Ashton Keynes C of E Primary School

Calculation policy

May 2017

To be reviewed: May 2018

Introduction

This document sets out the methods used at Ashton Keynes Primary School to teach children how to add, subtract, multiply and divide. It has been compiled with reference to the revised programmes of study for Mathematics, which became statutory in September 2014.

Each calculation method is presented to show progression from Year R through to Year 6. The statutory requirements for each year group have been displayed at the top of each year group section to give an indication of the expectations at the end of the academic year.

Our teaching sequences move from concrete objects (counters, cubes etc) to pictorial (diagrams and notes) to abstract (typical 'calculations') across all areas of Maths and examples of how these are used can be found at the end of this policy.

It should be noted that methods described for each year group are for children working at the typical level expected for their age, although teachers will use methods from year groups above and below, according to the needs of the individual child and the class as a whole.

If you would like further information regarding how these methods are used in your child's class, please speak to their teacher in the first instance, who will be able to talk you through the methods used.

Mrs L. Voss

Mathematics Subject Leader

Addition

EYFS (Reception) Addition

Statutory Requirements

Pupils should be taught to:

- read, write and interpret mathematical statements involving addition (+) and equals (=) signs (called 'number sentences' and calculations)
- represent and use number bonds within 10
- add one-digit numbers to 20, including zero
- solve one-step problems that involve addition, using concrete objects and pictorial representations.

Concrete Objects

Finding the total of a group of items e.g. counters, teddies, dinosaurs etc

Pictures/Marks

Using simple drawings to record and calculate the total.

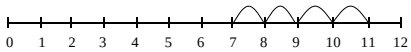
e.g. Lisa has 5 lollies and Tim has 2 lollies.
How many lollies do they have altogether?

Number Lines

Using prepared number lines to record 'jumps' and drawing own number lines to solve calculations.

e.g.

7 + 4



100 Squares

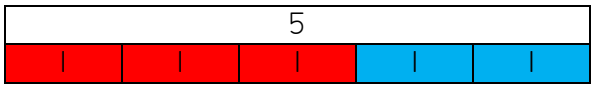
Become familiar with 100 squares to count forwards and backwards.

Bar Modelling

Drawing a bar model to represent real life problems.

e.g.

I have 3 red pens and 2 blue pens. How many are there altogether?



Year 1 Addition

Statutory Requirements

Pupils should be taught to:

- read, write and interpret mathematical statements involving addition (+) and equals (=) signs
- represent and use number bonds within 20
- add one-digit and two-digit numbers to 20, including zero
- solve one-step problems that involve addition, using concrete objects and pictorial representations, and missing number problems such as 7 = □ + 2.

Concrete Objects

Finding the total of a group of items e.g. counters, teddies, dinosaurs etc

Using Numicon to notice patterns when adding two quantities.

Pictures/Marks

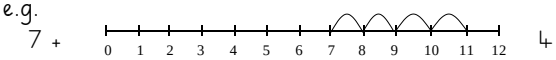
Using simple drawings to record and calculate the total.

e.g. Lisa has 5 lollies and Tim has 2 lollies.
How many lollies do they have altogether?

Number Lines

Using prepared number lines to record 'jumps' and drawing own number lines to solve calculations.

e.g.



100 Squares

Finding a starting point on the hundred square and moving to the right to count on in ones or moving down to add tens.

Bar Modelling

As at Year R, for larger numbers. Individual cells are removed to show the numbers as a part of the whole.

e.g. 16 + 4 =

?	
16	4

Year 2 Addition

Statutory Requirements

Pupils should be taught to:

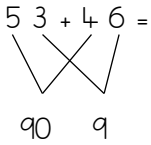
- solve problems with addition:
  - using concrete objects and pictorial representations, including those involving numbers, quantities and measures
  - applying their increasing knowledge of mental and written methods
- recall and use addition facts to 20 fluently, and derive and use related facts up to 100
- add numbers using concrete objects, pictorial representations, and mentally, including:
  - a two-digit number and ones
  - a two-digit number and tens
  - two two-digit numbers
  - adding three one-digit numbers
- show that addition of two numbers can be done in any order (commutative)
- recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.

Concrete Objects, Pictures/Marks

As in Year 1, to solve problems with numbers, quantities and measures.

Partitioning

Using lines or a 'W' to connect the tens and ones.
e.g. 53 + 46 = 99



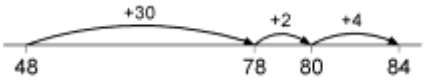
Ensuring that tens are discussed as such:
"50 add 40 equals 90, and 3 add 6 equals 9. 90 add 9 equals 99."
Children should be encouraged to partition in different ways
e.g. 53 + 46 = 50 + 50 + 3 + 6, or 53 + 40 + 6 etc
Children also solve missing number problems by rearranging calculations:
e.g. 53 + 46 = □ + 6
"53 + 40 is 93, then we can add 6 to make 99."

