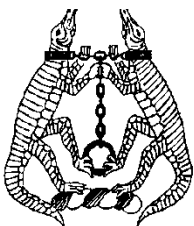
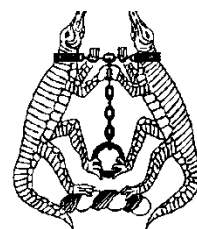


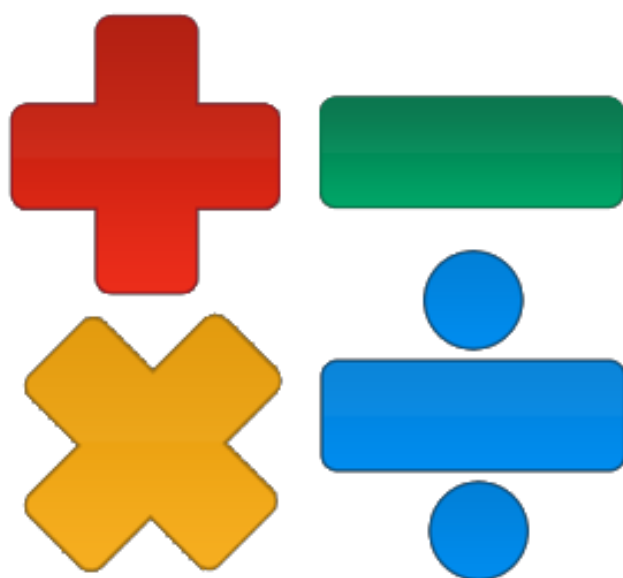
# Mathematics Calculation and Number Fluency Policy



**Sir Robert  
Geffery's School**



*Updated - Autumn Term 2022*



## **Introduction**

The purpose of this document is to build on the successes of the previous Calculation Policy to create a personalised, updated policy reflecting the requirements of the 2014 onwards National Curriculum and more importantly, the needs of our pupils.

This policy aims to develop, model and explain core understandings and mathematical principles and progression to ensure consistency in the teaching and learning of mathematics in our school.

The focus of this policy is the calculation of the four mathematical operations with an emphasis on written strategies to clarify processes and understanding and to make direct links to mental calculating. It is crucial that these mental strategies are taught discretely and linked to written strategies and not confined to starter activities in lessons.

**The overall aims of this policy are that, when children leave primary school they:**

- have a secure knowledge of number facts and a good understanding of the four operations supported by a fluency and understanding of the fundamentals of mathematics
- includes the idea of variation theory which is linked to mastery and Singapore Maths methods. This is taking known facts and repeating these to support the application of skills.
- know the best strategy to use, estimate before calculating, systematically break problems down into a series of simpler steps with perseverance and use estimation and rounding to check that an answer is reasonable.

- are able to use this knowledge and understanding to carry out calculations mentally, solve problems of increasing complexity and develop an ability to recall and apply knowledge rapidly.
- make use of diagrams and informal notes and jottings to help record steps and partial answers when using mental methods.
- have an efficient, reliable, compact written method of calculation for each operation, which they can apply with confidence when undertaking calculations.
- be able to reason; explain their strategies to calculate and, using spoken language, give mathematical justification, argument.

## Foundation Stage 1 - addition

### Curriculum 2014 Statutory Requirements

Pupils should be taught to:

Birth -to 11 months - notice changes in number of objects / images , sounds in groups of and upto 3

8 - 20 months - has some understanding that things exist even when out of sight

16-26 months - Begins to organise and categorise objects -sorting

22 - 36 months - knows that a group of things changes in quantity when something is added or taken away

30 - 50 - separates a group of 3 or 4 objects in different ways beginning to recognise that the total is still the same

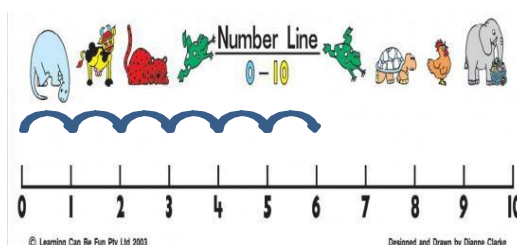
40-60 - finds the total number of items in two groups by counting all of them

In practical activities and discussions begins to use the vocabulary involved in addition and subtraction



**NUI2 REG**

I can count six frogs.



### Teaching Points

Use number lines 0-10

Numbers in the environment inside and outside

Putting objects in tens frames and numicon

## Foundation Stage 2 - addition

### Curriculum 2014 Statutory Requirements

Pupils should be taught to:

**Early Learning Goal** - Children count reliably with numbers from one to 20, place them in order and say which number is one more or one less than a given number. Using quantities and objects, they add and subtract two single-digit numbers and count on or back to find the answer. Count on from first group to add two groups of objects



$$5 + ? = 10$$



$$\textcircled{6} + \textcircled{3} = 9$$

Put biggest number in your head and count on using fingers or objects



1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	----

Progression  $6 + 3 = 9$

Use unifix

Use number track

Use numberline

Numicon

### Teaching Points

Counting and reading numbers to 20

Doubling using objects and numbers

Adding two single digit numbers referring to a number line

**Combining two parts to make a whole: part whole model.**

**Starting at the bigger number and counting on- using cubes.**

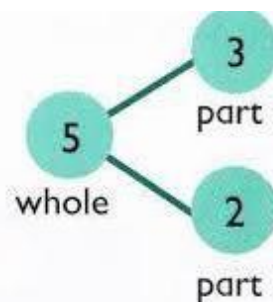
**Regrouping to make 10 using ten frame.**

### Variation ideas

Missing numbers

$$6 + ? = 9$$

Part + Part = Whole



## Year 1 – addition

### Curriculum 2014 Statutory Requirements

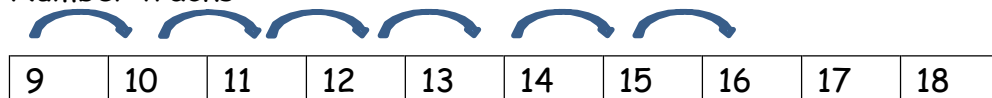
Pupils should be taught to:

- read, write and interpret mathematical statements involving addition (+) and equals (=) signs - THIS MEANS THE SAME AS - relate this to balance number sentences and scales
- represent and use number bonds and related subtraction facts 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  $9 = \square + 7$ .

Using a marked number line with marked divisions to 20 to solve calculations such as:

$9 + 7 = \square$  Demonstrate with frogs jumping along the line

Number tracks



**Appropriateness of number:** choices of number here remain within 20 and build towards crossing 10.

Progress - numbered line, divisions with numbers on.

Begin to introduce  $\square = 9 + 7$  to show the symbolism of balanced calculations and commutative number sentences.

Working up from number bonds to 5, 6, 7, 10, 20.

Practical equipment to support this addition work: Coat hangers, bead strings, 100 squares, Concrete objects, magic beans, numicon, base ten materials

Use part + part = whole as variation

### Teaching Points

Numbers to 20

Counting forward/up in jumps on top of the number line when adding.

Model the checking process as this is built upon throughout the strategies and policy.

Snakes and ladders game good to support

Ensure that children are being taught to count the jumps.

### Variation ideas

$7 + 2 =$

$17 + 2 =$

$7 + 12 =$

$9 + 6 =$

$10 + 6 =$

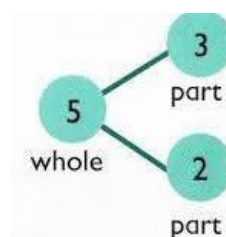
$11 + 6 =$

$13 + 6 =$

$8 + 3 =$

$10 + 3 =$

$12 + 3 =$



## Year 2 – addition

### Curriculum 2014 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) and subtraction of one number from another cannot
- recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems

Once understanding of place value is secure using practical resources e.g. base ten, bead strings, numicon etc. children will move to adding two, two digit numbers.

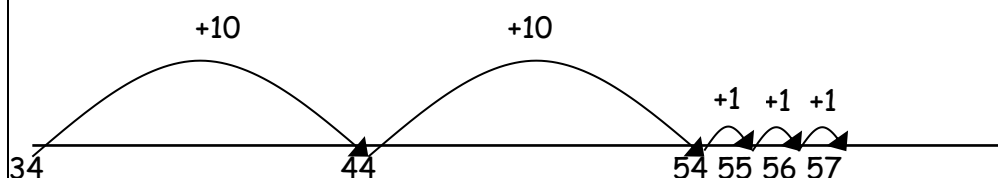
Partitioning and applying addition mentally of partitioned numbers:

$$\begin{array}{rclcl} 40 & + & 30 & = & 70 \\ \hline 47 & + & 36 & = & 83 \\ \hline 7 & + & 6 & = & 13 \end{array}$$

Children will begin to use 'empty number lines' themselves starting with the larger number and counting on.

- ✓ First counting on in tens and ones.

$$34 + 23 = 57$$



- ✓ Then helping children to become more efficient by adding the units in one jump (by using the known fact  $4 + 3 = 7$ ).

### Teaching Points

Counting forward in units then tens. When counting in units, suggesting 'number bonds' and related facts to make jumps.

Headings of columns for addition are labelled

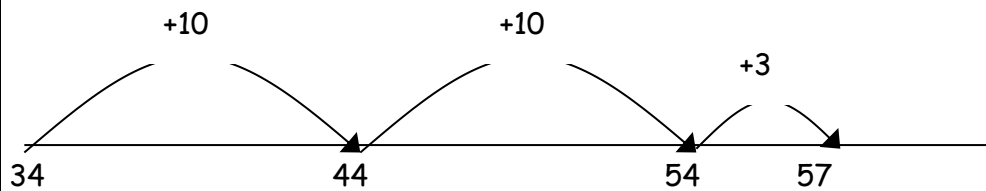
Note how appropriateness of number ensures that these numbers do not require carrying at this stage.

### Variation ideas

- $8 + 2 = 10$
- $80 + 20 = 100$
- $800 + 200 = 1000$
- $? = 8 + 2$
- $10 = ? + 2$
- $100 = ? + 20$

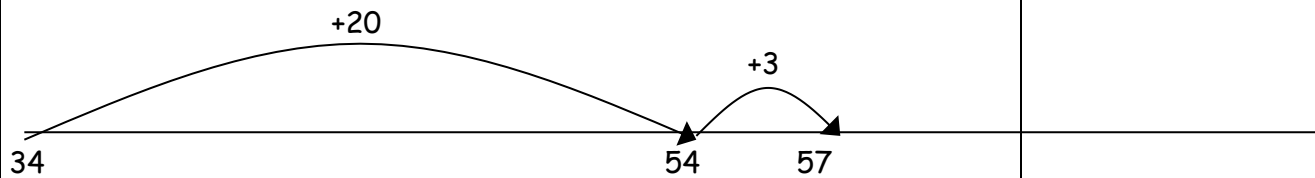


$$34 + 23 = 57$$



✓ Followed by adding the tens in one jump and the units in one jump.

$$34 + 23 = 57$$



Progressing to expanded written, column method:

Start with no crossing of tens, then onto crossing tens at the end of the year .

