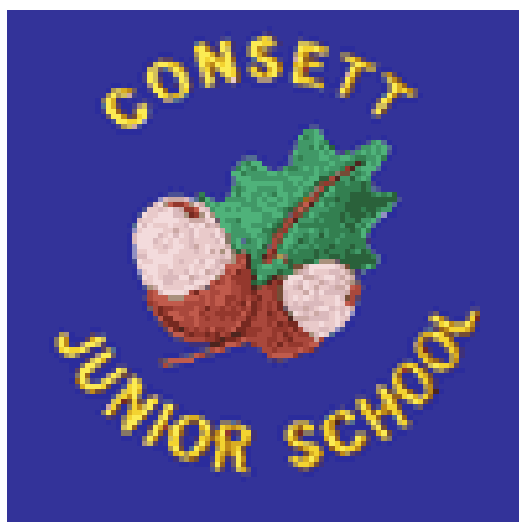# Consett Junior School

Written Calculations Policy

Document Control

Document Reference	Written Calculation Policy	Date implemented:	01/02/2014
Version	2.1	Date modified:	01/02/2020
Revision due date:	February 2022	Publication:	External
Reviewed by:	Scott Meadows	Sign and date:	1/02/2020
Authorised by:	Paul Dixon	Sign and date:	1/02/2020

Change history

Version	Date	Description
1.0	1/02/2014	Bi-Annual review
2.0	1/02/2016	Bi-Annual review
3.0	1/02/2018	Bi-Annual review
4.0	1/02/2020	Bi-Annual review

Related documents/policies

References	Title
	Accessibility Policy
	Fire Risk Policy

Progression Towards a Standard Written Method of Calculation

Introduction:
This calculation policy has been written in line with the programmes of study taken from the revised National Curriculum for Mathematics (2014). It provides guidance on appropriate calculation methods and progression. The content is set out under the following headings: addition, subtraction, multiplication and division. Statutory requirement statements, which are relevant to this written calculations policy, have been taken directly from the programmes of study and they are listed at the end of this policy.

The overall aims when children leave Consett Junior School are for them to:
- have a secure understanding of mental maths facts to apply to written mathematics
- have a secure knowledge of number facts and a good understanding of the four operations
- have a thorough understanding of vocabulary associated with the four operations
- have an efficient, reliable, compact written method of calculation for each operation that children can apply with confidence when undertaking calculations that they cannot carry out mentally
- be able to use this knowledge and understanding to answer reasoning questions, solve problems and work out mathematical puzzles
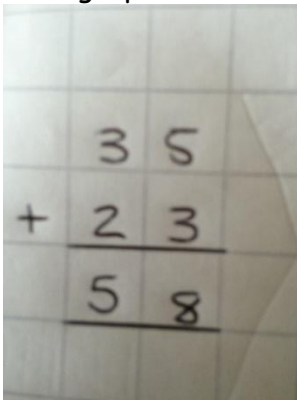
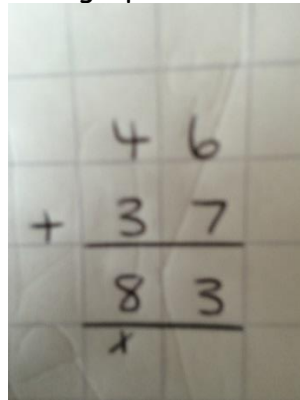# Addition

Key Vocabulary:
add, addition, plus, and, count on, more, sum, total, altogether, increase etc.

The following photographs show the progression in the teaching of addition in Consett Junior School:

Photograph 1:   Photograph 2:

When children arrive in KS2 most are ready to be introduced to the formal written method (see photograph 1). In the early stages counting apparatus, base-10 apparatus, place value charts, numbered number lines, marked but unnumbered number lines, empty number lines and hundred squares may be used to assist in the teaching of addition.