Bar Modelling

Continuing from Year 1, to model addition calculations and to help understand and solve addition problems.

Number Lines

Starting with the largest number and adding tens and ones in 'chunks' or bridging to the nearest 10.
e.g. 36 + 48 = 84



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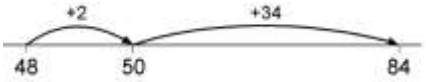
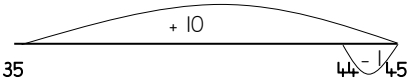


To add near multiples of 10 e.g. 9 or 31, children should add the multiple of 10 and adjust the answer:
e.g. 35 + 9 = 44



Expanded Column, stage 1

Setting out the calculation with tens and ones lined up. At this stage children would not add 'ones' where the total exceeds 10.
e.g. 37 + 52 = 89

30 + 7
50 + 2 +
80 + 9

Year 3 Addition

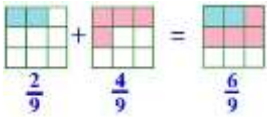
Statutory Requirements

Pupils should be taught to:

- add numbers mentally, including:
  - a three-digit number and ones
  - a three-digit number and tens
  - a three-digit number and hundreds
- add numbers with up to three digits, using formal written methods of columnar addition
- estimate the answer to a calculation and use inverse operations to check answers
- solve problems, including missing number problems, using number facts, place value, and more complex addition.
- add fractions with the same denominator within one whole [for example, $\frac{5}{7} + \frac{1}{7} = \frac{6}{7}$]

Concrete Objects, Pictures and Diagrams

As in Year 1, but used to add fractions.

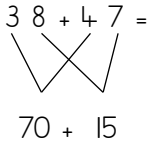


Known Facts

Using place value, known facts and hundred squares to add 3-digit numbers and ones, tens or hundreds mentally.
e.g. 354 + 30 = 384
In this example, the tens digits are most significant.

Partitioning

Using lines or a 'W' to connect the tens and ones. The total of the 'ones' may exceed 10.
e.g. 38 + 47 = 85



Ensuring that tens are discussed as such:
"30 add 40 equals 70, and 8 add 7 equals 15.
70 add 15 equals 85."

Bar Modelling

As in Year 2, but for more complex addition calculations and adding fractions with the same denominator within one whole.

Expanded Column, stage 2

Setting out the calculation with tens and ones lined up. Begin by adding the ones, then the tens, recording each step of the calculation on a new line, initially with a note in brackets beside.
e.g.

47
76 +
13 (7 + 6)
110 (40 + 70)
123

Progress to adding 3-digit numbers in this way.

Compact Column

Line up tens and ones. Begin by adding ones, then the tens. Record answer in appropriate column e.g. 8 + 7 =15, so 5 is recorded in the ones column and 1 as a note below the answer box in the tens column.
e.g.

27
58 +
85
1

Progress to adding 3-digit numbers in this way.

Year 4 Addition

Statutory Requirements

Pupils should be taught to:

- add numbers with up to 4 digits using the formal written method of columnar addition where appropriate
- estimate and use inverse operations to check answers to a calculation
- solve addition two-step problems in contexts, deciding which operations and methods to use and why.
- add fractions with the same denominator

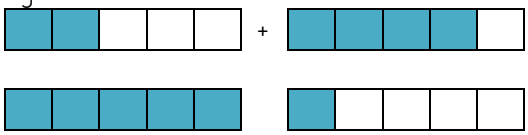
Mental Methods

Children will choose and use the most suitable method from those learnt in previous years to solve a particular calculation.

Bar Modelling

As in Year 2, but for more complex addition calculations and adding fractions with the same denominator.

e.g. 2/5 + 4/5 = 6/5 (or 1 1/5)



Compact Column

Line up hundreds, tens and ones. Continue to start by adding ones, then tens and hundreds. Digits needing to be carried should be called by their value e.g. carry 10 (not carry one) to help children remember their value. Carry digits are recorded below the answer line, in the column according to their value.

e.g.

```
  247
  581 +
  828
  1
```

Progress to adding 4-digit numbers and decimals (in the context of money) in this way.

Year 5 Addition

Statutory Requirements

Pupils should be taught to:

- add whole numbers with more than 4 digits, including using formal written methods (columnar addition)
- add numbers mentally with increasingly large numbers
- use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy
- solve addition multi-step problems in contexts, deciding which operations and methods to use and why.
- add fractions with the same denominator and denominators that are multiples of the same number

Mental Methods

Children will continue to choose and use the most suitable method from those learnt in previous years to solve a particular calculation.

Compact Column

As in Year 4, adding increasingly larger numbers and decimals to 2 decimal places.

Bar Modelling

Used to solve problems with two or more steps.

e.g. What is the total of a yo-yo costing £2.75, a DVD costing £14.00 and a poster costing £2.75?