	T	O	
	4	7	
+	3	6	
	1	3	(7+6)
	7	0	(40+30)
	8	3	

Ensure that the calculation done at each stage is written beside so children are aware of process.

## Year 3 – addition

### Curriculum 2014 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.

### Teaching Points

Numbers initially crossing tens boundary within a three digit number, moving to crossing tens and hundreds in numbers up to 1000.

Pupils begin to use number lines without given divisions.

Teaching point in example links to recognising number bonds and how smaller jumps, rather than jumping eight will help reinforce mental strategies.

### Variation:

Missing numbers

H	T	O
2	7	8
+	8	2
	1	0
1	5	0
2	0	0
3	6	0

Formal written strategy modelled with:

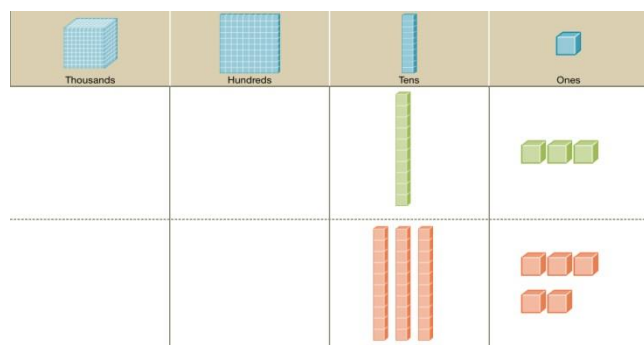
H T O labelled in columns.

One digit per square.

Calculate from ones (least significant figure).



### Base ten materials used to support addition



process

Eg)

+ 13

35

8

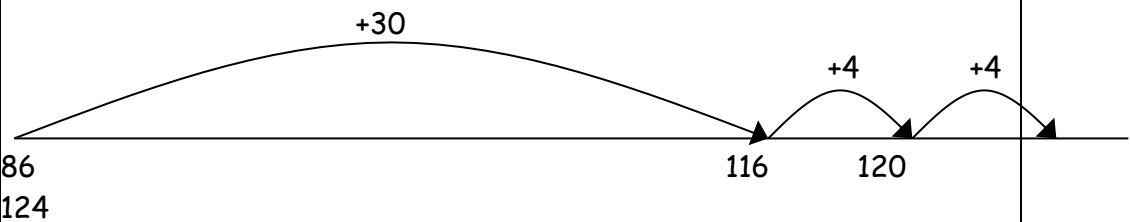
40

48

Children will continue to use empty number lines with increasingly large numbers, including compensation where appropriate.

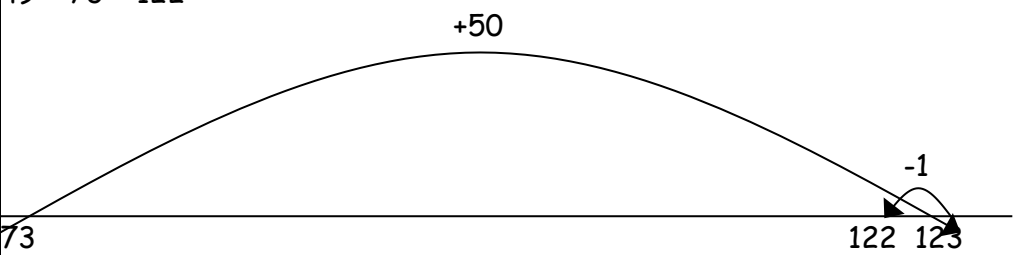
- ✓ Count on from the largest number irrespective of the order of the calculation.

$38 + 86 = 124$



✓ Compensation

$49 + 73 = 122$



# Year 4 – addition

## Curriculum 2014 Statutory Requirements

Pupils should be taught to:

- add with up to 4 digits using the formal written methods 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**.

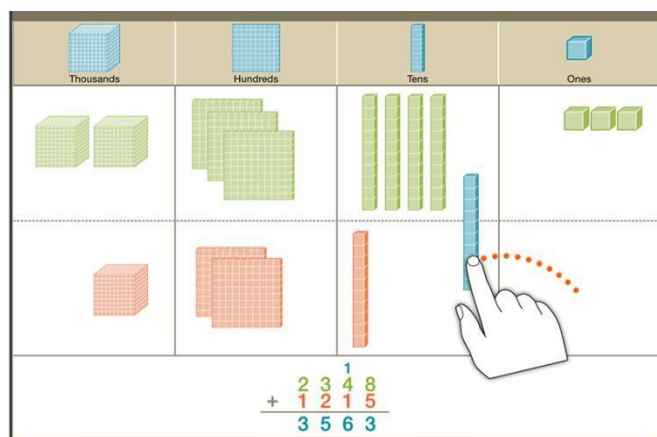
Formal written strategy modelled with:

Th H T O labelled in columns.

One digit per square.

Calculate from ones (least significant figure).

Th	H	T	O
4	6	2	7
3	9	1	4
8	5	4	1
+		+	



Base ten materials used to support understanding to abstract.

## Teaching Points

Building on strategy from Year 3 moving to using numbers which, when added, remain within the 10,000 boundary.

Ensure clarity when adding two, four digit numbers and move to adding up to three integers including three-digit add four-digit.

Progressing to the use of formal, compact method (modelling alongside expanded method).

Using similar methods, children will:

- ✓ add several numbers with different numbers of digits;
- ✓ begin to add two or more three-digit sums of money, with or without adjustment from the pence to the pounds;
- ✓ know that the decimal points should line up under each other, particularly when adding or subtracting mixed amounts, e.g. £3.59 + 78p.

## Year 5 - addition

### Curriculum 2014 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.

Building on Y4 strategy and number choices moving to numbers, when added within 1 million.

	TTh	Th	H	T	O
	4	3	2	0	1
	2	2	1	2	4
+	3	1	3	2	1
	9	6	6	4	6

Progressing to addition of numbers to two decimal places in context (such as money £ including € and \$ as appropriate)

$$£132.52 + £213.83$$

	H	T	U	•	1/10	1/100
	1	3	2	•	5	2
+	2	1	3	•	8	3
	3	4	6	•	3	5
	1					

Note appropriateness of number above where there is only one 'carry' initially to ensure clarity and understanding of the layout and process.

- Children to progress onto adding fractions with the same or different denominator.
- Children to move to adding numbers with 3 decimal places.

### Teaching Points

Note appropriateness of numbers: initially, when dealing with larger numbers, not requiring 'carrying' to ensure clarity and understanding of application of strategy moving swiftly to numbers requiring carrying.

Model when writing the answer, and when writing numbers such as that shown, the use of commas:  
96,646

Use of rounding to check the relevance of numbers in answer.

When calculating using numbers involving decimals, a clear step to success must be the writing in of the decimal point in the answer area **first** to help when carrying past this boundary.

#### Variation ideas

$$: 37 + 19 = 56$$

$$47 + 19 = 66$$

$$57 + 19 = 76$$

$$5.7 + 1.9 = 7.6$$

## Year 6 – addition

### Curriculum 2014 Statutory Requirements

Pupils should be taught to:

- solve addition multi-step problems in contexts, deciding which operations and methods to use and why

Building on Y5 strategy and number choices moving to numbers, when added within **10 million**.

Children secure strategies for addition when adding more than two numbers including numbers to three decimal places.

$$\begin{array}{r}
 1 \ 2 \ 0 \ 5 \ 3 \ 7 \\
 2 \ 3 \ 4 \ 2 \ 7 \ 1 \\
 + \ 3 \ 2 \ 3 \ 2 \ 2 \ 1 \\
 \hline
 6 \ 7 \ 8 \ 0 \ 2 \ 9 \\
 \hline
 \end{array}$$

↑   ↑

Calculating decimal numbers to three decimal places:

$$\begin{array}{r}
 0 \ . \ 5 \ 5 \ 7 \\
 1 \ . \ 2 \ 1 \ 1 \\
 + \ 0 \ . \ 2 \ 0 \ 2 \\
 \hline
 1 \ . \ 9 \ 7 \ 0 \\
 \hline
 \end{array}$$

1

Using similar methods, children will

- ✓ begin to add two or more decimal fractions with up to four digits and either one or two decimal places; Begin to add fractions with different denominators.
- ✓ Apply the above skills to solving problems with time and money

### Teaching Points

Note appropriateness of numbers: initially, when dealing with this size of numbers, not requiring numerous 'carrying' to ensure clarity and understanding of application of strategy.

Model when writing the answer, and when writing numbers such as that shown, the use of commas: 678,029 and modelling reading the numbers within the separated groups of numbers.

Reinforce and reiterate the value of each digit when talking about the number.

Note in the example, the use of '0' as a place value holder here and as a digit within the decimal number itself: to reiterate the understanding of its importance and 'value'.

## Foundation Stage 1 - subtraction

### Curriculum 2014 Statutory Requirements

Pupils should be taught to:

Birth -to 11 months - notice changes in number of objects / images , sounds in groups of and upto 3

8 - 20 months - has some understanding that things exist even when out of sight

16-26 months - Begins to organise and categorise objects -sorting

22 - 36 months - knows that a group of things changes in quantity when something is added or taken away

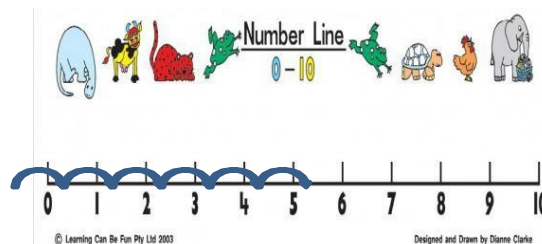
30 - 50 - separates a group of 3 or 4 objects in different ways beginning to recognise that the total is still the same

40-60 - Understands subtraction as taking away objects from a group and counting on how many are left.

In practical activities and discussions begins to use the vocabulary involved in addition and subtraction



I can count six frogs.