The next step would be photograph 2. Use the language of place value to ensure understanding: 'Six add seven equals 13. Write 3 in the ones column and 'carry' one (10) across to the tens column. 40 + 30 and the ten that we 'carried' equals 80. Write 8 (80) in the tens column.
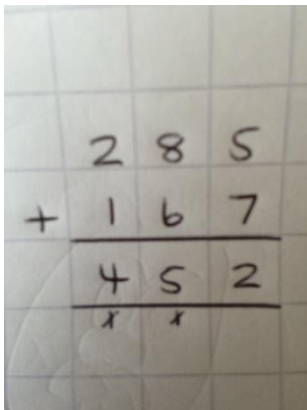
This will lead into the **formal written method** for HTU+TU and HTU+HTU…
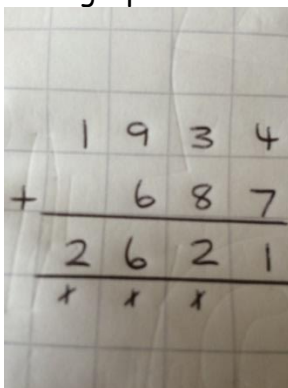
Photograph 3:
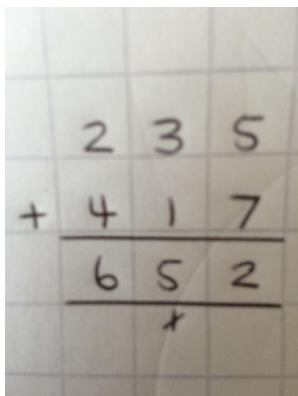
Use the language of place value to ensure understanding: 'Five add seven equals 12. Write 2 in the ones column and 'carry' one across into the tens column (10). 30 add 10 and then add the ten that we carried equals 50. Write 5 in the tens column. 200 add 400 equals 600. Write 6 in the hundreds column (600).

Photograph 4:

Use the language of place value to ensure understanding: 'Five add seven equals 12. Write 2 in the ones column and 'carry' one across into the tens column (10). 80 add 60 and then add the ten that we carried equals 150. Write 5 in the tens column and 'carry' 1 (100) across into the hundreds column. 200 add 100 and the 100 that has been carried equals 400. Write 4 in the hundreds column (400).
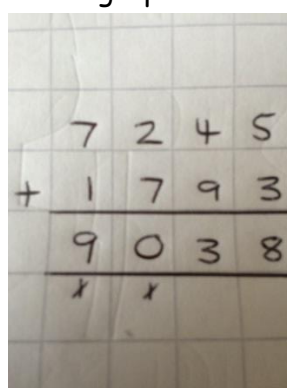
This will lead into the **formal written method** for ThHTU+HTU and ThHTU+ThHTU etc...

Ensure that children are confident with the methods outlined in the previous stages before moving on. Continue to develop the **formal written method** for addition with larger numbers (and decimal numbers) and with the addition of three or more numbers:
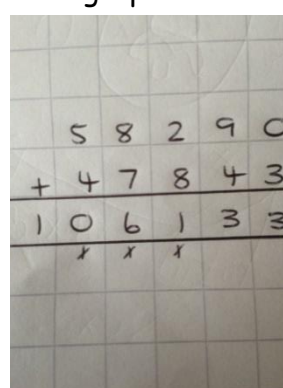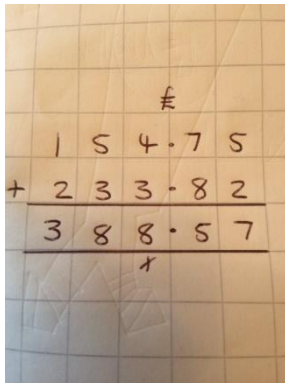
Photograph 5:

Photograph 6:

Photograph 7:

Continue to use the language of place value to ensure understanding. Ensure that the digits that have been 'carried' are recorded under the line in the correct column. Use the **formal written method** for the addition of decimal numbers:

Photograph 8:

Our aim is that by the end of Y6, children use mental methods (with jottings) when appropriate, but for calculations that they cannot do in their heads, they use an efficient formal written method accurately and with confidence.

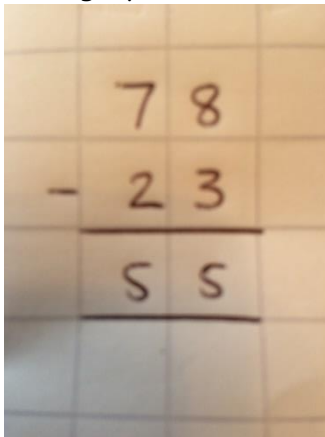## Subtraction

Key Vocabulary:
Subtract, take away, minus, count back, less, fewer, difference between, decrease etc.