?		
£2.75	£14.00	£2.75

Year 6 Addition

Statutory Requirements

Pupils should be taught to:

- perform mental calculations, including with mixed operations and large numbers
- use their knowledge of the order of operations to carry out calculations involving the four operations
- solve addition multi-step problems in contexts, deciding which operations and methods to use and why
- solve problems involving addition
- use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.
- add fractions with different denominators and mixed numbers, using the concept of equivalent fractions

Mental Methods Children will continue to choose and use the most suitable method from those learnt in previous years to solve a particular calculation. They will use the order of operations to solve calculations: BODMAS (brackets, orders, division, multiplication, addition, subtraction) or BIDMAS (brackets, indices, division, multiplication, addition, subtraction).	**Compact Column** As in Year 4, adding increasingly larger numbers and decimals to 2 decimal places.
Bar Modelling As in previous years, for multi-step problems involving fractions, decimals, percentages and measures including money. Children are expected to demonstrate their understanding of the approximate value of each part of the bar model, drawing roughly to scale.	

Subtraction

EYFS (Reception) Subtraction

Statutory Requirements

Pupils should be taught to:

- read, write and interpret mathematical statements involving subtraction (–) and equals (=) signs
- represent and use related subtraction facts within 10
- subtract one-digit numbers to 20, including zero
- solve one-step problems that involve subtraction, using concrete objects and pictorial representations.

Concrete Objects

Finding the difference between two groups of items e.g. counters, teddies, dinosaurs etc

Pictures/Marks

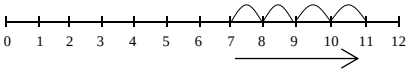
Using simple drawings to record and calculate the difference.

e.g. Sam spent 4p. What was his change from 10p?

Number Lines – counting on

Using prepared number lines to record 'jumps' and drawing own number lines to solve calculations.

e.g. 11 – 7 = 4

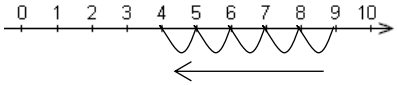


Start at 7 and jump up to 11. How many jumps have you made?

Number Lines – counting back

Using prepared number lines to record backwards 'jumps' below the line and drawing own number lines to solve calculations.

e.g. 9 – 5 = 4



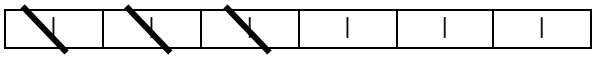
Start at 9 and jump back 5. Where have you landed?

Bar Modelling

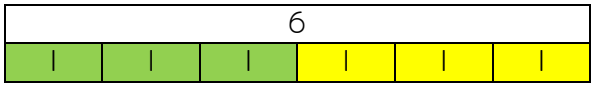
Drawing a bar model to represent real life problems.

e.g.

There are 6 children in the garden and 3 come into the classroom. How many are left in the garden?



6 children – 3 children = 3 children



Year 1 Subtraction

Statutory Requirements

Pupils should be taught to:

- read, write and interpret mathematical statements involving subtraction (–) and equals (=) signs
- represent and use related subtraction facts within 20
- subtract one-digit and two-digit numbers to 20, including zero
- solve one-step problems that involve subtraction, using concrete objects and pictorial representations, and missing number problems such as 7 = □ – 9.

Concrete Objects

Finding the difference between two groups of items e.g. counters, teddies, dinosaurs etc

Using Numicon/cubes to notice the difference between two numbers.

Pictures/Marks

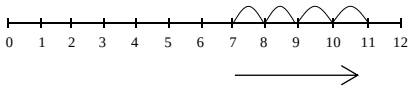
Using simple drawings to record and calculate the difference.

e.g. Sam spent 4p. What was his change from 10p?

Number Lines – counting on

Using prepared number lines to record 'jumps' and drawing own number lines to solve calculations.

e.g. 11 – 7 = 4

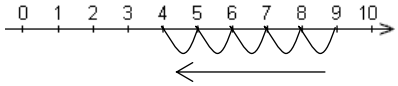


Start at 7 and jump up to 11. How many jumps have you made?

Number Lines – counting back

Using prepared number lines to record backwards 'jumps' below the line and drawing own number lines to solve calculations.

e.g. 9 – 5 = 4



Start at 9 and jump back 5. Where have you landed?

100 Squares

Finding a starting point on the hundred square and moving to the left to count back in ones or moving up to subtract tens.

Bar Modelling

As in Year R, for more complex calculations and to demonstrate subtraction problems.

Year 2 Subtraction

Statutory Requirements

Pupils should be taught to:

- solve problems with subtraction:
  - using concrete objects and pictorial representations, including those involving numbers, quantities and measures
  - applying their increasing knowledge of mental and written methods
- recall and use subtraction facts to 20 fluently, and derive and use related facts up to 100
- subtract numbers using concrete objects, pictorial representations, and mentally, including:
  - a two-digit number and ones
  - a two-digit number and tens
  - two two-digit numbers
- show that and subtraction of one number from another cannot be done in any order
- recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.