### Teaching Points

Use number lines 0-10

Numbers in the environment inside and outside

## Foundation Stage 2 - subtraction

### Curriculum 2014 Statutory Requirements

Pupils should be taught to:

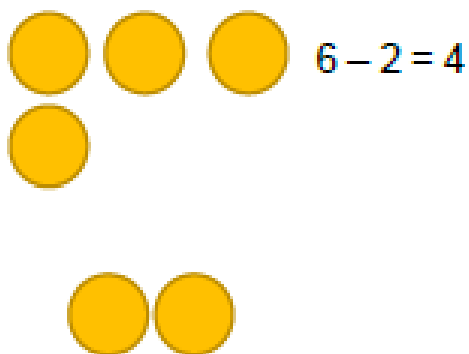
**Early Learning Goal** Children count reliably with numbers from one to 20, place them in order and say which number is one more or one less than a given number. Using quantities and objects, they add and subtract two single-digit numbers and count on or back to find the answer.

Count back from large group as you take away -  
say count back as you take away.

$$6 - 2 = 4$$



Count how many are left after the  
two are taken away



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



### Teaching Points

Counting and reading  
numbers to 20

Halving using objects

Sharing using objects

Subtracting two single  
digit numbers referring  
to a number line



# Year 1 - subtraction

## Curriculum 2014 Statutory Requirements

Pupils should be taught to:

- read, write and interpret mathematical statements involving subtraction (-) and equals (=) signs
- represent and use number bonds and 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  $9 = \square - 7$ .

Sam spent 7p. What was his change from 20p?



Children use concrete, practical resources moving to images and physically 'cross off' or remove to ensure a real understanding of 'taking away'.

Bead strings or bead bars can be used to illustrate subtraction including bridging through ten by counting back 3 then counting back 2.

$$13 - 5 = 8$$



Pupils begin to explore missing number problems involving - and = notation.

$$7 - 3 = \square$$

$$\square = 7 - 3$$

$$7 - \square = 4$$

$$4 = \square - 3$$

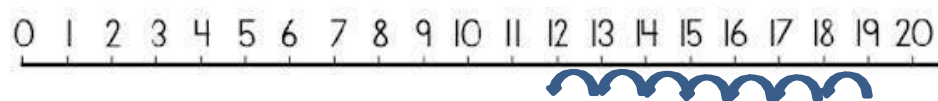
$$\square - 3 = 4$$

$$4 = 7 - \square$$

$$\square - \nabla = 4$$

$$4 = \square - \nabla$$

Counting back from original number on a number line:



End of year - using counting on to find the difference.

1 2 3 4 5 6 7 8 9 10 11 12



## Teaching Points

When counting the remaining amount, and when checking that the correct number have been taken away, model efficient counting in twos where necessary or arrayed numbers of ten for example.

Model the checking process as this is built upon throughout the strategies and policy.

When solving missing number problems, ensure that there is a variety of layout where there is a modelling of 'balancing calculations'.

Counting back along the top of the number line.

### Variation ideas

$$9 - 5 =$$

$$9 - 7 =$$

$$8 - 5 =$$

$$10 - 7 =$$

$$7 - 5 =$$

$$11 - 7$$

Solving a problem such as:

$$19 - 7 =$$

## Year 2 - subtraction

### Curriculum 2014 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
- subtracting three one-digit numbers
- show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot
- recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems

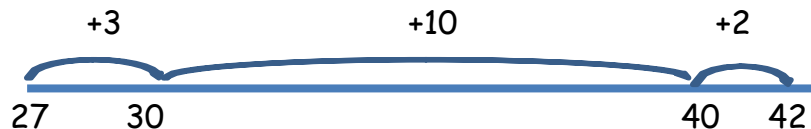
Building on strategies from Y1: using a number line to 'take away' and 'find the difference' by counting under or on the line respectively.

Start initially with a calculation such as  $39 - 7$ .

Moving to calculations such as:  $42 - 5$  (crossing tens)



$$42 - 27 = 25$$



Model when using the strategy above to find the difference to 'jump' to the next ten to help make jumps more straight forward.

### Teaching Points

This calculation does not cross into the previous tens boundary to ensure clarity on the strategy and ensures understanding through subtracting a 'units only' initially.

Move to modelling counting on top of the line to 'find the difference' or under to 'take away'.

Children use a number line without divisions.

Model breaking down the whole number through partitioning and also, using bonds of numbers such as 2 and 5 = 7 as shown.

### Variation ideas

$$37 - 6 =$$

Include number puzzles using missing numbers in different forms referring to missing numbers as shapes or letters to build on commutative facts:

$$70 + 30 = 100 \quad 100 - \Delta = 30 \quad 30 + \square = 100$$

$$47 - 6 =$$

$$57 - 6 =$$

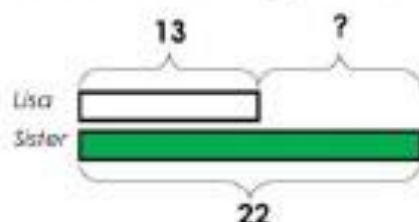
$$67 - 6 =$$

$$77 - 7 =$$

### Comparison Bar Models

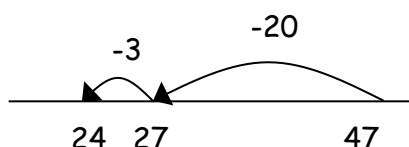
Draw bars to find the difference between 2 numbers.

Lisa is 13 years old. Her sister is 22 years old. Find the difference in age between them.



✓ Subtracting the tens in one jump and the units in one jump.

$$47 - 23 = 24$$



### Counting on

Count up from 47 to 82 in jumps of 10 and jumps of 1.

**Help children to become more efficient with counting on by:**

- ✓ Subtracting the units in one jump;
- ✓ Subtracting the tens in one jump and the units in one jump;
- ✓ Bridging through ten.
- ✓ Progress onto using formal written methods to subtract (column subtraction)
- ✓ Working with 2 digit numbers and progressing to 4 digit numbers.
- ✓ Begin to explore stealing from tens to units and hundreds to tens.

# Year 3 - subtraction

## Curriculum 2014 Statutory Requirements

Pupils should be taught to:

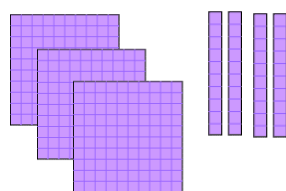
- subtract numbers mentally, including:
  - a three-digit number and ones
  - a three-digit number and tens
  - a three-digit number and hundreds
  - a three-digit number and thousands
- subtract numbers with up to three digits, using formal written methods of columnar subtraction
- estimate the answer 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.

Calculating subtractions from numbers up to 1000.

Model deciding appropriate calculation choices: calculations such as:

$296 - 5$  or  $296 - 35$  should be tackled mentally.

As pupils move towards formal, columnar written strategies, begin by modelling the value and layout practically



For example, model  $346 - 123$  using practical resources.

Move to formal columnar strategy using labelled columns and starting with numbers not requiring exchange before strategy and understanding is secure.

$$\begin{array}{r}
 \text{H} \quad \text{T} \quad \text{O} \\
 3 \quad 4 \quad 6 \\
 - 1 \quad 2 \quad 3 \\
 \hline
 2 \quad 2 \quad 3
 \end{array}$$

No Exchange  
at this stage!

$$\begin{array}{r}
 \text{H} \quad \text{T} \quad \text{O} \\
 - 2 \quad 9 \quad 8 \\
 \hline
 1 \quad 7 \quad 9 \\
 \hline
 \phantom{1} 9 \quad (18 - 9) \\
 \phantom{1} 1 \quad 0 \quad (80 - 70) \\
 \hline
 1 \quad 0 \quad 0 \quad (200 - 100)
 \end{array}$$

## Teaching Points

Ensure a discrete teaching of mental strategies building upon informal written strategies of number lines and partitioning numbers to subtract tens from tens and units from units modelling and promoting the use of jottings.

Note appropriateness of number here where 'exchanging' isn't required.

Practical resources to help promote abstract 'exchange' through concrete understanding of place value practically ready for exchanging later in the year.

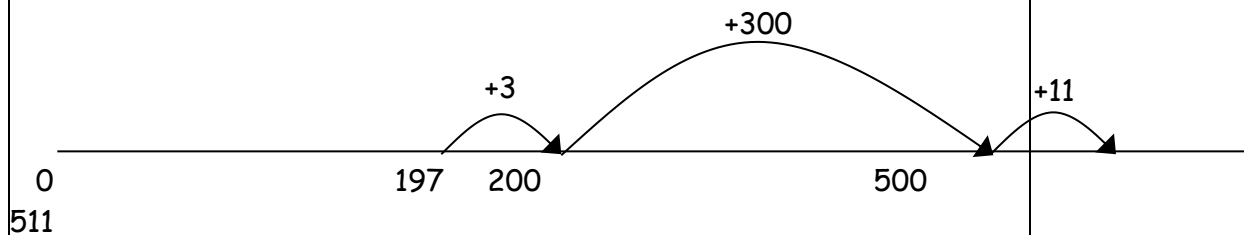
Modelling practical alongside formal written initially.

Model subtracting from least significant figure (ones).

Remember to use the inverse operation to check

Where the numbers are involved in the calculation are close together or near to multiples of 10, 100 etc counting on using a number line should be used.

$$511 - 197 = 314$$



Note this method to be used in Year 4 also.

## Year 4 – subtraction

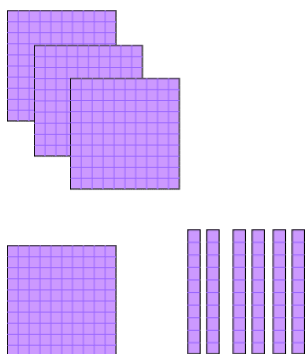
### Curriculum 2014 Statutory Requirements

Pupils should be taught to:

- subtract with up to 4 digits using the formal written methods of column 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.

Pupils calculate subtractions from numbers up to 10,000 and beginning to explore decimals in the context of currency (£).

Pupils use columnar written strategies to calculate building upon that from Year 3. As with Year 3, model layout and move to subtraction with the need for exchange using practical materials initially and progressing from 3-digit subtracting a 3-digit to 4-digit subtracting 3 and 4-digit integers. Take the Year 3 demonstration as the starting point in exchange.



Model exchange practically using physical resources and modelling exchanging a '100' for 10 tens and how this is placed within the 'tens' place value column.

$$\begin{array}{r} \begin{array}{cc} 2 & 1 \end{array} \\ \begin{array}{r} 346 \\ - 163 \\ \hline 183 \end{array} \end{array}$$

Progressively move towards 4-digit subtract 3- and 4-digit where again, only one exchange is needed initially.