The following photographs show the progression in the teaching of subtraction in Consett Junior School:

When children arrive in KS2 most are ready to be introduced to the formal written method (see photograph 9). In the early stages counting apparatus, base-10 apparatus, place value charts, numbered number lines, marked but unnumbered number lines, empty number lines and hundred squares may be used to assist in the teaching of subtraction.

On entering KS2 children will be introduced to the formal written method:

Photograph 9:

Use the language of place value to ensure understanding. 'Eight subtract three, seventy subtract twenty.'

When children are confident introduce the formal written method, involving decomposition/exchange/regrouping:

Photograph 10:

Use the language of place value to ensure understanding. 'We can't subtract seven from 3, so we need to regroup and exchange a ten for ten ones to give us 60 and 13. The use of red pen is simply for demonstration purposes.

If children are confident, extend the use of the formal written method with numbers over 100.

Photograph 11:

Use the language of place value to ensure understanding. In this example, it has only been necessary to exchange and regroup from the tens column.

NB: If, at any time, children are making significant errors, return to the previous stage in calculation or use base-10 apparatus and place value charts as a visual stimulus.

Photograph 12:

When children are confident introduce them to examples such as the one in photograph 12. Use the language of place value to ensure understanding. 'We can't subtract 9 from 5, so we need to regroup and exchange a ten for ten ones but we can't take from the zero. We regroup and exchange from the 4 in the hundreds column (400). The use of red pen is simply for demonstration purposes.

When children are confident, extend with four-digit numbers.

Photograph 13:   Photograph 14:   Photograph 15:

6

Continue to practise and apply the formal written method with large numbers and decimals throughout upper key stage 2.

Photograph 16:

Ensure the decimal point lines up.

NB: If, at any time, children are making significant errors, return to the previous stage in calculation.

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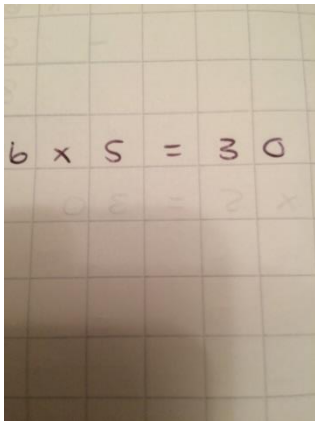
Multiplication

Key Vocabulary:
lots of, groups of, times, multiply, multiplication, multiple, product etc.
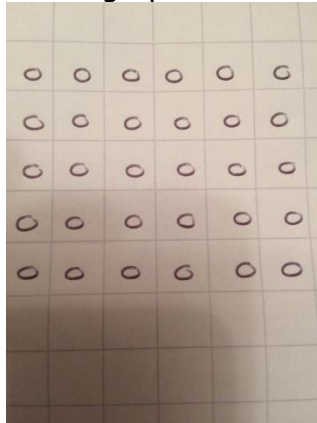
The following photographs show the progression in the teaching of multiplication in Consett Junior School:

Initially begin to teach multiplication through the use of arrays (see photographs 17 and 18).

Photograph 17:   Photograph 18:

Explain that 6x5 is the same as:
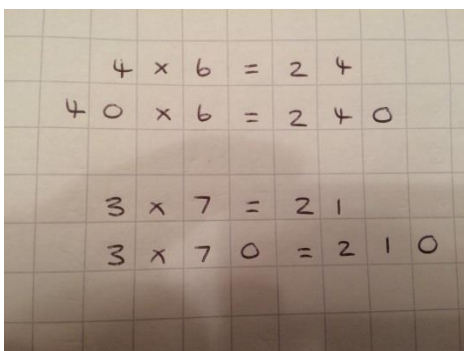'6 rows of 5'
'6 groups of 5'
'5 groups of 6'
'5 x 6 = 30'
'6 x 5 = 30'
'30 = 5 x 6'
'30 = 6 x 5'