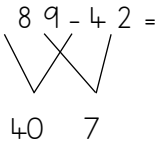
Concrete Objects, Pictures/Marks

As in Year 1, to solve problems with numbers, quantities and measures.

Partitioning

Using lines or a 'W' to connect the tens and ones.

e.g. 89 - 42 = 47



Ensuring that tens are discussed as such:

"80 take away 40 equals 40, and 9 take away 2 equals 7. Altogether we have taken away 47."

Adjusting

Subtracting the tens first, then the ones:

e.g. 89 – 42

89 – 40 = □ - 2

"89 – 40 is 49, then we can subtract 2 more. The answer is 47."

Bar Modelling

Using empty 'bars' and partially completed bars to illustrate calculations.

e.g. 28 - 12 = 16

Different sections of the bar can be left empty

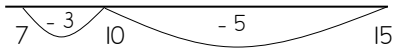
28	
12	?

Number Lines

As in Year 1.

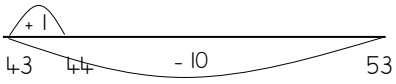
Continue to count on by jumping above the line, or count back jumping below the line. Encourage children to work towards subtracting tens and ones in 'chunks' or bridging to the nearest 10.

e.g. 15 – 8 = 7



To subtract near multiples of 10 e.g. 9 or 11, children should subtract the multiple of 10 and adjust the answer:

e.g. 53 - 9 = 44



Expanded Column, stage 1

Setting out the calculation with tens and ones lined up. At this stage children would not exchange tens for ones (decomposition).

e.g. 77 - 24 = 53

70 + 7
20 + 4 -
50 + 3

Year 3 Subtraction

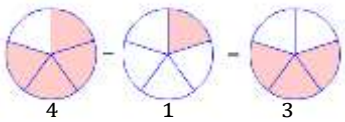
Statutory Requirements

Pupils should be taught to:

- subtract numbers mentally, including:
  - a three-digit number and ones
  - a three-digit number and tens
  - a three-digit number and hundreds
- subtract numbers with up to three digits, using formal written methods of columnar subtraction
- estimate the answer to a calculation and use inverse operations to check answers
- solve problems, including missing number problems, using number facts, place value, and more complex subtraction.
- subtract fractions with the same denominator within one whole [for example, $\frac{4}{6} - \frac{1}{6} = \frac{3}{6}$]

Concrete Objects, Pictures and Diagrams

As in Year 1, but used to subtract fractions.



$\frac{4}{5} - \frac{1}{5} = \frac{3}{5}$

Known Facts

Using place value, known facts and hundred squares to subtract 3-digit numbers and ones, tens or hundreds mentally.

e.g. 496 - 200 = 296

In this example, the hundreds digits are most significant.

Partitioning

Using lines or a 'W' to connect the tens and ones where exchanging is needed. Identify that you can't subtract a larger number from a smaller one, so you will need to exchange one of the tens for 10 ones.

e.g. 72 - 37 = 35

72 - 37 =

70-30 + 2-7 ⟶ can't do!

(60-30) + (12-7)

30 + 5

'Carrying' should not be used to describe taking a ten and putting it into the ones column – use 'exchanging' because it is being exchanged for 10 ones.

Expanded Column, stage 2

Setting out the calculation with tens and ones lined up. Begin by subtracting the ones, then the tens, recording each step of the calculation on a new line, initially with a note in brackets beside.

e.g.

97

36 -

1 (7 - 6)

60 (90 - 30)

61

Progress to subtracting 3-digit numbers in this way and exchanging.

e.g.

7 1

382

147 -

5 (12 – 7)

30 (70 – 40)

200 (300 – 100)

235

Compact Column

Line up tens and ones. Begin by subtracting ones, then the tens. As for expanded method, record exchanges made above the relevant digits.

e.g.

7 1

86

58 -

28

Progress to subtracting 3-digit numbers in this way.

Bar Modelling

As in Year 2, but for more complex subtraction calculations and subtracting fractions with the same denominator within one whole.

Year 4 Subtraction

Statutory Requirements

Pupils should be taught to:

- subtract numbers with up to 4 digits using the formal written method of columnar subtraction where appropriate
- estimate and use inverse operations to check answers to a calculation
- solve subtraction two-step problems in contexts, deciding which operations and methods to use and why.
- subtract fractions with the same denominator

Mental Methods

Children will choose and use the most suitable method from those learnt in previous years to solve a particular calculation.

Compact Column

Using the same method for Year 3, progressing to subtracting 4-digit numbers and decimals (in the context of money) in this way.

