GROUVILLE SCHOOL

CALCULATION POLICY

June 2018

This Policy should be read alongside other related policies including our Mathematics Policy and our Teaching & Learning Policy.

Grouville School Calculation Policy 2018

UNRC Article 28: Every child is a right to an education.
UNRC Article 29: Every child has the right to be the best they can be
Well-being and achievement are at the heart of Grouville School so that we can all develop as Lifelong Learners and take responsibility for ourselves and the community.

Calculation Policy Aim

This Calculation Policy sets out the key methods used to help our pupils with calculations and has been devised to meet requirements of the Jersey Curriculum 2014 for the teaching and learning of Mathematics and the Development Matters Curriculum for EYFS. It should be read in conjunction with our 2018 Grouville Mathematics Policy to ensure teaching and learning consistencies are embedded across the school.

Our Calculation Policy is designed to guide the teaching and learning of mathematics across the 4 operations to ensure pupils receive a consistent and smooth progression across the school, between and within Year Groups. The purpose of this document is to demonstrate the methods of calculating used at Grouville School and to show the progression of those methods from EYFS through to Year 6. There are examples of the expected mathematical calculations for each Year Group and examples of what the written calculations may look like. The attached appendix (Year Group Curriculum Coverage) provides further information on the coverage of the Jersey Curriculum for Mathematics objectives across each Year Group.

Our teaching of Mathematics at Grouville is centred around Teaching for Mastery and is underpinned by a highly successful and research based Singaporean approach, in which pupils use manipulatives to understand the mathematical concept. Our Calculation Policy is based upon a concrete, pictorial and abstract approach to teaching and learning Mathematics at Grouville School. Pupils are first introduced to an idea or skill by using concrete manipulatives (a hands-on approach), followed by the pictorial stage (the visual stage), where pupils are encouraged to relate the concrete understanding to pictorial representations. The final, abstract, stage is a change for pupils to represent problems by using more abstract mathematical calculations. It is expected that the CPA approach is used continuously in all new learning and across all four operations, and pupils continue through Grouville School, they will become more fluent and adept with the CPA approach and this will promote further development of their number sense and application within upper Key Stage 2.

This Calculation Policy outlines methods that pupils will be taught within their respective Year Group, our aim is to ensure that all children are able to devise a range of strategies to help them to calculate correct answers as efficiently as possible, whilst building their passion, confidence and pride in their mathematical development.

It is important to note that the progression through each operation (addition, subtraction, multiplication and division) is firmly rooted in mathematical understanding, not just methodological competence. Teachers are responsible for assessing children's starting points and catering for the needs of all children through scaffolding using the CPA approach and extending through deep questioning and through administering more complex variations of the same task - encouraging a variety of mathematical representations and strategies.

Children should not move onto the next calculation stage if they are not secure in the previous, and fluency and catch up sessions should be used to ensure no one gets left behind – we all learn together. Analysis of end of unit & end of term assessments will enable teachers to track progress and attainment, and to highlight any need to revisit concepts.

If you have any further questions about our Calculation Policy or our Maths Policy, please consult with your child's class teacher in the first instance.

If you would like further guidance, please feel free to make an appointment to meet with the Subject Leader for Mathematics, Debbie Buesnel. Appendix 1 includes a Maths Glossary that may support your reading of this Policy.

Curriculum Overview – National Curriculum Statements

Key Stage 1 (Years 1 and 2)

The focus of mathematics teaching is to ensure that children develop confidence and mental fluency with whole numbers, counting and place value. This should involve working with numerals, words and the four operations, including with practical resources.

Lower Key Stage 2 (Years 3 and 4)

The principal focus is to ensure that children become increasingly fluent with whole numbers and the four operations, including number facts and the concept of place value. This should ensure that children develop efficient written and mental methods and perform calculations accurately with increasingly large whole numbers. At this stage, children should develop their ability to solve a range of problems, including with simple fractions and decimal place value.
By the end of year 4, children should have memorised their multiplication tables up to and including the 12x multiplication table and show precision and fluency in their work.