### Teaching Points

Note that when modelling practically, and until secure, only one exchange per calculation is required.

Note at the point of physical exchange that the value of the number remains the same (there is still 346, some are simply exchanged).

Modelling of formal written must, initially, occur alongside the practical examples.

When moving to formal column method, ensure a progressive learning sequence where only one exchange is required and move this along when secure.

When modelling formal

Progressing to subtraction of numbers to two decimal places in context (such as money £ including € and \$ as appropriate)

$$£213.83 - £183.51$$

H	T	0 • t	h
<sup>1</sup> 2	<sup>1</sup> 1	3 • 8	3
1	8	3 • 5	1
0	3	0 •	2

Estimating answers:

Rounding this calculation to nearest ten: £210 - £180 = £30

written calculations, model placing a decimal point in the 'answer line' before commencing subtracting from the least significant figure.

## Year 5 – subtraction

### Curriculum 2014 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.

Strategies build on those of Year 4 and involve starting numbers of up to 100,000 and progressing to 1,000,000.

Formal Written:

Progressively, and before moving to larger numbers, begin to explore written strategies where '2 exchanges' are needed:

	Th	H	T	
	7	<sup>8</sup> 9	<sup>9</sup> 0	<sup>1</sup> 6
-	2	5	9	8
	5	3	0	8

Estimating answers:

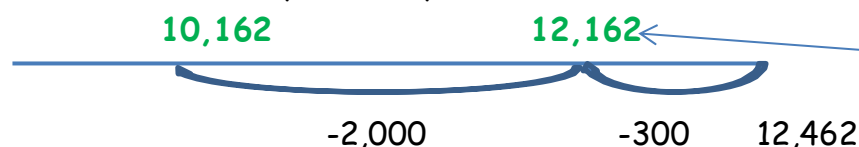
$$E: 7900 - 2600 =$$

Progressively move to calculations such as:

$$14,067 - 11,850 =$$

Mental Strategies:

When modelling and teaching mental strategies, refer to picturing the use of a number line and either counting back or on:  $\Delta = 12,462 - 2,300$



### Teaching Points

Discrete teaching of the notion of more than one exchange must be taught discretely, and does exchanging through a 0 as shown. Modelling here how an exchange is needed and is placed alongside a prior exchange.

Modelling and checking against estimates is a key part of the calculation process to ensure an understanding and automatic check of validity.

Note use of , to separate chunks of numbers in 'number sentences' but not in columnar strategy.

Note use of symbols and algebraic symbols such as  $x$  or  $y$  to find missing values.

When modelling mental methods, promote values in red as being jottings.

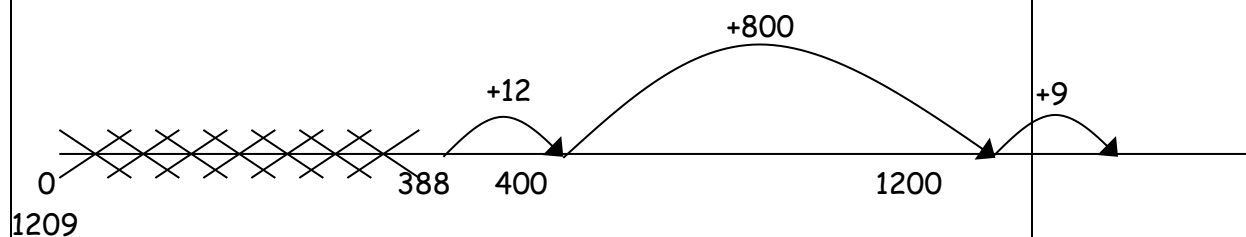
Children should:

- ✓ begin to find the difference between two decimal fractions with up to three digits and the same number of decimal places;
- ✓ know that decimal points should line up under each other.



Where the numbers are involved in the calculation are close together or near to multiples of 10, 100 etc counting on using a number line should be used.

$$1209 - 388 = 821$$



## Year 6 – subtraction

### Curriculum 2014 Statutory Requirements

Pupils should be taught to:

- solve subtraction multi-step problems in contexts, deciding which operations and methods to use and why

Strategies build on those of Year 5 and involve starting numbers of up to 1,000,000 and progressing to 10,000,000.

Pupils apply their learning of subtraction strategies and combine these with other areas of learning to solve problems such as:

$$632,465 + (745,676 - 325,534) =$$

progressing to

$$8,675,509 - (9,645,253 - 2,867,675) =$$

Pupils apply written subtraction skills to numbers up to and including three decimal places (3dp). These are presented in contextual situations such as units of measure.

Calculations and ranges of numbers are applied through worded problems including units of measure.

Calculations to include examples such as:

$$12 - 2.736$$

$$35.712 - 8.653$$

Children should:

- ✓ be able to subtract fractions with different denominators.
- ✓ be able to subtract two or more decimal fractions with up to three digits and up to 3 decimal places;

### Teaching Points

Model the use of brackets in multi-step problems identifying brackets as the initial step needed and combining this with an additional written strategy.

Refer at these stages, as taught in previous years to estimation recorded as E=.

Here, discrete and modelled teaching of 'selecting the appropriate strategy' must be taught.

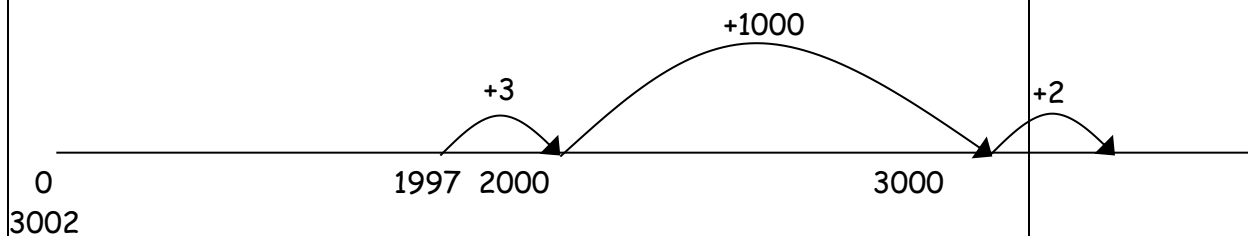
For this example, counting on mentally, or with jottings referring back to knowledge of number lines would work best.

Here, a formal, columnar subtraction strategy will be more effective.

Apply the above skills to solving problems with time and money.

Where the numbers are involved in the calculation are close together or near to multiples of 10, 100 etc counting on using a number line should be used.

$$3002 - 1997 = 1005$$



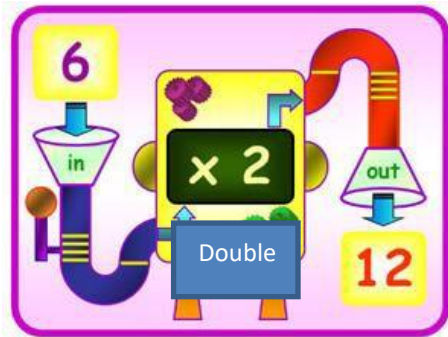
## Foundation Stage 2 - multiplication

### Curriculum 2014 Statutory Requirements

Pupils should be taught to:

**Early Learning Goal** Children count reliably with numbers from one to 20, place them in order and say which number is one more or one less than a given number. Using quantities and objects, they add and subtract two single-digit numbers and count on or back to find the answer. They solve problems, including doubling, halving and sharing.

Doubling machines, ladybirds with spots, symmetry, dice, making it clear that doubling is adding the same number. Doubling songs



$6 + 6 = 12$  - Making it clear you are adding the same number.

Draw pictures to show how to double a number.

Double 4 is 8



### Teaching Points

Doubling using objects and numbers

# Year 1 - multiplication

## Curriculum 2014 Statutory Requirements

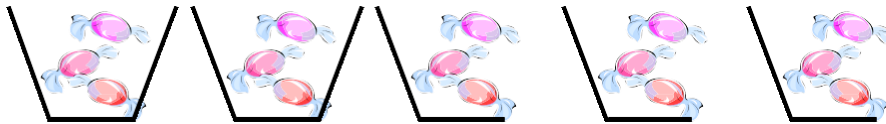
Pupils should be taught to:

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

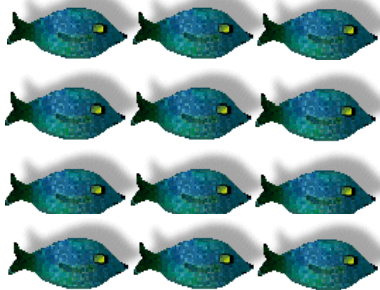
Pupils build on learning in the Foundation Stage and **ensure a clear understanding of the concept of doubling before moving.**

Using concrete objects, image representations and the use of physical or images of arrays, pupils solve problems such as:

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



There are three fish in one tank. How many fish are in four tanks?



Use different objects to add equal groups.

Ensure that pupils experience contextual links such as:



## Teaching Points

Note that when using worded problems, the language aspect of this must be accessible - here, the use of talking tins or image based questioning might be needed to ensure equality of access to the mathematics aspect of the question.

Key vocabulary - Lots of

Make links with repeated addition

Counting in steps of 2, 5 and 10 - tables progression

## Year 2 - multiplication

### Curriculum 2014 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 ( $\times$ ) and equals (=) signs
- show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot
- solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts.

**Pupils recall and use 2x 5x 10x and 3x table  
but use doubling to progress onto 4x**

### Start initially with recap of arrays:

Create arrays using counters/ cubes to show multiplication sentences.



Pupils explore, practically, commutative multiplication facts showing that the same product is produced.

### Build on repeated addition

$$3 \times 4 = 12$$

Also demonstrate this is the same as  $4 \times 3$

### Teaching Points

Here, build upon partitioning skills to partition and then multiply to strengthen links between place value and partitioning.

Model practically with place value arrow cards to model multiplication steps.

When introducing grid method, referring to it as such, model initially alongside partitioning strategy.

Note appropriateness of number where numbers remain initially in 'teens' to strengthen ability to multiply a digit by 10.