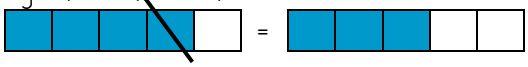
e.g.

```
  4 1
£3.57
£1.29 –
£2.28
```

Bar Modelling

As in Year 2, but for more complex subtraction calculations and subtracting fractions with the same denominator.

e.g. 4/5 - 1/5 = 3/5



Year 5 Subtraction

Statutory Requirements

Pupils should be taught to:

- subtract whole numbers with more than 4 digits, including using formal written methods (columnar subtraction)
- subtract numbers mentally with increasingly large numbers
- use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy
- solve subtraction multi-step problems in contexts, deciding which operations and methods to use and why.
- subtract fractions with the same denominator and denominators that are multiples of the same number

Mental Methods Children will continue to choose and use the most suitable method from those learnt in previous years to solve a particular calculation.	**Compact Column** As in Year 4, subtracting increasingly larger numbers and decimals to 2 decimal places.
Bar Modelling Continue to use bars to represent known numbers and missing amounts in problem-solving questions.	

Year 6 Subtraction

Statutory Requirements

Pupils should be taught to:

- perform mental calculations, including with mixed operations and large numbers
- use their knowledge of the order of operations to carry out calculations involving the four operations
- solve subtraction multi-step problems in contexts, deciding which operations and methods to use and why
- solve problems involving subtraction
- use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.
- subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions

Mental Methods Children will continue to choose and use the most suitable method from those learnt in previous years to solve a particular calculation. They will use the order of operations to solve calculations: BODMAS (brackets, orders, division, multiplication, addition, subtraction) or BIDMAS (brackets, indices, division, multiplication, addition, subtraction).	**Compact Column** As in Year 4, subtracting increasingly larger numbers and decimals to 2 decimal places.
Bar Modelling As in previous years, for multi-step problems involving fractions, decimals, percentages and measures including money. Children are expected to demonstrate their understanding of the approximate value of each part of the bar model, drawing roughly to scale.	

Multiplication

EYFS (Reception) Multiplication

Statutory Requirements

Pupils should be taught to:

- solve one-step problems involving multiplication, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.

Concrete Objects

Grouping items in pairs, groups of 5 etc.
Counting in 2s, 5s and 10s.
Doubling numbers to 20

Pictures/Marks

Using simple drawings to record and calculate the total.

e.g. There are 3 sweets in one bag.
How many sweets will there be in 5 bags?

Bar Modelling

Used to demonstrate a real-life situation involving multiplying.
e.g.
If there are 6 pairs of socks hanging on the washing line, how many socks will there be altogether?

?					
2	2	2	2	2	2

(May draw the socks in each section before using numbers.)

Year 1 Multiplication

Statutory Requirements

Pupils should be taught to:

- solve one-step problems involving multiplication, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.

Concrete Objects

Grouping items in pairs, groups of 5 etc.
Counting in 2s, 5s and 10s.
Doubling numbers to 20

Pictures/Marks

Using simple drawings to record and calculate the total.

e.g. There are 3 sweets in one bag.
How many sweets will there be in 5 bags?

Arrays

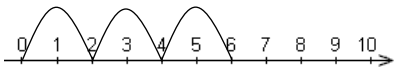
Representing multiplication calculations in columns and rows using repeated addition and multiplication:

4 + 4 = 8 or 2 + 2 + 2 + 2 = 8
4 x 2 = 8 or 2 x 4 = 8

Number Lines

Using prepared number lines to record 'jumps' and drawing own number lines to solve calculations.

e.g.
2 x 3



0 2 4 6

Bar Modelling

As at Year R, to represent problems and assist understanding.

Year 2 Multiplication

Statutory Requirements

Pupils should be taught to:

- recall and use multiplication facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers
- calculate mathematical statements for multiplication within the multiplication tables and write them using the multiplication (×) and equals (=) signs
- show that multiplication of two numbers can be done in any order (commutative)
- solve problems involving multiplication, using materials, arrays, repeated addition, mental methods, and multiplication facts, including problems in contexts.

Concrete Objects

Grouping items in pairs, groups of 5, 10 etc.
Counting in 2s, 5s and 10s, both forwards and backwards.

Pictures/Marks

As at Year 1.
For calculations and problems using 2, 5 and 10 times tables.

100 Square

Finding multiples of 2, 5 and 10, looking for patterns.

Arrays

As at Year 1.
For calculations and problems using 2, 5 and 10 times tables.

Number Lines

At as Year 1.
For calculations and problems using 2, 5 and 10 times tables.

Bar Modelling

To illustrate problems involving repeated addition.
e.g. 7 x 5 = 35

?				
7	7	7	7	7

Partitioning

Using lines or a 'W' to multiply both digits in the 2-digit number by the 1-digit number.
e.g. 15 x 6 = 90

10x6=60 + 5x6=30

Ensuring that tens are discussed as such:
"6 tens are 60 and 6 fives are 30. 60 add 30 is 90, so 6 fifteens are 90."

Year 3 Multiplication

Statutory Requirements

Pupils should be taught to:

- recall and use multiplication facts for the 3, 4 and 8 multiplication tables
- write and calculate mathematical statements for multiplication using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods
- solve problems, including missing number problems, involving multiplication, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects.

Concrete Objects

Grouping items in groups of 3, 4, 8 etc.
Counting in 3s, 4s and 8s, both forwards and backwards.