The next stage would be to use known times table facts to multiply with multiples of ten (see photograph 19). You know that 4x6=24 so 40x6=240 or you know that 3x7=21 so 3x70=210 etc. These are known as 'facts for free'.
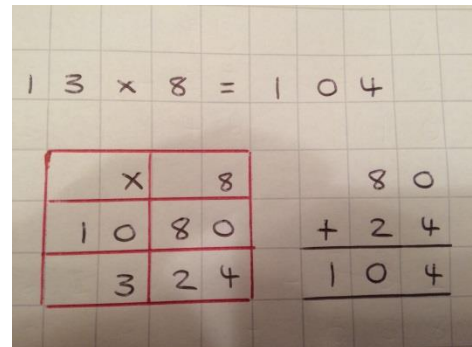
Photograph 19:

This will lead to children being taught the informal grid method of multiplication (see photograph 20).

Photograph 20:

'Partition 13 into 10 + 3 then multiply each number by 8. Add the partial products (80 and 24) together.'

Once children are confident using the grid method to calculate TUxU, the next stage would be to move onto HTUxU. The use of red pen is for demonstration purposes only.
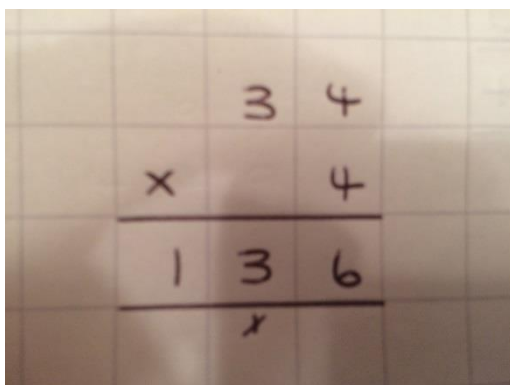
Photograph 21:
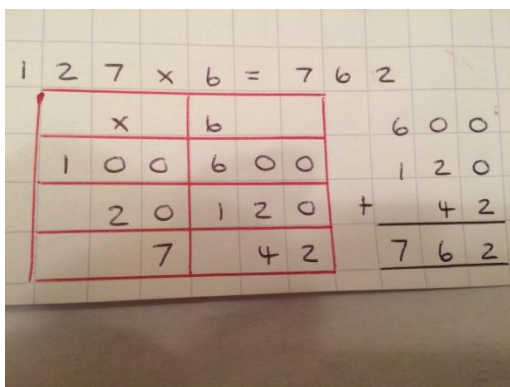
'Partition 127 into 100 + 20 + 7 then multiply each number by 6. Add the partial products (600, 120 and 42) together.'

This leads to short multiplication (formal method) of a two–digit number multiplied by a one- digit number. This could be introduced towards the end of Y4 if children are ready (see photograph 22).

Photograph 22:

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

Continue to practise the formal method of short multiplication of a two-digit number by a one -digit number. If children are confident, continue to develop short multiplication with three- digit numbers multiplied by a one-digit number (see photograph 23).

Photograph 23:

NB: If, at any time, children are making significant errors, return to the previous stage in calculation.

This leads to compact long multiplication formal method (two-digit numbers multiplied by a teen-number and then TUxTU). Use the language of place value to ensure understanding.

Photograph 24:

When children are confident with long multiplication extend with three-digit numbers multiplied by a two-digit number. Use the language of place value to ensure understanding.

Photograph 25:

NB: Ensure that children are confident with the methods outlined in the previous stage's guidance before moving on.

The next step would be to multiply multi-digit numbers (including decimals) up to 4 digits by a two-digit whole numbers using the formal written method of multiplication. When multiplying with decimals the decimal point must stay still.

Photograph 26:

Continue to practise and develop the formal long multiplication method with larger numbers and decimals throughout Y6.

Division

Lots of, groups of, share, group, half, divide, division, divided by, remainder, factor, divisible, equal groups of, share equally etc.
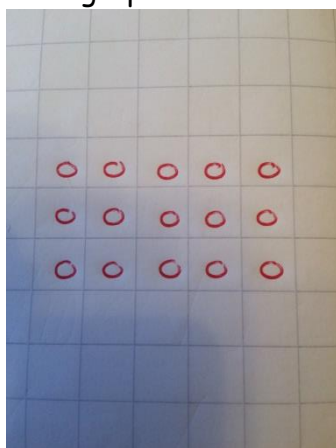
The following photographs show the progression in the teaching of division in Consett Junior School:

In the initial stages of teaching division begin with arrays to support division.

