

Riverside Academy



Calculation Policy
2021

Progression in written methods of calculations

Written methods in Addition

Foundation:

No written methods, hands on activities and use of number fans and number lines.



3 people are on the bus, and two more get on, how many altogether?



Can you show me one more than 5? Can you show me one more than 7?

To use language of bigger than or smaller than relating to quantities.

To be able to distinguish one more than or one less than up to ten.

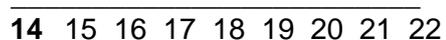
Year 1

Method: *Number line*

$$6 + 5 =$$



$$8 + 14 = \text{ (Larger number first)}$$



$$17 + 10 = \text{ (Jumping in tens) } \text{ J10}$$



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 $7 = \square - 9$.

Year 3

Method: *Column Addition*

$$\begin{array}{r} \text{H T O} \quad \text{(Label columns and carry underneath)} \\ 338 \\ + 124 \\ \hline 462 \\ \text{\textit{A}} \end{array}$$

NB Pupils use their understanding of place value and partitioning, and practise using columnar addition increasingly large numbers up to three digits to become fluent

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.

Year 4

Method: *Column Addition*

$$\begin{array}{rcccc} & \text{Th} & \text{HT} & \text{O} & \\ & 2 & 6 & 7 & 4 \\ + & 2 & 2 & 8 & 1 \\ \hline & 4 & 9 & 5 & 5 \\ & & & & \nearrow \end{array}$$

(Label columns and carry underneath)

Method: *Column Addition Decimals*

$$\begin{array}{r} \pounds 2.75 \\ \pounds 4.43 \\ \hline \pounds 7.18 \\ \nearrow \end{array}$$

NB Pupils continue to practise both mental methods and columnar addition with increasingly large numbers to aid fluency

Pupils should be taught to:

- add numbers with up to 4 digits using the formal written methods of columnar addition 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.

Year 5

Method: *Column Addition*

$$\begin{array}{rcccc} \text{Tth} & \text{Th} & \text{H} & \text{T} & \text{O} \\ 5 & 2 & 6 & 7 & 4 \\ + & 4 & 2 & 2 & 8 & 1 \\ \hline 9 & 4 & 9 & 5 & 5 \\ \hline \end{array} \quad \text{(Label columns and carry underneath)}$$

Method: *Column Addition Decimals*

$$\begin{array}{r} \text{T} & \text{O} & . & \text{t} & \text{h} \\ 6 & 5 & . & 4 & 3 \\ + & 2 & 3 & . & 1 & 8 \\ \hline 8 & 8 & . & 6 & 1 \\ \hline \end{array}$$

NB Pupils practise using the formal written methods of columnar addition increasingly large numbers to aid fluency

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 ¹_{SEP} problem, levels of accuracy
- solve addition multi-step problems in contexts, deciding which operations and methods to use and why.

Year 6

Method: *Column Addition*

$$\begin{array}{rcccc} \text{Tth} & \text{Th} & \text{H} & \text{T} & \text{O} & \\ & 5 & 2 & 6 & 7 & 4 \\ + & 4 & 2 & 2 & 8 & 1 \\ \hline & 9 & 4 & 9 & 5 & 5 \\ & & & & & \nearrow \end{array}$$

(Label columns and carry underneath)

Method: *Column Addition Decimals*

$$\begin{array}{r} \text{T O . t h} \\ 65.43 \\ + 23.18 \\ \hline 88.61 \\ \nearrow \end{array}$$

NB Pupils practise addition for larger numbers, using the formal written methods of columnar addition.

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

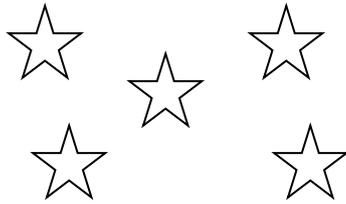
Progression in written methods of calculation

Written methods in Subtraction

Foundation

Method: *Kinaesthetic learning*

$$5 - 3 =$$



Begin to relate subtraction to 'taking away'.

In practical activities and discussion begin to use the vocabulary involved in subtracting.

Year 1

Method: *Number line*

$9 - 6 =$ (Larger number always on right)

3 4 5 6 7 8 9

$10 - 6 =$

4 5 6 7 8 9 10

$15 - 8 =$

7 8 9 10 11 12 13 14 15

$26 - 10 =$

16 26

Pupils should be taught to:

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

Year 2

Method: *Number line*

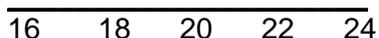
$$28 - 12 =$$

$$28 - 10 - 2 =$$



Method: *Finding the difference (Complimentary addition)*
For those that are able.

$$24 - 16 =$$



NB Recording subtraction in columns supports place value and prepares for formal written methods with larger numbers.