100 Square

Finding multiples of 3, 4 and 8, looking for patterns.

Arrays

As at Year 1.
For calculations, problems and showing the commutative law using 3, 4 and 8 times tables.

Partitioning

As for Year 2, using known facts to simplify calculations.

Mental Methods

Using knowledge from multiplication tables when multiplying by multiples of 10
e.g. 42 x 3

4 x 3 = 12
so
(40 x 3 = 120) + (2 x 3 = 6)
120 + 6 = 126

Short Multiplication, stage 1

Setting out the calculation with tens and ones lined up. Begin by multiplying the ones, then the tens, recording each step of the calculation on a new line, initially with a note in brackets beside. Complete the calculation by adding the two rows of 'working out'.
e.g.

```
  24
   6 x
  24 (6 x 4)
 120 (6 x 20)
 144
```

Short Multiplication, stage 2

Setting out the calculation with tens and ones lined up. Begin by multiplying the ones, then the tens. Show tens that are carried as a note below the answer line in the tens column.
e.g.

```
  36
   5 x
 180
  3
```

Bar Modelling

As for Year 2, to illustrate multiplication problems.

Year 4 Multiplication

Statutory Requirements

Pupils should be taught to:

- recall multiplication facts for multiplication tables up to 12 × 12
- use place value, known and derived facts to multiply mentally, including: multiplying by 0 and 1; multiplying together three numbers
- recognise and use factor pairs and commutativity in mental calculations
- multiply two-digit and three-digit numbers by a one-digit number using formal written layout
- solve problems involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects.

Mental Methods

Using known multiplication facts and place value knowledge to solve more complex calculations.

e.g. 2 x 3 = 6, so 2 x 300 = 600

2 x 6 x 5 = 2 x 5 x 6 = 10 x 6 = 60

Short Multiplication, stage 2

As in Year 3, progressing to 3-digit numbers multiplied by 1-digit numbers.

e.g.

```
  1 2 4
    3 x
  3 7 2
  1
```

Bar Modelling

As in Year 3, for multiplication tables and related facts, and visualising problem-solving questions.

e.g. 50 x 6 = 300

?					
50	50	50	50	50	50

Year 5 Multiplication

Statutory Requirements

Pupils should be taught to:

- identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers
- know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers
- establish whether a number up to 100 is prime and recall prime numbers up to 19
- multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers
- multiply numbers mentally drawing upon known facts
- multiply whole numbers and those involving decimals by 10, 100 and 1000
- recognise and use square numbers and cube numbers, and the notation for squared (^{2}) and cubed (^{3})
- solve problems involving multiplication including using their knowledge of factors and multiples, squares and cubes
- solve problems involving multiplication and a combination of the four operations, including understanding the meaning of the equals sign
- solve problems involving multiplication, including scaling by simple fractions and problems involving simple rates.
- multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams

Short Multiplication, stage 2

As in Year 3, progressing to 4-digit numbers multiplied by 1-digit numbers.

e.g.

```
  1 2 6 4
      5 x
  ---------
  6 3 2 0
  1 3  2
```

Notes

Used when multiplying proper fractions and mixed numbers by whole numbers.

e.g. $\frac{2}{5} \times 3 = \frac{6}{5} = 1\frac{1}{5}$

$1\frac{3}{4} \times 5 = 5\frac{15}{4} = 8\frac{3}{4}$

Long Multiplication, stage 1

Setting out the calculation with tens and ones lined up. Begin by multiplying the ones from the bottom number with the ones from the top number, then the tens from the top number, recording each step of the calculation on a new line, initially with a note in brackets beside. Repeat by multiplying the tens from the bottom number with the ones from the top number and the tens from the top number. Complete the calculation by adding up the 4 rows.

e.g.

```
    2 4
    3 6 x
    2 4  (6 x 4)
  1 2 0  (6 x 20)
  1 2 0  (30 x 4)
  6 0 0  (30 x 20)
  -------
  8 6 4
```

Long Multiplication, stage 2

Setting out the calculation with tens and ones lined up. Multiply the ones from the bottom number with the ones from the top number, then the tens from the top number, recording any tens or hundreds as notes below the answer line in the appropriate column. Repeat by multiplying the tens from the bottom number with the ones from the top number and the tens from the top number.

e.g.

```
    1 7
    2 5 x
    8 5
      3
  3 4 0
  1
  -------
  4 2 5
  1
```

Bar Modelling

Continued from previous years, to support with problem-solving.

Year 6 Multiplication

Statutory Requirements

Pupils should be taught to:

- multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication
- perform mental calculations, including with mixed operations and large numbers
- use their knowledge of the order of operations to carry out calculations involving the four operations
- solve problems involving multiplication
- use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.
- multiply simple pairs of proper fractions, writing the answer in its simplest form [for example, $\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$]
- multiply one-digit numbers with up to two decimal places by whole numbers

Mental Methods

Children will continue to choose and use the most suitable method from those learnt in previous years to solve a particular calculation.