Upper Key Stage 2 (Years 5 and 6)

Children extend their understanding of the number system and place value to larger numbers. Connections are made between multiplication and division with fractions, decimals, percentages and ratio. At this stage, children should develop their ability to solve a wider range of problems including increasingly complex properties of numbers and arithmetic, and problems demanding efficient written and mental methods of calculation. With this foundation in arithmetic, children are introduced to the language of algebra as a means for solving a variety of problems.

By the end of Year 6, children should be fluent in written methods for all four operations, including long multiplication and division, and in working with fractions, decimals and percentages.

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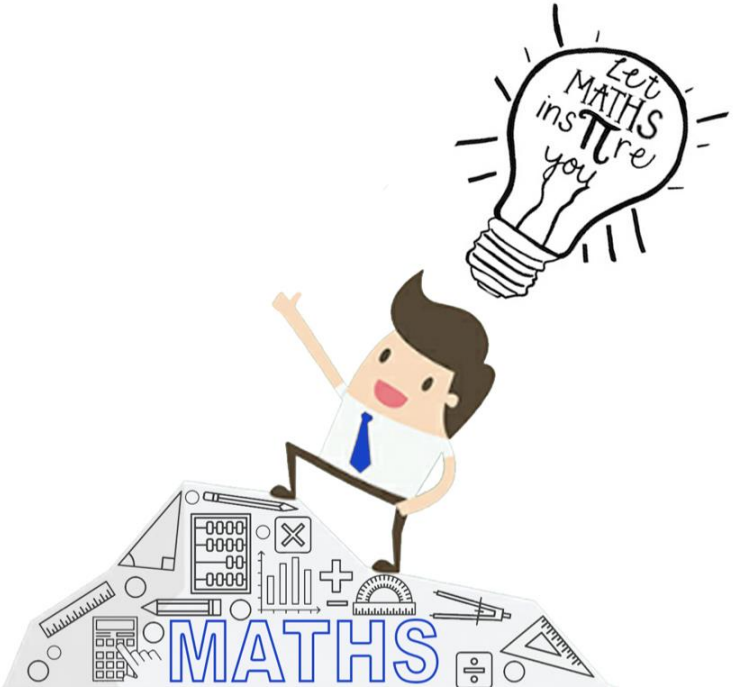
Addition



Addition

Mental Addition

Pupils will complete 2 minutes guided fluency every day focusing on one of the 4 operation strands suited to the Year Group expectations. Longer fluency sessions will commence in autumn 2018 in addition to structured 2 part lessons.

Chanting: Teachers will use the spring 2018 INSET as a model for these sessions. The vocabulary will be modelled on IWB saved centrally to ensure consistency throughout the school. E.g. 5 = 4 + 1 is said as - 5 is 4 and 1. Addition will always be practised alongside visual representations such as part whole or bar models during the pictorial stage.

Year 1 NC Objectives

- read, write and interpret mathematical statements involving addition (+), subtraction (–) and equals (=) signs
- represent and use number bonds and related subtraction facts within 20
- add and subtract one-digit and two-digit numbers to 20, including 0
- solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as 7 = ? – 9

Year 2 NC Objectives

- count in steps of 2, 3, and 5 from 0, and in 10s from any number, forward and backward
- solve problems with addition and 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 addition and subtraction facts to 20 fluently, and derive and use related facts up to 100
- add and subtract numbers using concrete objects, pictorial representations, and mentally, including:
  - a two-digit number and 1s
  - a two-digit number and 10s
  - 2 two-digit numbers
  - adding 3 one-digit numbers
- show that addition of 2 numbers can be done in any order (commutative) and subtraction of 1 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 NC Objectives

- count from 0 in multiples of 4, 8, 50 and 100; find 10 or 100 more or less than a given number
- add and subtract numbers mentally, including:
  - a three-digit number and 1s
  - a three-digit number and 10s
  - a three-digit number and 100s
- add and subtract numbers with up to 3 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
- problems and practical problems involving these ideas

Children memorise and reason with number bonds to 10 and 20 in several forms (for example, 9 + 7 = 16; 16 – 7 = 9; 7 = 16 – 9). They should realise the effect of adding or subtracting 0. This establishes addition and subtraction as related operations.
Children combine and increase numbers, counting forwards and backwards.
They discuss and solve problems in familiar practical contexts, including using quantities. Problems should include the terms: put together, add, altogether, total, take away, distance between, difference between, more than and less than, so that children develop the concept of addition and subtraction and are enabled to use these operations flexibly.