### Variation ideas

$$2 \times 3 =$$

$$2 \times 30 =$$

$$2 \times 300 =$$

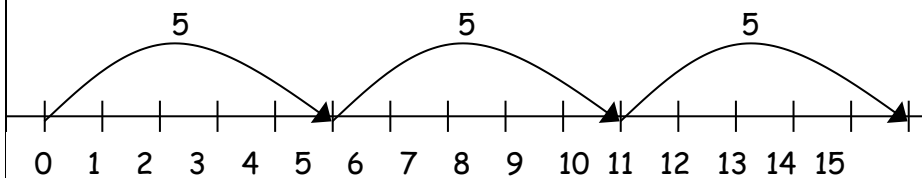
$$20 \times 3 =$$

$$200 \times 3 =$$

3 times 5 is  $5 + 5 + 5 = 15$  or 3 lots of 5 or  $5 \times 3$

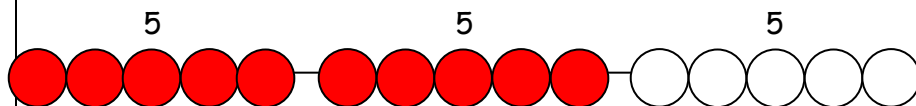
Repeated addition can be shown easily on a number line:

$$5 \times 3 = 5 + 5 + 5$$



and on a bead bar:

$$5 \times 3 = 5 + 5 + 5$$



## Year 3 - multiplication

### Curriculum 2014 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 written methods
- solve problems involving missing number problems involving multiplication including positive number scaling problems and correspondence problems where  $n$  objects are connected to  $m$  objects.

Pupils recall and use **2x 5x 10x 3x 4x 6x 7x 8x**  
and **9x**

Tables knowledge builds on using doubling skills of 2x to find 4x and then doubling 4x to find 8x emphasising efficiency and using known facts.

Pupils solve problems such as **34 x 3** using the **grid method**.

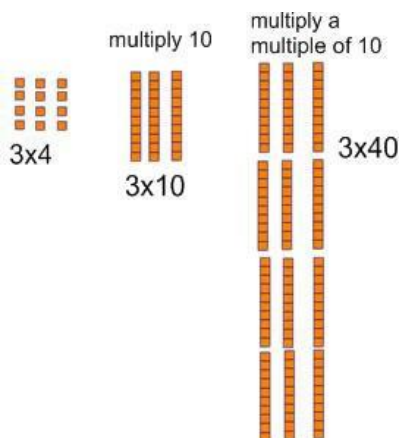
Model calculating this alongside the expanded preparing for short multiplication in Year 4 - teach alongside.

		3
X		
30		90
4		12
		102

When calculating a calculation such as **34 x 2**, model and discuss appropriateness of approach and referring to known skills: double.

Progress and model to doubling and double again when finding **4x**.

**Use base ten resources to support**



### Teaching Points

Use base 10 to support

Note how digits in numbers are, initially, those that are being reinforced and taught through expected multiplication tables knowledge.

### Variation ideas

$$9 \times 8 =$$

$$9 \times 80 =$$

$$9 \times 800 =$$

$$90 \times 8 =$$

$$900 \times 8 =$$

$$? = 900 \times 8$$

$$72 = ? \times 8$$

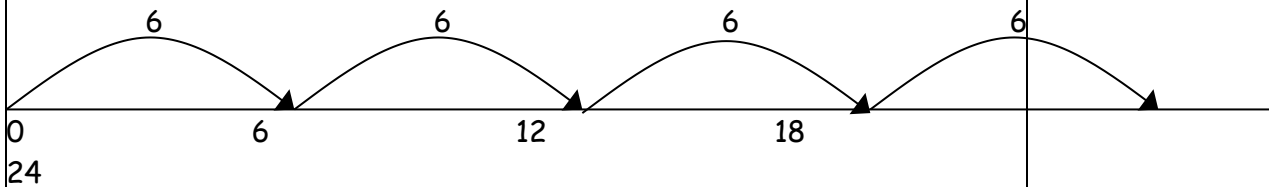


Children will continue to use:

✓ **Repeated addition**

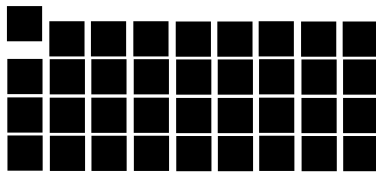
4 times 6 is  $6 + 6 + 6 + 6 = 24$  or 4 lots of 6 or  $6 \times 4$

Children should use number lines to support their understanding.



✓ **Arrays**

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



$$9 \times 4 = 36$$

$$9 \times 4 = 36$$

✓ **Using symbols to stand for unknown numbers to complete equations using inverse operations**

$$\square \times 5 = 20$$

$$3 \times \triangle = 18$$

$$\square \times \bigcirc = 32$$

✓ **Partitioning**

$$\begin{aligned} 38 \times 5 &= (30 \times 5) + (8 \times 5) \\ &= 150 + 40 \\ &= 190 \end{aligned}$$

## Year 4 - multiplication

### Curriculum 2014 Statutory Requirements

Pupils should be taught to:

- recall and use multiplication facts for multiplication tables up to  $12 \times 12$
- use place value, known and derived facts to multiply mentally, including:  $\times 0$   $\times 1$  and 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, including the distributive law to multiply two-digit numbers by one-digit including positive number scaling problems and correspondence problems where  $n$  objects are connected to  $m$  objects.

Pupils recall and use tables facts up to  $12 \times 12$

Building on the strategies from Year 3, pupils move towards multiples of ten based on the known table facts from above such as  $30 \times$  and  $40 \times$ .

Calculations are completed progressing from 2-digit  $\times$  1-digit to 3-digit ( $1[] [] \times []$ )  $\times$  1-digit.

Calculations continues an 'expanded' formal written methods:

H	T	O	
1	4	3	
	X	6	
	1	8	( $3 \times 6$ )
2	4	0	( $40 \times 6$ )
6	0	0	( $100 \times 6$ )
8	5	8	

### Teaching Points

Note here that number choice ensures that columnar addition is supported in this example where 'carrying' of numbers is not required for the strategy to work.

Model brackets to show calculation to ensure and check understanding

Where columnar addition is secure, progress to applying carrying here. Pupils reinforce  $\times 10$  and  $\times 100$  through conversions of units of measure in contextual situations.

### Variation ideas

$$6 \times 7 =$$

$$6 \times 70 =$$

$$6 \times 700 =$$

$$60 \times 7 =$$

$$? = 600 \times 7$$

$$0.6 \times 7 =$$

$$0.6 \times 70 =$$

## Year 5 – multiplication

### Curriculum 2014 Statutory Requirements

Pupils should be taught to:

- identify multiples and factors: all factor pairs of a number, common factors of two numbers, establish whether a number up to 100 is prime and recall prime numbers up to 19
- multiply numbers up to four digits by a one- or two-digit number using a formal written method
- multiply whole numbers and those involving decimals by 10, 100 and 1000.

#### Short Multiplication

H	T	O
1	4	3
x		6
8	5	8

2	1	
---	---	--

Using an expanded, column multiplication strategy, pupils multiply numbers such as:

$$37 \times 29$$

		T	O	
		3	7	
	X	2	9	
		6	3	(9x7)
	2	7	0	(9x30)
	1	4	0	(20x7)
	6	0	0	(20x30)
1	0	7	3	
	1			

*-Using similar methods, they will be able to multiply decimals with one decimal place by a single digit number, approximating first.*

Introduction of long multiplication methods in year 5 H T O x TO e.g. 756x32

#### Teaching Points

Note here that this strategy and number choices rely on an ability to use columnar addition efficiently and accurately. Those pupils needing support here can revert to grid but progress to expanded formal as soon as is practicably possible.

Note modelling of noting steps to help with self-checking and ensuring knowledge of place value.

Multiply by ones, explain when multiplying by tens, the numbers will be 10 times bigger, digits move to the left on one place as a result. 0 is a place holder.

## Year 6 - multiplication

### Curriculum 2014 Statutory Requirements

Pupils should be taught to:

- identify multi-digit numbers up to 4 digits by a two-digit number using formal, long multiplication
- identify common factors, common multiples and common prime numbers
- use their knowledge of the order of operations to carry out calculations involving the four operations

Pupils progress towards multiplying Th H T O  $\times$  T O and H T O . t h  $\times$  T using formal written method of long multiplication:

$$2314 \times 23 =$$

$$\begin{array}{r}
 \begin{array}{cccc}
 2 & 3 & 1 & 4 \\
 \times & & 2 & 3 \\
 \hline
 6 & 9 & 4 & 2 \\
 4 & 6 & 2 & 8 & 0 \\
 \hline
 5 & 3 & 2 & 2 & 2 \\
 \text{\tiny 1} & \text{\tiny 1} & \text{\tiny 1} & & 
 \end{array}
 \end{array}$$

Progress to three-digit  $\times$  2-digit and TU.t  $\times$  U using expanded formal. Move to Year 6 strategy where these numbers are confident.

$$\begin{array}{r}
 \begin{array}{cccc}
 \text{T} & \text{O} & & 1/10 \\
 3 & 6 & \bullet & 2 \\
 \times & 7 & & \\
 \hline
 & 1 & \bullet & 4 \\
 & 4 & 2 & \bullet & 0 \\
 2 & 1 & 0 & \bullet & 0 \\
 \hline
 2 & 5 & 3 & \bullet & 4
 \end{array}
 \end{array}$$

*-Children to also be able to multiply simple pairs of proper fractions and give the answer in the lowest terms.*

### Teaching Points

Build here from 'teens' to 20s and reinforce efficiency where this number could apply  $\times 10$  and doubling knowledge.

#### Variation

Be aware of how calculation maybe in different order. Progress onto missing numbers in the calculation.

$$\begin{array}{r}
 \begin{array}{cccc}
 2 & 3 & 1 & 4 \\
 \times & & 2 & 3 \\
 \hline
 4 & 6 & 2 & 8 & 0 \\
 & 6 & 9 & 4 & 2 \\
 \hline
 5 & 3 & 2 & 2 & 2 \\
 \text{\tiny 1} & \text{\tiny 1} & \text{\tiny 1} & & 
 \end{array}
 \end{array}$$

## Foundation Stage 2 - division

### Curriculum 2014 Statutory Requirements

Pupils should be taught to:

**Early Learning Goal Children count reliably with numbers from one to 20, place them in order and say which number is one more or one less than a given number. Using quantities and objects, they add and subtract two single-digit numbers and count on or back to find the answer. They solve problems, including doubling, halving and sharing.**

### Teaching Points

Counting and reading numbers to 20

Doubling using objects and numbers

Halving using objects

Sharing using objects

Food as a focus for understanding

Practically halving objects - both halves being exactly the same size - Start with play dough and things you can cut and then progress to practical objects.

Eg: Pizza - cut in half to make two pieces - then add toppings ,  
eg: 2 tomatoes - half of 2 is 1.