They will use the order of operations to solve calculations: BODMAS (brackets, orders, division, multiplication, addition, subtraction) or BIDMAS (brackets, indices, division, multiplication, addition, subtraction).

Notes

As in Year 5, progressing to multiply simple pairs of proper fractions.

e.g. $\frac{2}{5} \times \frac{1}{2} \xrightarrow{=} \frac{2 \times 1}{5 \times 2} = \frac{2}{10} = \frac{1}{5}$

Grid Method

As in Year 3, but used to multiply one-digit numbers with up to two decimal places by whole numbers.

e.g. 1.63 x 4 = 6.52

x	1	0.6	0.03
4	4	2.4	0.12

As multiplication can be done in any order (commutative), the grid can also be set out as follows:

1.63 x 4 = 6.52

x	4
1	4
0.6	2.4
0.03	0.12

Long Multiplication, stage 2

As in Year 5, progressing to multiplying 4-digit numbers by 2-digit numbers.

Bar Modelling

As in previous years, for multi-step problems involving fractions, decimals, percentages and measures including money. Children are expected to demonstrate their understanding of the approximate value of each part of the bar model, drawing roughly to scale.

Division

EYFS (Reception) Division

Statutory Requirements

Pupils should be taught to:

- solve one-step problems involving division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.
- recognise, find and name a half as one of two equal parts of an object, shape or quantity

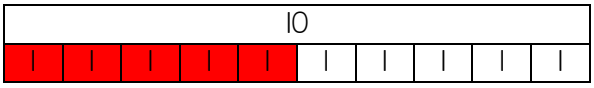
Concrete Objects

Sharing items with a partner to find half, in 4 groups to find a quarter etc.

Bar Modelling

To illustrate practical situations where 'sharing equally' is required.

e.g. There are 10 apples in the bowl and half of them are red. How many are red?



Year 1 Division

Statutory Requirements

Pupils should be taught to:

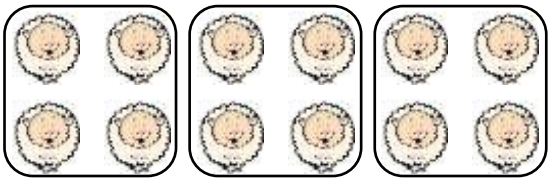
- solve one-step problems involving division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.
- recognise, find and name a half as one of two equal parts of an object, shape or quantity
- recognise, find and name a quarter as one of four equal parts of an object, shape or quantity.

Concrete Objects

Sharing items with a partner to find half, in 4 groups to find a quarter etc.

Pictures/Marks

Using simple drawings to record and share.



e.g. There are 12 sheep in a field. How many sheep pens would a farmer need if only 4 sheep can fit in each pen?

Arrays

Representing division calculations in columns and rows using repeated division:

6 ÷ 3 = 2 or 6 ÷ 2 = 3

Bar Modelling

To illustrate division problems, following on from Year R.

Year 2 Division

Statutory Requirements

Pupils should be taught to:

- recall and use division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers
- calculate mathematical statements for division within the multiplication tables and write them using the division (÷) and equals (=) signs
- show that division of one number by another cannot be done in any order
- solve problems involving division, using materials, arrays, repeated addition, mental methods, and division facts, including problems in contexts.
- recognise, find, name and write fractions $\frac{1}{3}$, $\frac{1}{4}$, $\frac{2}{4}$ and $\frac{3}{4}$ of a length, shape, set of objects or quantity

Concrete Objects

Sharing items in pairs, groups of 5, 10 etc.
Counting in 2s, 5s and 10s, both forwards and backwards.
Finding $\frac{1}{3}$, $\frac{1}{4}$, $\frac{2}{4}$ and $\frac{3}{4}$ of sets of objects.

Pictures/Marks

As at Year 1.
For calculations and problems using 2, 5 and 10 times tables as well as finding $\frac{1}{3}$, $\frac{1}{4}$, $\frac{2}{4}$ and $\frac{3}{4}$ of quantities.

Arrays

As at Year 1.
For calculations and problems using 2, 5 and 10 times tables as well as finding $\frac{1}{3}$, $\frac{1}{4}$, $\frac{2}{4}$ and $\frac{3}{4}$ of quantities.

Number Lines

At as Year 1.
For calculations and problems using 2, 5 and 10 times tables.

Bar Modelling

To illustrate division problems.
e.g. Find $\frac{1}{3}$ of 18.

18		
?	?	?

Year 3 Division

Statutory Requirements

Pupils should be taught to:

- recall and use division facts for the 3, 4 and 8 multiplication tables
- write and calculate mathematical statements for division using the multiplication tables that they know, using mental and progressing to formal written methods
- solve problems, including missing number problems, involving division, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects.
- recognise, find and write fractions of a discrete set of objects

Mental Methods

Using knowledge of times tables to find the nearest multiple and calculate answers to division calculations.

e.g. 20 ÷ 3

3 x 6 = 18, so 20 ÷ 3 = 6 r2

Concrete Objects/Pictures/Marks

As at Year 2, for further multiplication tables and fractions.