Photograph 27:
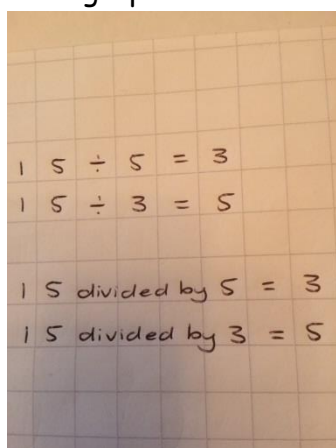
Photograph 28:

Present division questions in many different ways:
$15 \div 5 = 3$
$15 \div 3 = 5$
$3 = 15 \div 5$
$5 = 15 \div 3$
How many groups of 3?
How many groups of 5?
15 shared between 3 people is…?
15 shared between 5 people is…?
15 divided by 5 = 3
15 divided by 3 = 5

Introduce the formal layout (see photographs 29 and 30) using multiplication/division facts that the children know:
$28 \div 2 = 14$ and $24 \div 3 = 8$ etc.

Photograph 29:
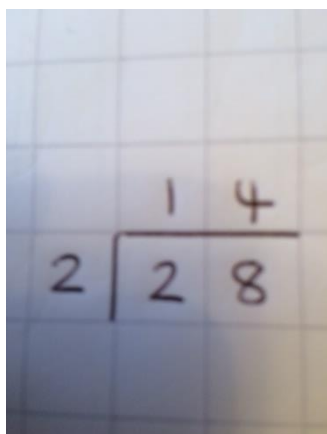
photograph 30:
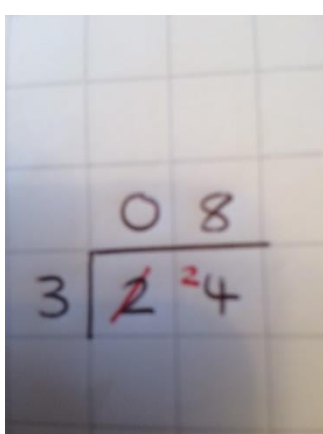
'How many groups of three in 24?'
'Twenty four divided by three equals eight.'
'How many threes are there in twenty four?'

NB: If, at any time, children are making significant errors, return to the previous stage in calculation

Continue using the formal written layout, introducing remainders: $25 \div 3 = 8 \text{ r}1$

Photograph 31:

NB: Remainders are not specifically referred to until year 5 in the National Curriculum. However, this may be an appropriate point to introduce them using familiar multiplication facts.

Continue to practise the formal written method of short division (HTU ÷ U) with whole number answers...
184 ÷ 8 = 23

Photograph 32:
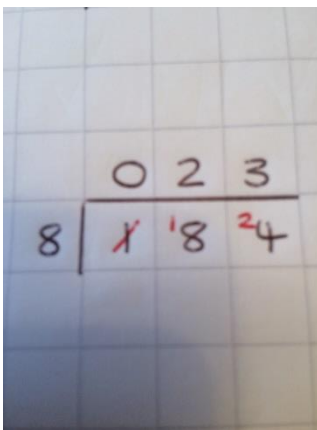
Use the language of place value to ensure understanding.

...and with remainders: 432 ÷ 5 = 86 r2

Photograph 33:

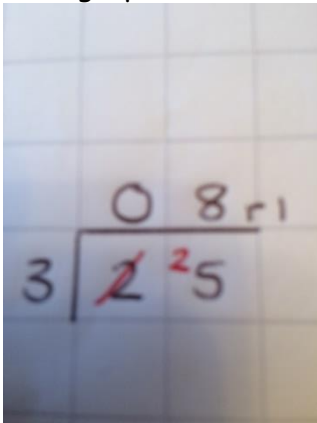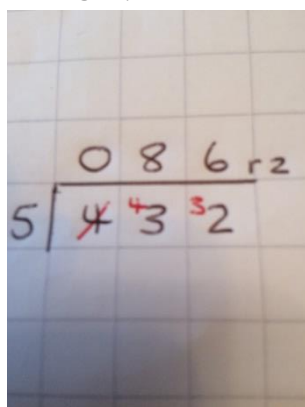The remainder can also be expressed as a fraction, 2/5 (the remainder divided by the divisor): 432 ÷ 5 = 86 2/5

Continue to practise, develop and extend the formal method of short division, with and without remainders. Interpret and express remainders according to the context.
NB: If, at any time, children are making significant errors, return to the previous stage in calculation.