Making number stories is a focus for understanding



### Vocabulary:

Halving is smaller / Doubling is larger

2 Equal parts

Children will understand equal groups and share items out in play and problem solving. They will count in 2s and 10s and later in 5s.



## Year 1 – division

### Curriculum 2014 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.

Pupils begin by reinforcing prior learning where division is understood by grouping and sharing:

Develop halving understanding of shapes and numbers initially and move on to quarters.

12 girls play a game in groups of 4. How many are in each group?

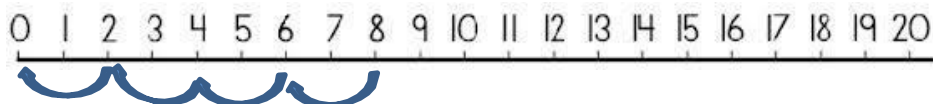


Pupils begin to explore related division facts and linking these directly to inverse, commutative facts:

$$\begin{array}{ll} 6 \div 2 = \square & \square = 6 \div 2 \\ 6 \div \square = 3 & 3 = 6 \div \square \\ \square \div 2 = 3 & 3 = \square \div 2 \\ \square \div \nabla = 3 & 3 = \square \div \nabla \end{array}$$

Sharing of 'chunks' begins to be modelled physically on a number line:

$$8 \div 2 = \text{"How many 2s make 8?"}$$



### Teaching Points

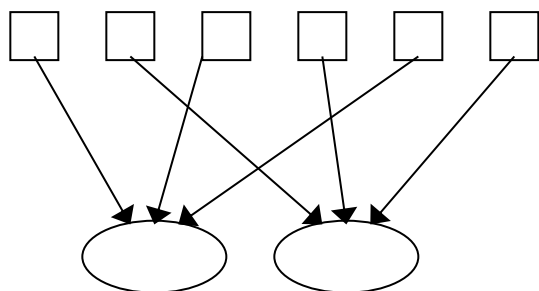
Children physically group items and count in groups.

Model forming arrays to be organised and systematic to aid counting when this develops into counting in multiples.

Use of a numbered number line and counting jumps and 'chunks' of 2.

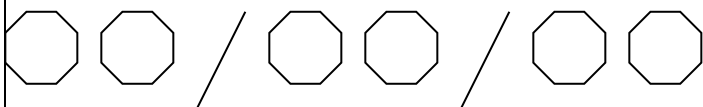
✓ **Sharing equally**

6 sweets shared between 2 people, how many do they each get?



✓ **Grouping or repeated subtraction**

There are 6 sweets, how many people can have 2 sweets each?



## Year 2 – division

### Curriculum 2014 Statutory Requirements

Pupils should be taught to:

- recall and use multiplication and division facts for the 2, 3, 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 signs  $\div$  and  $=$
- show that multiplication of two numbers is commutative but division is not
- solve problems involving division using materials, arrays, repeated addition, mental methods and division facts, including problems in contexts.

Calculations here build on expected known multiplication facts where division is by a divisor of 2, 5 and 10 initially progressing to Y3 multiplication facts of 3.



Link division to multiplication by creating an array and thinking about the number sentences that can be created.

Pupils continue to explore division as sharing and grouping:

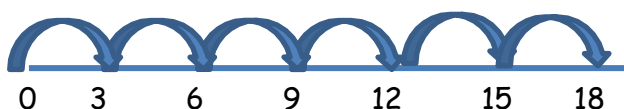
number sentences that can be created.

Eg  $15 \div 3 = 5$      $5 \times 3 = 15$   
 $15 \div 5 = 3$      $3 \times 5 = 15$

$18 \div 3$  can be modelled as sharing – 18 shared between 3 or modelling jumping back in threes to share:



Move on to grouping – How many 3's make 18?



Short division method:

$72 \div 3$

### Teaching Points

#### Variation

$2 \times 3 = 6$

$3 \times 2 = 6$

$6 \div 3 = 2$

$6 \div 2 = 3$

Model counting jumps on number line.

Note the appropriateness of number: these calculations **do not leave a remainder** and build upon multiplication facts that are expected to be fluent.



$$3 \overline{) 72}$$

✓ Using symbols to stand for unknown numbers to complete equations using inverse operations

$$\square \div 2 = 4$$

$$20 \div \triangle = 4$$

$$\square \div \triangle = 4$$

## Year 3 - division

### Curriculum 2014 Statutory Requirements

Pupils should be taught to:

- recall and use multiplication and division facts for the 3, 4 and 8 x tables
- write and calculate mathematical statements for division using the multiplication tables they know, including 2-digit divided by 1-digit using mental and progressing to formal written methods
- solve problems, involving missing number problems, involving division, including positive number scaling problems and correspondence problems where n objects are connected to m objects.

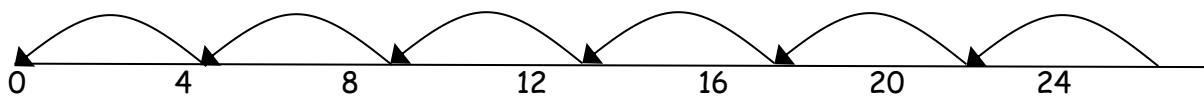
Ensure that the emphasis in Y3 is on grouping rather than sharing.

Children will continue to use:

- ✓ **Repeated subtraction using a number line**

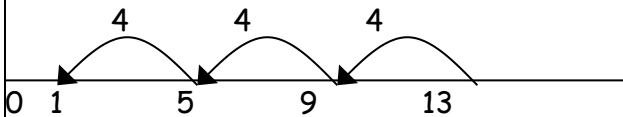
Children will use an empty number line to support their calculation.

$$24 \div 4 = 6$$



Children should also move onto calculations involving remainders.

$$13 \div 4 = 3 \text{ r } 1$$



- ✓ **Using symbols to stand for unknown numbers to complete equations using inverse operations**

$$26 \div 2 = \square$$

$$24 \div \triangle = 12$$

$$\square \div 10 = 8$$

Then onto:

## Informal Written Method (Bus Stop Method)

$$36 \div 4 =$$

$$\begin{array}{r} 9 \\ 4 \overline{) 36} \end{array}$$

Write out 4 x tables:

4, 8, 12, 16, 20, 24, etc

Progress on to division with remainders:

$$53 \div 4 =$$

$$\begin{array}{r} 13 \text{ r } 1 \\ 4 \overline{) 53} \end{array}$$

Children need to be reminded to always check their answers with the inverse

## Teaching Points

Teacher models the layout of a calculation where there are the following key features:

First ten tables facts to build on recall and also, to promote a habit to be referred to later on in the progressive division strategies.

## Year 4 - division

### Curriculum 2014 Statutory Requirements

Pupils should be taught to:

- recall multiplication and division facts up to  $12 \times 12$
- use place value, known and derived facts to divide mentally, including dividing by 1
- solve problems involving dividing a three-digit number by one-digit and number using a formal layout

Pupils build on knowledge from Year 3 to use strategies to divide 3-digit numbers by 1- and 2-digit numbers:

### Teaching Points

$$432 \div 5 =$$

$$\begin{array}{r} 86 \text{ r } 2 \\ 5 \overline{) 432} \end{array}$$

Greater depth - Here, remainders can begin to be expressed as a fraction. Here, appropriateness of number enables this to be expressed as a decimal with ease.  $2/5 = 0.4$

Pupils apply short division strategy to solve questions such as fractions of amounts:

$1/8$  of 12 etc...

Any remainders should be shown as integers, i.e. 14 remainder 2 or 14 r 2. Children need to be able to decide what to do after division and round up or down accordingly. They should make sensible decisions about rounding up or down after division. For example  $62 \div 8$  is 7 remainder 6, but whether the answer should be rounded up to 8 or rounded down to 7 depends on the context.

e.g. I have 62p. Sweets are 8p each. How many can I buy?

Answer: 7 (the remaining 6p is not enough to buy another sweet)

e.g. Apples are packed into boxes of 8. There are 62 apples. How many boxes are needed?

Answer: 8 (the remaining 6 apples still need to be placed into a box)

## Year 5 – division

### Curriculum 2014 Statutory Requirements

Pupils should be taught to:

- identify multiples and factors, including finding all factor pairs of a number, common factors of two numbers, know and use the vocabulary of prime numbers and establish whether a number up to 100 is prime
- multiply and divide numbers mentally drawing on known facts
- divide numbers up to 4 digits by a one-digit number using a written method and interpret remainders appropriately for the context
- divide whole numbers and those involving decimals by 10, 100 and 1000.

Pupils develop use of the short division method started in Year 4.

Pupils apply short division strategy to solve questions such as:  $1176 \div 6 =$

$$\begin{array}{r} 196 \\ 6 \overline{) 1176} \end{array}$$

Pupils apply this with a remainder

$$\begin{array}{r} 196 \text{ r } 3 \\ 6 \overline{) 11739} \end{array}$$

Then interpret the remainder as a fraction  
 $\frac{3}{6}$  then a decimal - 0.5

$$\begin{array}{r} 196.5 \\ 6 \overline{) 11739.30} \end{array}$$

Where appropriate children should be showing remainders as decimals or fractions e.g. measures.

Children need to be able to decide what to do after division and round up or down accordingly. They should make sensible decisions about rounding up or down after division. For example  $240 \div 52$  is 4 remainder 32, but

### Teaching Points

Decide using known facts if there will be a remainder - using the rules of divisibility to support.

Always check with the remainder and include approximations to check answer is correct.

Ensure lots of discussion so children have a secure understanding of the place value.

whether the answer should be rounded up to 5 or rounded down to 4 depends on the context.

## Year 6 – division

### Curriculum 2014 Statutory Requirements

Pupils should be taught to:

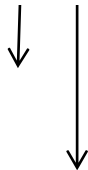
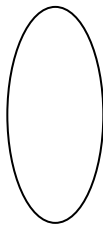
- divide numbers up to 4 digits by a two-digit number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding as appropriate for the context.
- divide numbers up to 4 digits by a two-digit number using the formal written method of short division as appropriate.

Children will continue to use written methods to solve short division  $TU \div U$  and  $HTU \div U$ .

#### Long division $THHTU \div TU$

$$972 \div 36$$

$$\begin{array}{r} 27 \\ 36 \overline{) 972} \\ \underline{- 72} \phantom{00} \\ 292 \\ \underline{292} \phantom{00} \\ 0 \end{array}$$



Answer : 27

Any remainders should be shown as fractions/decimals, i.e. if the children were dividing 32 by 10, the answer should be shown as  $3 \frac{2}{10}$  +which could then be written as  $3 \frac{1}{5}$  in it's lowest terms.