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 ^[1]_[SEP] related facts up to 100
- subtract numbers using concrete objects, pictorial representations, and mentally, including: ^[1]_[SEP] a two-digit number and ones^[1]_[SEP]; a two-digit number and tens^[1]_[SEP]; two two-digit numbers^[1]_[SEP]; 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.

Year 3

Method: *Column Subtraction*

$$\begin{array}{r} \text{H T O} \quad \quad \text{(Label columns and exchanges)} \\ 5 \text{ } 13 \\ \cancel{8} \ \cancel{2} \ 3 \\ - \ \underline{1 \ 5 \ 1} \\ \underline{4 \ 8 \ 2} \end{array}$$

NB Pupils use their understanding of place value and partitioning, and practise using subtraction with increasingly large numbers up to three digits to become fluent

Pupils should be taught to:

- subtract numbers mentally, including: - a three-digit number and ones^[1]_{SEP}- a three-digit number and tens^[1]_{SEP}- a three-digit number and hundreds
- subtract numbers with up to three digits, using formal written methods of columnar addition and 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.

Year 4

Method: *Column subtraction*

	Th	H	T	O		(Label columns and exchanges)
		8	13			
		9	8	3		
-		8	7	7	1	
		1	1	5	2	

NB Pupils continue to practise both mental methods and columnar subtraction with increasingly large numbers to aid fluency

Pupils should be taught to:

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

Year 5

Method: *Column subtraction*

$$\begin{array}{r} \text{Tth Th H T O} \quad (\text{Label columns and carry underneath}) \\ 518 \quad 314 \\ \cancel{88} \cancel{2} \cancel{4} \cancel{4} \\ - \quad \underline{49217} \\ \underline{19027} \end{array}$$

Method: *Column Subtraction Decimals*

$$\begin{array}{r} \text{T O . t h} \\ \quad \quad 313 \\ 65. \cancel{4} \cancel{3} \\ - \quad \underline{23.18} \\ \underline{42.25} \end{array}$$

NB Pupils practise using the formal written methods of columnar subtraction with increasingly large numbers to aid fluency

Pupils should be taught to:

- subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)
- subtract numbers mentally with increasingly large numbers
- use rounding to check answers to calculations and determine, in the context of a $\left[\begin{array}{c} \text{[]} \\ \text{[]} \end{array} \right]$ problem, levels of accuracy
- solve subtraction multi-step problems in contexts, deciding which operations and methods to use and why.

Year 6

Method: *Column subtraction*

$$\begin{array}{r} \text{Hth Tth Th H T O} \quad (\text{Label columns and exchange}) \\ 5 \ 12 \quad \quad 3 \ 16 \\ \cancel{8} \ \cancel{2} \ 8 \ 8 \ \cancel{4} \ \cancel{8} \\ - \ 4 \ 4 \ 2 \ 8 \ 1 \ 8 \\ \hline 1 \ 6 \ 6 \ 0 \ 2 \ 8 \end{array}$$

Method: *Column Subtraction Decimals*

$$\begin{array}{r} \text{T O . t h th} \\ 6 \ 14 \quad 2 \ 13 \\ \cancel{7} \ \cancel{4} . 3 \ \cancel{3} \ \cancel{8} \\ - \ 2 \ 7 . 1 \ 2 \ 7 \\ \hline 4 \ 7 . 2 \ 0 \ 5 \end{array}$$

NB Pupils practise addition for larger numbers, using the formal written methods of columnar addition.

NB Pupils practise subtraction using the formal written methods of columnar subtraction.

Pupils should be taught to:

- perform mental calculations, including with mixed operations and large numbers
- identify common factors, common multiples and prime 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

Written methods in Multiplication

Foundation

No written methods.

Multiplication is to be taught as repeated addition on 1-20 number lines and in sharing activities.



3 Children receive 2 lollipops each, how many lollipops are there altogether?

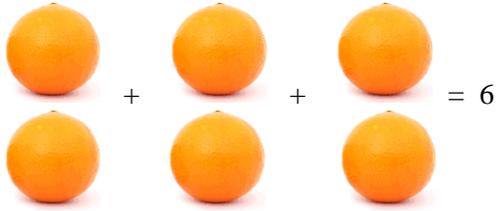
Count aloud in ones, twos, fives or tens.