+ = signs and missing numbers
Children need to understand the concept of equality before using the '=' sign. Calculations should be written either side of the equality sign so that the sign is not just interpreted as 'the answer'.
2 = 1+ 1
2 + 3 = 4 + 1
Calculations should include part whole diagrams (whole = part + part) or vice versa

Missing numbers need to be placed in all possible places.
3 + 4 = □ □ = 3 + 4
3 + □ = 7 7 = □ + 4

Counting and Combining sets of Objects
Combining two sets of objects (aggregation) which will progress onto adding on to a set (augmentation)

Using materials and a range of representations, children practise counting, reading, writing and comparing numbers to at least 100 and solving a variety of related problems to develop fluency. They count in multiples of 3 to support their later understanding of a third.

As they become more confident with numbers up to 100, children are introduced to larger numbers to develop further their recognition of patterns within the number system and represent them in different ways, including spatial representations.

Children should partition numbers in different ways (for example, 23 = 20 + 3 and 23 = 10 + 13) to support subtraction. They become fluent and apply their knowledge of numbers to reason with, discuss and solve problems that emphasise the value of each digit in two-digit numbers. They begin to understand 0 as a place holder.

It is valuable to use a range of representations (also see Y1).
Continue to use numberlines to develop understanding of:
Counting on in tens and ones
23 + 12 = 23 + 10 + 2
= 33 + 2
= 35

Partitioning and bridging through 10.
The steps in addition often bridge through a multiple of 10 e.g. Children should be able to partition the 7 to relate adding the 2 and then the 5.
8 + 7 = 15

Adding 9 or 11 by adding 10 and adjusting by 1
e.g. Add 9 by adding 10 and adjusting by 1
35 + 9 = 44

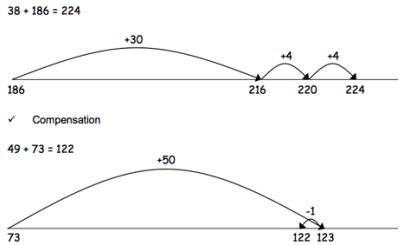
Children now use multiples of 2, 3, 4, 5, 8, 10, 50 and 100.

Children practise solving varied addition and subtraction questions. For mental calculations with two-digit numbers, the answers could exceed 100.

Children use their understanding of place value and partitioning, and practise using columnar addition and subtraction with increasingly large numbers up to 3 digits to become fluent (see Mathematics appendix 1).

Children will continue to use empty number-lines with increasingly large numbers, including compensation where appropriate. Calculations should involve three-digit numbers and involve partitioning into HUNDREDS, TENS and ONES.

Count on from the largest number irrespective of the order of the calculation



Children will begin to use informal pencil and paper methods (jottings) to support, record and explain partial mental methods building on existing mental strategies.

35 + 37

37 + 30 = 67
67 + 5 = 67 + (3 + 2)
67 + 3 = 70
70 + 2 = **72**

It is important that the children are secure with: 'bridging through ten', partitioning numbers and, crucially, place value

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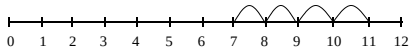
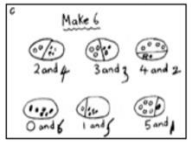
Understanding of counting on with a number track.

Understanding of counting on with a numberline (supported by models and images).

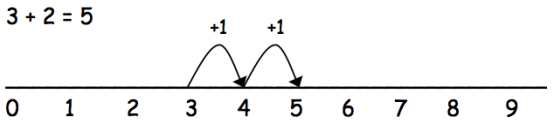
7+ 4



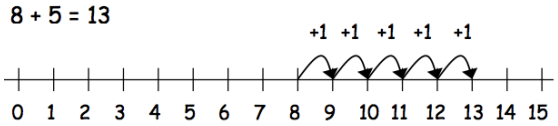
Children are encouraged to develop a mental picture of the number system in their heads to use for calculation.



They develop ways of recording calculations using pictures, etc. They use number-lines and practical resources to support calculation, (such as physically jumping along giant number-lines), and teachers demonstrate the use of the number-line.