Bar Modelling

As at Year 2, for further multiplication tables and fractions.

Short Division

Using known multiplication tables to divide 2 or 3-digit numbers. Sometimes referred to as the 'bus stop' method.

The number to be divided (dividend) is placed below the 'bus stop' and the divisor placed to the left. The most significant number is addressed first, with any remainder carried to the next significant number.

e.g. 81 ÷ 3

$$3\overline{)\,8\ ^{2}1}\quad 2\ 7$$

Year 4 Division

Statutory Requirements

Pupils should be taught to:

- recall division facts for multiplication tables up to 12 × 12
- use place value, known and derived facts to divide mentally, including dividing by 1
- solve integer scaling problems and harder correspondence problems such as n objects are connected to m objects.

Mental Methods

As in Year 3, using knowledge of times tables to find a nearest multiple and calculate answers to division calculations.

e.g. 89 ÷ 9

9 x 9 = 81, so 89 ÷ 9 = 9 r8

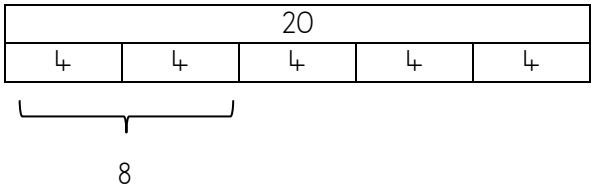
Short Division

As in Year 3, using known multiplication tables to divide 2 or 3-digit numbers, progressing to numbers with whole number remainders.

Bar Modelling

Continued from previous years, including finding fractions of amounts.

e.g. Find 2/5 of 20



Year 5 Division

Statutory Requirements

Pupils should be taught to:

- solve problems involving division including using their knowledge of factors and multiples, squares and cubes
- solve problems involving division and a combination of the four operations, including understanding the meaning of the equals sign
- solve problems involving division, including scaling by simple fractions and problems involving simple rates.

Mental Methods As in Year 3, progressing to using knowledge of times tables, factors, multiples, squares and cubes to find a nearest multiple and calculate answers to division calculations.	**Short Division** As in Year 4.
Bar Modelling Continued from Year 4.	

Year 6 Division

Statutory Requirements

Pupils should be taught to:

- divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context
- divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context
- perform mental calculations, including with mixed operations and large numbers
- use their knowledge of the order of operations to carry out calculations involving the four operations
- solve problems involving division
- use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.
- divide proper fractions by whole numbers [for example, $\frac{1}{3} \div 2 = \frac{1}{6}$]
- associate a fraction with division and calculate decimal fraction equivalents [for example, 0.375] for a simple fraction [for example, $\frac{3}{8}$]
- use written division methods in cases where the answer has up to two decimal places

Mental Methods

As in Year 5, with increasingly large numbers.

Notes

Used when dividing proper fractions by whole numbers.

e.g. $\frac{2}{5} \xrightarrow{\div 2} \frac{2}{10} = \frac{1}{5}$

Children may be encouraged to use the reciprocal (turning the fraction upside down) before multiplying the denominators and numerators.

Encourage children to think of the problem in context or using diagrams e.g. how many $\frac{2}{5}$ are in 2?

Long Division, whole number remainders

- Children may find it helpful to list the first 6-7 multiples of the divisor before beginning.
- The first digit of the dividend is divided by the divisor, with the whole number result placed at the top. Any remainders are ignored at this point.
- The answer from the first operation is multiplied by the divisor. The result is placed under the number divided into.
- Subtract the bottom number from the top number.
- Bring down the next digit of the dividend, divide the new number by the divisor and repeat the process until no further digits can be brought down. This generates the final answer and a whole number remainder.

e.g. 432 ÷ 15 = 28 r12

```
      2  8  r12
   ┌──────
15 │ 4  3  2
     3  0  0
   ──────
     1  3  2
     1  2  0
   ──────
        1  2
```

Long Division, fraction remainders

Using same method as whole number remainder, but using the remainder as a fraction of the divisor.

e.g. $432 \div 15 = 28\ \frac{12}{15}$

or

$432 \div 15 = 28\ \frac{4}{5}$

```
      2  8
   ┌──────
15 │ 4  3  2
     3  0  0   15×20
   ──────
     1  3  2
     1  2  0   15×8
   ──────
        1  2
```

Short Division, decimal remainders

As in Year 4, but instead of leaving a whole number remainder, the dividend is extended using a decimal point.

e.g. 84 ÷ 5

```
      1  6  .  8
   ┌──────────
 5 │ 8 ³4 . ⁴0
```

Bar Modelling

As in previous years, for multi-step problems involving fractions, decimals, percentages and measures including money. Children are expected to demonstrate their understanding of the approximate value of each part of the bar model, drawing roughly to scale.


ASHTON KEYNES