Extend to decimals with up to two decimal places. Children should know that decimal points line up under each other.

$$87.5 \div 7$$

### Teaching Points

Model selection of an appropriate division format - dependent on size of number, efficient ability to apply larger 'tables facts' such as  $15 \times$  as shown.

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## Year 1 - Fractions

Pupils should be taught to:

- 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.

## Year 2 - Fractions

Pupils should be taught to:

- 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
- Write simple fractions for example,  $\frac{1}{2}$  of 6 = 3 and recognise the equivalence of  $\frac{2}{4}$  and  $\frac{1}{2}$ .

Use of bar modelling to assist learning

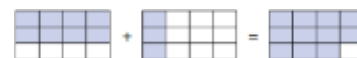
## Year 3 - Fractions

Pupils should be taught to:

- Count up and down in tenths; recognise that tenths arise from dividing an object into 10 equal parts and in dividing one-digit numbers or quantities by 10
- Recognise, find and write fractions of a discrete set of objects: unit fractions and non-unit fractions with small denominators
- Recognise and use fractions as numbers: unit fractions and non-unit fractions with small denominators
- Recognise and show, using diagrams, equivalent fractions with small denominators

Add and subtract fractions with the same denominator within one whole :

Eg:  $\frac{8}{12} + \frac{3}{12} = \frac{11}{12}$  Teaching point - add numerator - ensure children recognise what a whole looks like.



Compare and order unit fractions, and fractions with the same denominators

Ensure bar modelling used as a method.

## Year 4 - Fractions

Pupils should be taught to:

- Recognise and show, using diagrams, families of common equivalent fractions
- Count up and down in hundredths; recognise that hundredths arise when dividing an object by one hundred and dividing tenths by ten.

Add and subtract fractions with the same denominator

$$3/8 + 5/8 = 8/8 \text{ same as 1 whole}$$

$$6/7 - 4/7 = 2/7 \text{ Teaching point is subtracting the numerator}$$

## Year 5 - Fractions

Pupils should be taught to:

- Compare and order fractions whose denominators are all multiples of the same number
- Identify, name and write equivalent fractions of a given fraction, represented visually, including tenths and hundredths
- Add and subtract fractions with the same denominator and denominators that are multiples of the same number

Add and subtract fractions with the same denominator and denominators that are multiples of the same number

Recognise mixed numbers and improper fractions and convert from one form to the other and write mathematical statements as a mixed number

$$\text{For example, } \frac{2}{5} + \frac{4}{5} = \frac{6}{5} = 1 \frac{1}{5}$$

$$1/8 + 1/8 = 2/8 = 1/4$$

$$\frac{1}{4} + 1/8 = 3/8 - \frac{1}{4} = 2/8 + 1/8 = 3/8$$

Multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams

$$1/5 \times 3 = 3/5$$

$$2/5 \times 4 = 8/5$$

## Year 6 - Fractions

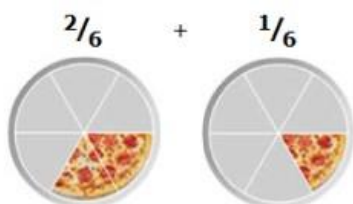
Pupils should be taught to:

- Use common factors to simplify fractions; use common multiples to express fractions in the same denominator
- Compare and order fractions, including fractions  $> 1$

Add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions

Important: you multiply **both top and bottom** by the same amount, to keep the value of the fraction the same

Now the fractions have the same bottom number ("6"), and our question looks like this:

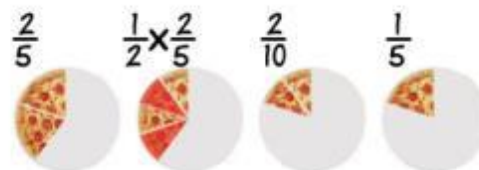


The bottom numbers are now the same, so we can go to step 2.

**Step 2:** Add the top numbers and put them over the same denominator:

$$\frac{2}{6} + \frac{1}{6} = \frac{2+1}{6} = \frac{3}{6}$$

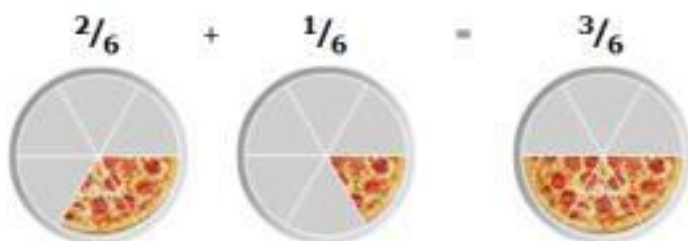
Here you can see it with pizza ...



... and do you see how two-tenths is simpler as one-fifth?

Multiply simple pairs of proper fractions, writing the answer in

In picture form it looks like this:



its simplest form for example,  $\frac{1}{2} \times \frac{2}{5}$

Example:

$$\frac{1}{2} \times \frac{2}{5}$$

Step 1. Multiply the top numbers:

$$\frac{1}{2} \times \frac{2}{5} = \frac{1 \times 2}{2 \times 5} = \frac{2}{10}$$

Step 2. Multiply the bottom numbers:

$$\frac{1}{2} \times \frac{2}{5} = \frac{1 \times 2}{2 \times 5} = \frac{2}{10}$$

Step 3. Simplify the fraction:

$$\frac{2}{10} = \frac{1}{5}$$

Divide proper fractions by whole numbers

for example,  $\frac{1}{3} \div 2 = \frac{1}{6}$

**\*KCF Method\***

**(keep, change, flip)**

$$\frac{1}{2} \text{ divided by } 3 = \frac{1}{2 \times 3} = \frac{1}{6}$$

When half a pizza is divided into 3 equal parts. Each person gets one sixth of a whole pizza.



By the end of year 6, children will have a range of calculation methods, mental and written. Selection will depend upon the numbers involved.

Children should not be made to go onto the next stage if:

- 1) they are not ready.
- 2) they are not confident.

Children should be encouraged to approximate their answers before calculating.

Children should be encouraged to check their answers after calculation using an appropriate strategy.

Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.

## Foundation – key vocabulary

### Adding and subtracting

add, more, and  
make, sum, total  
altogether  
score  
double  
one more, two more, ten  
more...  
how many more to make... ?  
how many more is... than...?  
take (away), leave  
how many are left/left over?  
how many have gone?  
one less, two less... ten less...  
how many fewer is... than...?  
difference between  
is the same as

### Solving problems

#### Reasoning about numbers or shapes

pattern  
puzzle  
answer  
right, wrong  
what could we try next?  
how did you work it out?  
count, sort  
group, set  
match  
same, different  
list

### Problems involving 'real life' or money

compare  
double  
half, halve  
pair  
count out, share out  
left, left over  
money  
coin  
penny, pence, pound  
price  
cost  
buy  
sell  
spend, spent  
pay  
change  
dear, costs more  
cheap, costs less, cheaper  
costs the same as  
how much...? how many...?  
total

## Year 1 – key vocabulary

<p><i>Words new to Year 1 are in red</i></p> <p><b>Addition and subtraction</b></p> <p>+, add, more, <b>plus</b></p> <p>make, sum, total</p> <p>altogether</p> <p>score</p> <p>double, <b>near double</b></p> <p>one more, two more... ten more</p> <p>how many more to make...?</p> <p>how many more is... than...?</p> <p><b>how much more is...?</b></p> <p>-, <b>subtract</b>, take (away), <b>minus</b> leave</p>	<p><b>Multiplication and division</b></p> <p>lots of, groups of</p> <p>x, times, multiply, multiplied by</p> <p>once, twice, three times, four times, five times... ten times...</p> <p>times as (big, long, wide and so on)</p> <p>repeated addition</p> <p>array</p> <p>row, column</p> <p>double, halve</p> <p>share, share equally</p> <p>one each, two each, three</p>	<p><b>Solving problems</b></p> <p><b>Making decisions and reasoning</b></p> <p>pattern</p> <p>puzzle</p> <p>answer</p> <p>right, wrong</p> <p>what could we try next?</p> <p>how did you work it out?</p> <p>count out, share out, left, left over</p> <p><b>number sentence</b></p> <p><b>sign, operation</b></p>
<p>how many are left/left over?</p> <p>how many are gone?</p> <p>one less, two less, ten less...</p> <p>how many fewer is... than...?</p> <p><b>how much less is...?</b></p> <p>difference between</p> <p><b>half, halve</b></p> <p><b>=, equals, sign</b>, is the same as</p>	<p>each...</p> <p>group in pairs, threes... tens</p> <p>equal groups of</p> <p>÷, divide, divided by, divided into, left, left over</p>	

## Year 2 – key vocabulary

*Words new to Year 2 are in red*

### Addition and subtraction

+, add, **addition**, more, plus  
 make, sum, total  
 altogether  
 score  
 double, near double  
 one more, two more... ten more... **one hundred more**  
 how many more to make...?  
 how many more is... than...?  
 how much more is...?  
 -, subtract, take away, minus  
 leave, how many are left/left over?  
 one less, two less... ten less...  
**one hundred less**  
 how many less is... than...?  
 how much fewer is...?  
 difference between  
 half, halve  
 =, equals, sign, is the same as  
**tens boundary**

### Multiplication and division

lots of, groups of  
 x, times, multiply, multiplied  
 by  
 multiple of  
 once, twice, three times, four times, five times... ten times...  
 times as (big, long, wide and so on)  
 repeated addition  
 array  
 row, column  
 double, halve  
 share, share equally  
 one each, two each, three each...  
 group in pairs, threes... tens  
 equal groups of  
 ÷, divide, divided by, divided into, left, left over

### Solving problems

#### Making decisions and reasoning

pattern, puzzle  
**calculate, calculation**  
**mental calculation**  
**jotting**  
 answer  
 right, **correct**, wrong  
 what could we try next?  
 how did you work it out?  
 number sentence  
 sign, operation, **symbol**

## Year 3 – key vocabulary

*Words new to Year 3 are in red*

### Addition and subtraction

+, add, addition, more, plus  
make, sum, total  
altogether  
score  
double, near double  
one more, two more... ten  
more... one hundred  
more  
how many more to make ...?  
how many more is... than ...?  
how much more is...?