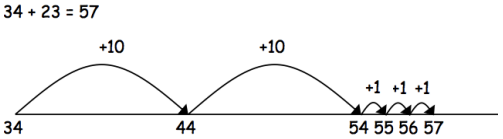


Children then begin to use numbered lines to support their own calculations using a numbered line to count on in ones.

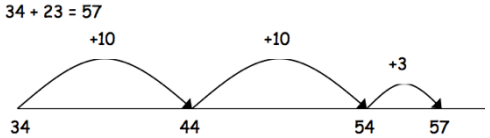


Bead strings or bead bars can be used to illustrate addition including 'bridging through ten' by counting on 2 then

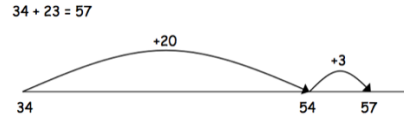
Children will begin to use 'empty number-lines' themselves starting with the greater number and counting on. Partitioning into TENS and ONES should be used. First counting on in TENS and ONES (use 'ones' rather than 'units' to avoid confusion).



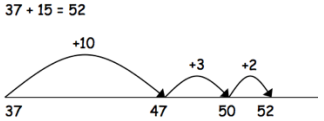
Then helping children to become more efficient by adding the units in one jump (by using the known fact: 4 + 3 = 7)



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



Bridging through ten' can help children become more efficient.



Children should count regularly, on and back, in steps of 2, 3, 5 and 10. Counting forwards in tens from any number should lead to adding multiples of 10.

Children should practise addition to 20 to become increasingly fluent. They should use the facts they know to before moving on to column additions.

Partition into tens and ones

Partition both numbers and recombine.

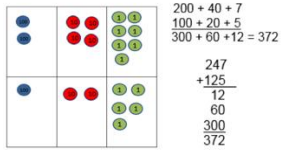
Count on by partitioning the second number only e.g.

247 + 125 = 247 + 100 + 20+ 5
= 347 + 20 + 5
= 367 + 5
= 372

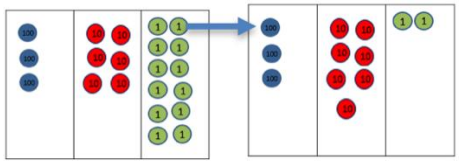
Children need to be secure adding multiples of 100 and 10 to any three-digit number including those that are not multiples of 10.

Towards a Written Method

Introduce expanded column addition modelled with place value counters (Dienes could be used for those who need a less abstract representation)



Leading to children understanding the exchange between tens and ones.



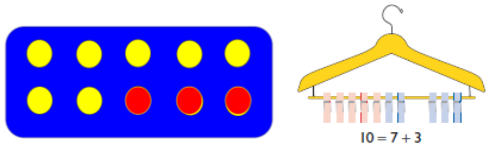
Some children may begin to use a formal columnar algorithm, initially introduced alongside the expanded method.

counting on 3.

Children should experience regular counting on and back from different numbers in 1s and in multiples of 2, 5 and 10.

Children should memorise and reason with number bonds for numbers to 20, experiencing the = sign in different positions.

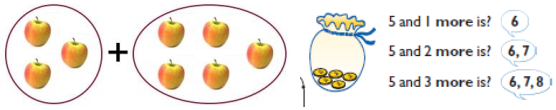
They should see addition and subtraction as related operations. E.g. 7 + 3 = 10 is related to 10 – 3 = 7, understanding of which could be supported by an image like this.



Use bundles of straws and Dienes to model partitioning teen numbers into tens and ones and develop understanding of place value.

Children have opportunities to explore partitioning numbers in different ways.
e.g. 7 = 6 + 1, 7 = 5 + 2, 7 = 4 + 3 =

Children should begin to understand addition as combining groups and counting on.



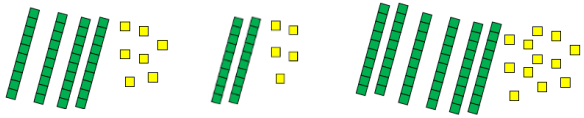
When using vocabulary of addition, refer to = as 'the same derive others, e.g using 7 + 3 = 10 to find 17 + 3= 20, 70 + 30 = 100
They should use concrete objects such as bead strings and number lines to explore missing numbers – 45 + __ = 50.