In upper KS2 children will be taught to divide numbers up to 4 digits by a two-digit number (see photograph 34) using the formal written method of short division where appropriate, interpreting remainders according to the context. They will be taught to divide decimal numbers (see photograph 35).

They will 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.

Photograph 34:

496 ÷ 11 = 45 r1
The remainder can also be expressed as a fraction, 1/11 (the remainder divided by the divisor).

Photograph 35:

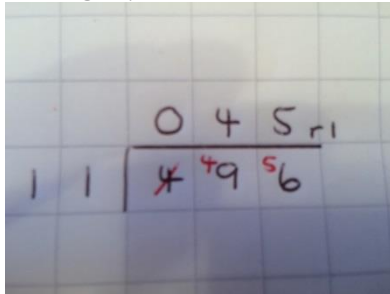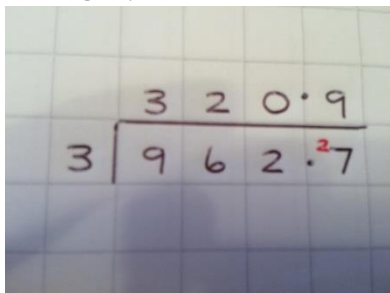When dividing with decimals the decimal point must stay still.

Continue to practise the formal method of short division, with and without remainders, using the language of place value to ensure understanding.

Dividing by a two-digit number using a formal method of long division (see photograph 36). This method may be taught as an alternative or to support the formal written method of short division:

Photograph 36:
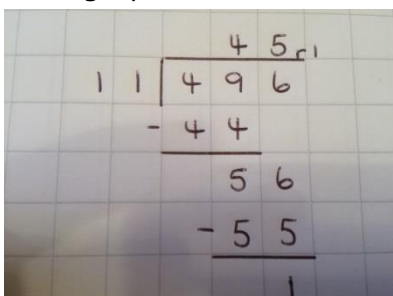
496 ÷ 11 = 45 r1
The remainder can also be expressed as a fraction, 1/11 (the remainder divided by the divisor).

NB: If, at any time, children are making significant errors, return to the previous stage in calculation.

Our aim is that by the end of Y6 children use mental methods (with jottings) when appropriate, but for calculations that they cannot do in their heads, they use an efficient formal written method accurately and with confidence.

National Curriculum for Mathematics (2014)

Addition, Subtraction, Multiplication and Division Statutory Requirements

Y3 Statutory Requirements
Pupils should be taught to:
- add and subtract numbers mentally, including:
- a three-digit number and ones
- a three-digit number and tens
- a three-digit number and hundreds
- add and 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 addition and subtraction.
- recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables
- write and calculate mathematical statements for multiplication and 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 multiplication and division, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects.

Y4 Statutory Requirements
Pupils should be taught to:
- add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate
- estimate and use inverse operations to check answers to a calculation
- solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why.
- recall multiplication and division facts for multiplication tables up to 12 × 12
- use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers
- recognise and use factor pairs and commutativity in mental calculations
- multiply two-digit and three-digit numbers by a one-digit number using formal written layout
- solve problems involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects.

Y5 Statutory Requirements
Pupils should be taught to:
- add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)
- add and 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 addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.
- Pupils should be taught to:
- identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers
- know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers
- establish whether a number up to 100 is prime and recall prime numbers up to 19
- multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers
- multiply and 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
- multiply and divide whole numbers and those involving decimals by 10, 100 and 1000
- recognise and use square numbers and cube numbers, and the notation for squared (^{2}) and cubed (^{3})
- solve problems involving multiplication and division including using their knowledge of factors and multiples, squares and cubes
- solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign
- solve problems involving multiplication and division, including scaling by simple fractions and problems involving simple rates.

Y6 Statutory Requirements
Pupils should be taught to:
- multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication
- 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
- solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why
- solve problems involving addition, subtraction, multiplication and division
- use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.