### Multiplication and division

lots of, groups of  
x, times, **multiplication**,  
multiply, multiplied by  
multiple of, **product**  
once, twice, three times,  
four times, five times... ten  
times...  
times as (big, long, wide and  
so on)  
repeated addition  
array  
row, column  
double, halve

### Solving problems

### Making decisions and reasoning

pattern, puzzle  
calculate, calculation  
mental calculation

**method**

jotting  
answer  
right, correct, wrong  
what could we try next?  
how did you work it out?

-, subtract, take (away),  
minus  
leave, how many are left/left  
over?  
one less, two less... ten less...  
one hundred less  
how many fewer is... than ...?  
how much less is...?  
difference between  
half, halve  
=, equals, sign, is the same as  
tens boundary, **hundreds**  
**boundary**

share, share equally  
one each, two each, three  
each...  
group in pairs, threes... tens  
equal groups of  
÷, divide, **division**, divided by,  
divided into  
left, left over, **remainder**

number sentence  
sign, operation, symbol,  
**equation**



## Year 4 – key vocabulary

*Words new to Year 4 are in red*

### **Addition and subtraction**

add, addition, more, plus,

**increase**

sum, total, altogether

score

double, near double

how many more to make...?

subtract, subtraction, take

away, minus, **decrease**

leave, how many are left/left over?

difference between

half, halve

how many more/fewer is... than...?

how much more/less is...?

is the same as, equals, sign

tens boundary, hundreds

boundary

**inverse**

### **Multiplication and division**

lots of, groups of

times, multiplication, multiply,

multiplied by

multiple of, product

once, twice, three times

four times, five times... ten

times

times as (big, long, wide, and so on)

repeated addition

array

row, column

double, halve

share, share equally

one each, two each, three each...

group in pairs, threes... tens

equal groups of

divide, division, divided by,

divided into, **divisible by**

remainder

**factor, quotient**

**inverse**

### **Solving problems**

#### **Making decisions and reasoning**

pattern, puzzle

calculate, calculation

mental calculation

method

jotting

answer

right, correct, wrong

what could we try next?

how did you work it out?

number sentence

sign, operation, symbol,

equation

## Year 5 – key vocabulary

<i>Words new to Year 5 are in red</i>	Multiplication and division	Solving problems
<p><i>red</i></p> <p><b>Addition and subtraction</b>  add, addition, more, plus,  increase  sum, total, altogether  score  double, near double  how many more to make...?  subtract, subtraction, take  (away), minus, decrease  leave, how many are left/left  over?  difference between  half, halve  how many more/ fewer is...  than...?  how much more/less is...?  equals, sign, is the same as  tens boundary, hundreds  boundary  <i>units boundary, tenths  boundary</i>  inverse</p>	<p>lots of, groups of  times, multiply, multiplication,  multiplied by  multiple of, product  once, twice, three times  four times, five times... ten  times  times as (big, long, wide, and  so on)  repeated addition  array  row, column  double, halve  share, share equally  one each, two each, three  each...  group in pairs, threes... tens  equal groups of  divide, divided by, divided  into, divisible by, <i>divisor</i>  remainder  factor, quotient, divisible by  inverse  <i>long division / multiplication  short division / multiplication</i></p>	<p><b>Making decisions and reasoning</b>  pattern, puzzle  calculate, calculation  mental calculation  method, <i>strategy</i>  jotting  answer  right, correct, wrong  what could we try next?  how did you work it out?  number sentence  sign, operation, symbol,  equation</p>

## Year 6 – key vocabulary

<p><i>Words new to Year 6 are in red</i></p> <p><b>Addition and subtraction</b>  add, addition, more, plus, increase  sum, total, altogether  score  double, near double  how many more to make...?  subtract, subtraction, take (away), minus, decrease  leave, how many are left/left over?  difference between</p>	<p><b>Multiplication and division</b>  lots of, groups of  times, multiplication, multiply, multiplied by  multiple of, product  once, twice, three times  four times, five times... ten times  times as (big, long, wide, and so on)  repeated addition  array, row, column  double, halve  share, share equally</p>	<p><b>Solving problems</b>  <b>Making decisions and reasoning</b>  pattern, puzzle  calculate, calculation  mental calculation  method, strategy  jotting  answer  right, correct, wrong  what could we try next?  how did you work it out?  number sentence  sign, operation, symbol,</p>
<p>half, halve  how many more/fewer is... than...?  how much more/less is...?  is the same as, equals, sign  tens boundary, hundreds boundary  units boundary, tenths boundary  inverse  <b>amount</b>  <b>brackets</b>  <b>calculator: clear, display, enter,</b>  <b>key, memory,</b>  <b>change (money)</b>  <b>commutative</b>  <b>complements (in 10, 100)</b>  <b>currency</b>  <b>discount</b>  <b>exact, exactly</b>  <b>exchange rate</b>  <b>most/least significant digit</b></p>	<p>one each, two each, three each...  group in pairs, threes... tens  equal groups of  divide, division, divided by, divided into  remainder  factor, quotient, divisible by  inverse  divisible by, <b>divisor</b>  remainder  <b>long division / multiplication</b>  <b>short division / multiplication</b></p>	<p>equation</p>

# PROGRESSION THROUGH MENTAL CALCULATIONS

## MENTAL CALCULATIONS

(ongoing)

These are a **selection** of mental calculation strategies to support fluency:

## ADDITION

### Mental recall of number bonds

$$6 + 4 = 10$$

$$\square + 3 = 10$$

$$25 + 75 = 100$$

$$19 + \square = 20$$

### Use near doubles

$$6 + 7 = \text{double } 6 + 1 = 13$$

### Addition using partitioning and recombining

$$34 + 45 = (30 + 40) + (4 + 5) = 79$$

### Counting on or back in repeated steps of 1, 10, 100, 1000

$$86 + 57 = 143 \text{ (by counting on in tens and then in ones)}$$

$$460 - 300 = 160 \text{ (by counting back in hundreds)}$$

### Add the nearest multiple of 10, 100 and 1000 and adjust

$$24 + 19 = 24 + 20 - 1 = 43$$

$$458 + 71 = 458 + 70 + 1 = 529$$

### Use the relationship between addition and subtraction

$$36 + 19 = 55$$

$$19 + 36 = 55$$

$$55 - 19 = 36$$

$$55 - 36 = 19$$

## SUBTRACTION

### Mental recall of addition and subtraction facts

$$10 - 6 = 4$$

$$17 - \square = 11$$

$$20 - 17 = 3$$

$$10 - \square = 2$$

### Find a small difference by counting up

$$82 - 79 = 3$$

### Counting on or back in repeated steps of 1, 10, 100, 1000

$$86 - 52 = 34 \text{ (by counting back in tens and then in ones)}$$

$$460 - 300 = 160 \text{ (by counting back in hundreds)}$$

### Subtract the nearest multiple of 10, 100 and 1000 and adjust

$$24 - 19 = 24 - 20 + 1 = 5$$

$$458 - 71 = 458 - 70 - 1 = 387$$

### **Use the relationship between addition and subtraction**

$$36 + 19 = 55$$

$$19 + 36 = 55$$

$$55 - 19 = 36$$

$$55 - 36 = 19$$

## **MULTIPLICATION**

### **Doubling and halving**

Applying the knowledge of doubles and halves to known facts.

e.g.  $8 \times 4$  is double  $4 \times 4$

### **Using multiplication facts**

*Tables should be taught everyday from Y2 onwards, either as part of the mental oral starter or other times as appropriate within the day (Year 1 to recall multiples of 2, 5, 10).*

Year 1        2 times table  
              5 times table  
              10 times table

Year 2        2 times table  
              3 times table  
              4 times table  
              5 times table  
              10 times table

Year 3        Derive and recall the times tables above plus 6X 7X, 8X and 9X  
Year 4        Derive and recall division facts quickly for all tables up to  $12 \times 12$

Year 5 & 6    Derive and recall instantly division facts for all tables up to  $12 \times 12$

### **Using and applying division facts**

Children should be able to utilise their tables knowledge to derive other facts.

e.g. If I know  $3 \times 7 = 21$ , what else do I know?

$30 \times 7 = 210$ ,  $300 \times 7 = 2100$ ,  $3000 \times 7 = 21\,000$ ,  $0.3 \times 7 = 2.1$  etc

### **Use closely related facts already known**

$$\begin{aligned} 13 \times 11 &= (13 \times 10) + (13 \times 1) \\ &= 130 + 13 \\ &= 143 \end{aligned}$$

### **Multiplying by 10 or 100**

Knowing that the effect of multiplying by 10 is a shift in the digits one place to the left.

Knowing that the effect of multiplying by 100 is a shift in the digits two places to the left.

From Year 2 onwards children begin to multiply by 10/100 using decimals (measures)

### Partitioning

$$\begin{aligned} 23 \times 4 &= (20 \times 4) + (3 \times 4) \\ &= 80 + 12 \\ &= 102 \end{aligned}$$

### Use of factors

$$8 \times 12 = 8 \times 4 \times 3$$

## DIVISION

### Doubling and halving

Knowing that halving is dividing by 2

### Deriving and recalling division facts

*Tables should be taught from Y2 onwards, either as part of the mental oral starter or other times as appropriate within the day (Year 1 to recall multiples of 2, 5, 10)*

Year 1 2 times table

5 times table

10 times table

Year 2 2 times table

3 times table

4 times table

5 times table

6 times table

10 times table

Year 3 Derive and recall the times tables above plus 7X, 8X and 9X

Year 4 Derive and recall division facts quickly for all tables up to 12 x 12

Year 5 & 6 Derive and recall instantly division facts for all tables up to 12 x 12

### Using and applying division facts

Children should be able to utilise their tables knowledge to derive other facts.

e.g. If I know  $3 \times 7 = 21$ , what else do I know?

$30 \times 7 = 210$ ,  $300 \times 7 = 2100$ ,  $3000 \times 7 = 21\,000$ ,  $0.3 \times 7 = 2.1$  etc

### Dividing by 10 or 100

Knowing that the effect of dividing by 10 is a shift in the digits one place to the right.

Knowing that the effect of dividing by 100 is a shift in the digits two places to the right.

From Year 2 onwards children begin to divide by 10/100 using decimals (measures)

### Use of factors

$$378 \div 21 \quad 378 \div 3 = 126 \quad 378 \div 21 = 18$$
$$126 \div 7 = 18$$

**Use related facts**

Given that  $1.4 \times 1.1 = 1.54$

What is  $1.54 \div 1.4$ , or  $1.54 \div 1.1$ ?

*MANY MENTAL CALCULATION STRATEGIES WILL CONTINUE TO BE USED. THEY ARE NOT REPLACED BY WRITTEN METHODS.*