As well as number lines, 100 squares could be used to explore patterns in calculations such as 74 +11, 77 + 9 encouraging children to think about 'What do you notice?' where partitioning or adjusting is used.

Children should learn to check their calculations, by using the inverse. They should continue to see addition as both combining groups and counting on. They should use Dienes to model partitioning into tens and ones and learn to partition numbers in different ways e.g. 23 = 20 + 3 = 10 + 13.

Towards a Written Method
Partitioning in different ways and recombine 47+25

47 **25** **60 + 12**



Leading to exchanging: **72**

Expanded written method
40 + 7 + 20 + 5 =
40+20 + 7 + 5 =
60 + 12 = 72

40 + 7
+ 20 + 5
60 + 12 = 72

Vocabulary
+, add, addition, more, plus, make, sum, total, altogether, how many more to make…? how many more is… than…? how much more is…? =, equals, sign, is the same as, Tens, ones,

	h	t	o
			8
+	2	3	6
		1	4
		3	0
+	2	0	0
	2	4	4

The formal method should be seen as a more streamlined version of the expanded method, not a new method.
(All exchanging should be placed on top of numbers)

	h	t	o
	1		
	2	3	6
+	3	9	1
		2	7

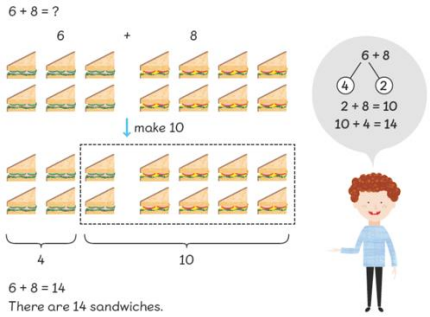
Children should continue to count regularly, on and back, now including multiples of 4, 8, 50, and 100, and steps of 1/10.
The use of informal jottings should be encouraged. This will help to develop children's understanding of working mentally.

Children should continue to partition numbers in different ways. They should be encouraged to choose the mental strategies which are most efficient for the numbers involved, e.g. Adding calculations by transforming them to be more 'number friendly' such as 63 + 29 is the same as 62 + 30; counting on by partitioning the second number such as 72 + 31 = 72 + 30 + 1 = 102 + 1 = 103

Manipulatives will be used to support mental imagery and conceptual understanding. Children will be shown how these images are related e.g. What's the same? What's different?

as'. 'Equals' can be used later when the concept of equivalence is understood. Children should know that addition can be done in any order (commutative law)

Children should progress their understanding of number bonds to 10 by making 10 first in larger calculations.



Vocabulary
Addition, add, forwards, put together, more than, total, altogether, distance between, difference between, equals = same as, most, pattern, odd, even, digit, counting on.

Generalisations
- True or false? Addition makes numbers bigger.
- True or false? You can add numbers in any order and still get the same answer.

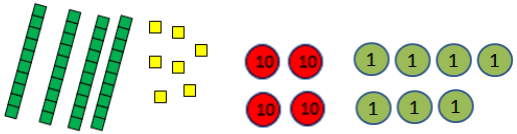
Some Key Questions
How many altogether? How many more to make…? I add …more. What is the total? How many more is… than…? How much more is…? One more, two more, ten more…
What can you see here?
Is this true or false?
What is the same? What is different?

partition
Near multiple of 10, tens boundary, More than, one more, two more… ten more… one hundred more

Generalisations
- Odd + odd = even; odd + even = odd; etc.
- 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 missing number problems. This understanding could be supported by images such as the following…

7 + ? = 10

Some Key Questions
How many altogether? How many more to make…? How many more is… than…? How much more is…?
Is this true or false?
If I know that 17 + 2 = 19, what else do I know? (e.g. 2 + 17 = 19; 19 – 17 = 2; 19 – 2 = 17; 190 – 20 = 170 etc.)
What do you notice? What patterns can you see?



