remainders appropriately.**

NB *Ensure that children are confident with the methods outlined in the previous year's guidance before moving on and continue to make the link with partitioning.*

The formal written method of short division

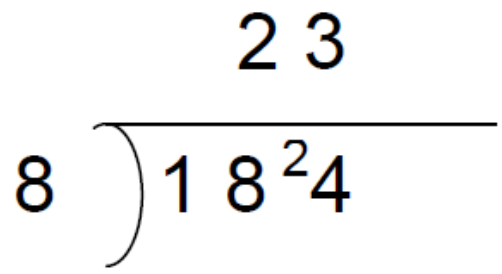
98 ÷ 7 = 14



Use the vocabulary of place value to ensure understanding and make the link to partitioning.

Progress to 3 and 4 digit numbers...

184 ÷ 8 = 23



Using short division with remainders

The remainder can also be expressed as a fraction, (the remainder divided by the divisor) and a decimal. This could be done as a quick conversion (e.g. 86 2/5 = 86.4) or by continuing to exchange into decimals.

432 ÷ 5 = 86 r2 = $86\frac{2}{5}$ = 86.4

$$5\overline{)\,4\,3^{3}2}\qquad 8\,6\,r\,2$$

$$5\overline{)\,4^{4}3^{3}2.^{2}0}\qquad 8\,6.\,4$$

Continue to practise, develop and extend the formal method of short division, with and without remainders. Interpret and express remainders according to the context.

Division - Year 6

- **Use short and long division to divide numbers up to 4 digits by two-digit whole numbers and interpret remainders appropriately.**

NB *Ensure that children are confident with the methods outlined in the previous year's guidance before moving on. Continue to practise the formal method of short division, with and without remainders, using the language of place value to ensure understanding (see Y5 guidance).*

Formal method of short division with remainders (extend to 2-digit divisors and ensure children are fluent with decimals)

$$\begin{array}{r} 45\text{ r }1 \\ 11\overline{)\,496} \end{array} \qquad \begin{array}{r} 86.4 \\ 5\overline{)\,432.0} \end{array}$$

The remainder can also be expressed as a fraction and a decimal when appropriate, (the remainder divided by the divisor).

Dividing by a two-digit number using a formal method of long division

$$\begin{array}{r} 45\text{ r }1 \\ 11\overline{)\,496} \\ -\,440 \quad (40 \times 11) \\ \hline 56 \\ -\,55 \quad (5 \times 11) \\ \hline 1 \quad \text{(remainder)} \end{array}$$

Multiples of the divisor (11) have been subtracted from the dividend (496)

'40 (lots of 11) + 5 (lots of 11) = 45 (lots of 11)'

'1 is the remainder'
Answer: 45 r1

Children will need to select the most effective method for each calculation /problem they meet, including whether to use the standard, formal written method of long division.

432 ÷ 15 =28 r12 = 28 12/15 = 28 4/5 = 28.8

```
      28 r12
    ---------
15 ) 432
     300   (20 x 15)
     ---
     132
     120   (8 x 15)
     ---
      12   (remainder)
```

Multiples of the divisor (15) have been subtracted from the dividend (432)

'20 (lots of 15) + 8 (lots of 15) = 28

12 is the remainder'

The remainder can also be expressed as a fraction (28 and 4/5), (the remainder divided by the divisor) or as a decimal, 0.8 (see next example).

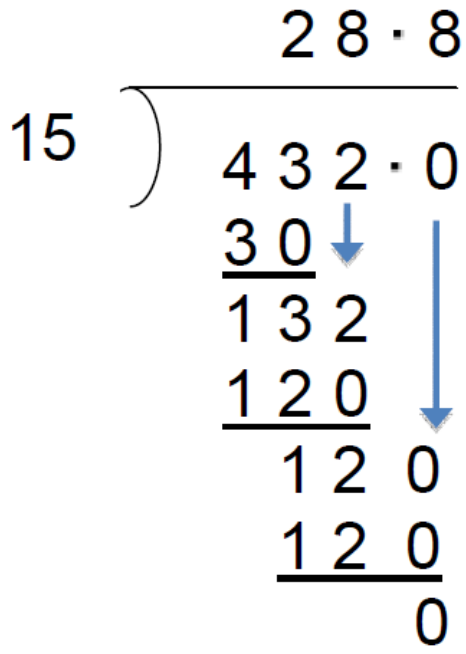
Formal Long Division – numbers up to 4 digits divided by 2-digit numbers.

Lots of practise writing out facts using 1x, 10x, 5x derive. Children may practise the method by dividing by 1 digit numbers first.

```
      67
   ------
36 | 2412
     216↓
     ----
      252
      252
      ---
      000
```

1 – 36
2 – 72
3 - 108
4 – 144
5 – 180
6 – 216
7 – 252
8 – 288
9 – 324
10 - 360

432 ÷ 15 = 28.8



The remainder is expressed as a decimal.