Count repeated groups of the same size.

Year 1

Method: *Repeated addition*

$$3 \times 2 = 6$$



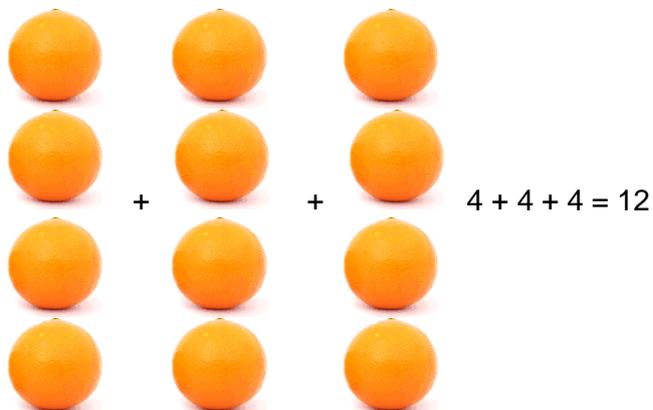
Pupils should be taught to:

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

Year 2

Method: *Repeated addition*

$$3 \times 4 = 12$$



$$4 \times 3 = 12$$

Method: *Repeated addition on a number line*

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

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)
- solve problems involving multiplication, using materials, arrays, repeated addition, mental methods, and multiplication including problems in contexts.

Year 3

Short Multiplication Method:

2 digit x 1 digit

$$\begin{array}{r} 24 \\ \times 6 \\ \hline 144 \\ \hline \end{array}$$

NB Pupils develop reliable written methods for multiplication, starting with calculations of two-digit numbers by one-digit numbers and progressing to the formal written methods of short multiplication.

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.

Year 4

Short Multiplication Method:

2 digit x 1 digit

$$\begin{array}{r} 24 \\ \times 6 \\ \hline 144 \\ \hline \end{array}$$

3 digit x 1 digit

$$\begin{array}{r} 342 \\ \times 7 \\ \hline 2394 \\ \hline \end{array}$$

NB: multiply two-digit and three-digit numbers by a one-digit number using formal written ^[SEP]layout. Differentiate as necessary for grid method

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 ^[SEP]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.

Year 5

Long Multiplication Method:

2 digit x 2 digit

$$\begin{array}{r} 2 \\ 24 \\ \times 16 \\ \hline 240 \\ 144 \\ \hline 384 \end{array}$$

3 digit x 2 digit

$$\begin{array}{r} 1 2 \\ 124 \\ \times 26 \\ \hline 2480 \\ 744 \\ \hline 3224 \\ \cancel{\times} \cancel{\times} \end{array}$$

$$\begin{array}{r} 1 2 \\ 124 \\ \times 26 \\ \hline 744 \\ 2480 \\ \hline 3224 \\ \cancel{\times} \cancel{\times} \end{array}$$

NB multiply numbers up to 4 digits by a one- or two-digit number using a formal written $\overline{\overline{}}$ method, including long multiplication for two-digit numbers

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 $\overline{\overline{}}$ 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

Year 6

Long Multiplication Method:

2 digit x 2 digit

$$\begin{array}{r} 2 \\ 24 \\ \times 16 \\ \hline 240 \\ 144 \\ \hline 384 \end{array}$$

3 digit x 2 digit

$$\begin{array}{r} 12 \\ 124 \\ \times 26 \\ \hline 2480 \\ 744 \\ \hline 3224 \\ \hline \cancel{x} \cancel{x} \end{array}$$

$$\begin{array}{r} 12 \\ 124 \\ \times 26 \\ \hline 744 \\ 2480 \\ \hline 3224 \\ \hline \cancel{x} \cancel{x} \end{array}$$

NB multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication

Pupils should be taught to:

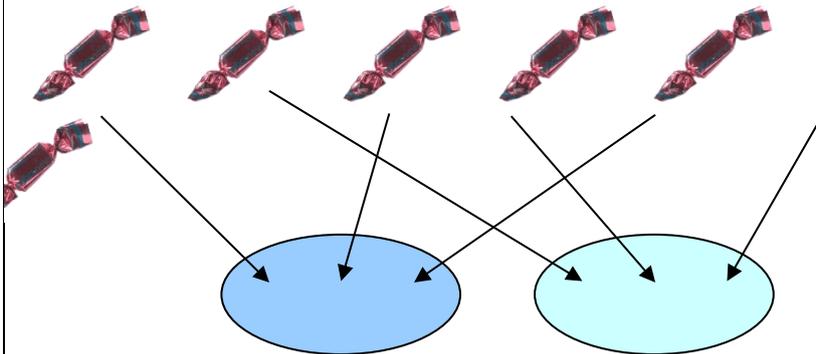
- multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication
- perform mental calculations, including with mixed operations and large numbers
- identify common factors, common multiples and prime numbers
- use their knowledge of the order of operations to carry out calculations involving the four operations

Written methods in Division

Foundation

Stage 1:

Method: To understand division as **Sharing Equally**
e.g. $6 \div 2$ (share 6 sweets between 2 children)



Count aloud in ones, twos, fives or tens.

Share objects into equal groups and count how many in each group

Year 1

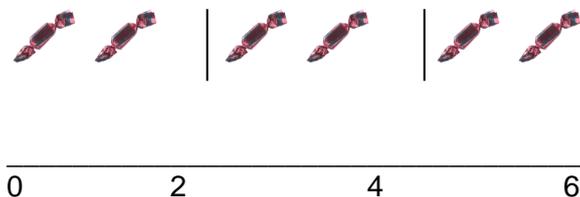
Stage 1:

Grouping (or repeated subtraction)

Grouping (or repeated subtraction) occurs when we are asked to find how many groups of a given size are equivalent to the original quantity. For example how many groups of 2 marbles are in a set of 6 marbles, the calculation:

$$6 \div 2 \quad (\text{how many 2s in 6?})$$

Shown/calculated on a number line:



It is vital that we teach all of the above methods of division, including repeated subtraction, to enable children to understand methods taught later on.

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.

Year 2

$$10 \times 2 = 20$$

$$2 \times 2 = 4$$

2 lots

10 lots

0 2 4 6 8 10 12 14 16 18 20 22 24

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 multiplication and division within the multiplication tables and write them using the division (\div) 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 division, using materials, arrays, repeated addition, mental methods, and division facts, including problems in contexts.

Year 3

Key Facts: $10 \times 7 = 70$
 $5 \times 7 = 35$
 $2 \times 7 = 14$
 $1 \times 7 = 7$

-14 - 14 - 70

2 lots 2 lots 10 lots

0 2 16 30 100

Extending to the Short Division Method

$98 \div 7$ becomes

$$\begin{array}{r} 14 \\ 7 \overline{) 98} \end{array}$$

NB Pupils develop reliable written methods for division, starting with calculations of two-digit numbers by one-digit numbers and progressing to the formal written methods of short division.

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, including for two-digit numbers times one-digit numbers, 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.

Year 4

Short Division Method

$98 \div 7$ becomes

$$\begin{array}{r} 14 \\ 7 \overline{) 98} \end{array}$$

NB Pupils practise to become fluent in the formal written method of short division with exact answers

Pupils should be taught to:

- recall division facts for multiplication tables up to 12×12
- divide numbers up to 2 digits by a one-digit number using the formal written method of short division
- use place value, known and derived facts to divide mentally, including: dividing by 1
- recognise and use factor pairs and commutativity in mental calculations

Year 5

Short Division Method

3 Digits ÷ 1 with
Remainders

432 ÷ 5 becomes

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

3 Digits ÷ 2 with
Remainders

496 ÷ 11 becomes

$$\begin{array}{r} 45 \text{ r}1 \\ 11 \overline{) 496} \end{array}$$

NB divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context

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
- divide numbers mentally drawing upon known facts
- divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context
- divide whole numbers and those involving decimals by 10, 100 and 1000

Year 6

Long Division Method

3 Digits ÷ 2

432 ÷ 15 becomes

$$\begin{array}{r} 28 \text{ r } 12 \\ 15 \overline{) 432} \\ \underline{300} \\ 132 \\ \underline{120} \\ 12 \end{array}$$

3 Digits ÷ 2 with
Remainders

432 ÷ 15 becomes

$$\begin{array}{r} 28 \\ 15 \overline{) 432} \\ \underline{300} \quad 15 \times 20 \\ 132 \\ \underline{120} \quad 15 \times 8 \\ 12 \end{array}$$

NB 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

NB ÷ 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

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
- identify common factors, common multiples and prime numbers
- use their knowledge of the order of operations to carry out calculations involving the four operations