Vocabulary
Hundreds, tens, ones, estimate, partition, recombine, difference, decrease, near multiple of 10 and 100, inverse, rounding, column subtraction, exchange
See also Y1 and Y2

Generalisations
Noticing what happens to the digits when you count in tens and hundreds.
Odd + odd = even etc. (see Year 2)
Inverses and related facts – develop fluency in finding related addition and subtraction facts.
Develop the knowledge that the inverse relationship can be used as a checking method.

Some Key Questions
What do you notice? What patterns can you see?
When comparing two methods alongside each other: What's the same? What's different? Look at this number in the formal method; can you see where it is in the expanded method / on the number line? How many ways can you represent this? What is the most efficient?

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Year 4 NC Objectives	Year 5 NC Objectives	Year 6 NC Objectives
• 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	• 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	• perform mental calculations, including with mixed operations and large numbers • use their knowledge of the order of operations to carry out calculations involving the 4 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

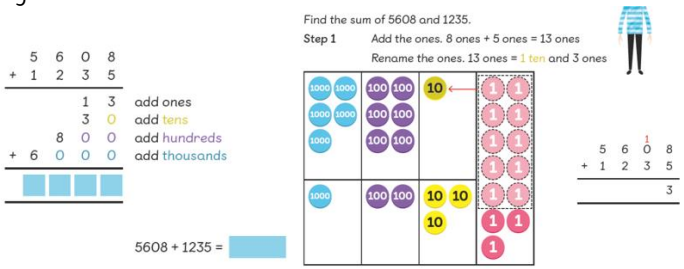
Children continue to practise both mental methods and columnar addition and subtraction with increasingly large numbers to aid fluency.

Children should continue to partition numbers in different ways. They should be encouraged to choose from a range of strategies:

- Counting forwards and backwards: 124 – 47, count back 40 from 124, then 4 to 80, then 3 to 77
- Reordering: 28 + 75, 75 + 28 (thinking of 28 as 25 + 3)
- Partitioning: counting on or back: 5.6 + 3.7, 5.6 + 3 + 0.7 = 8.6 + 0.7
- Partitioning: bridging through multiples of 10: 6070 – 4987, 4987 + 13 + 1000 + 70
- Partitioning: compensating/transforming – 138 + 69, 138 + 70 - 1
- Partitioning: using 'near' doubles - 160 + 170 is double 150, then add 10, then add 20, or double 160 and add 10, or double 170 and subtract 10
- Partitioning: bridging through 60 to calculate a time interval – What was the time 33 minutes before 2.15pm?
- Using known facts and place value to find related facts.

Children must have a clear understanding of place value before beginning column addition as a regular method.

The bar model should continue to be used to help with problem solving. Expanded column addition modelled with place value counters, progressing to calculations with 4-digit numbers.



The digits in the column addition must be referred to as their value, not the name of the digit.

Children practise using the formal written methods of columnar addition and subtraction with increasingly large numbers to aid fluency (see Mathematics appendix 1).

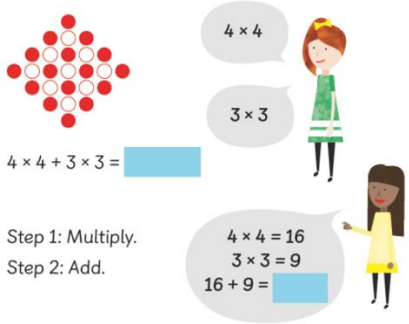
They practise mental calculations with increasingly large numbers to aid fluency (for example, 12,462 – 2,300 = 10,162).

Children should continue to partition numbers in different ways. They should be encouraged to choose from a range of strategies:

- Counting forwards and backwards in tenths and hundredths: 1.7 + 0.55
- Reordering: 4.7 + 5.6 – 0.7, 4.7 – 0.7 + 5.6 = 4 + 5.6
- Partitioning: counting on or back - 540 + 280, 540 + 200 + 80
- Partitioning: bridging through multiples of 10:
- Partitioning: compensating/transforming: 5.7 + 3.9, 5.7 + 4.0 – 0.1
- Partitioning: using 'near' double: 2.5 + 2.6 is double 2.5 and add 0.1 or double 2.6 and subtract 0.1
- Partitioning: bridging through 60 to calculate a time interval: It is 11.45. How many hours and minutes is it to 15.20?
- Using known facts and place value to find related facts.

Continued use of empty number-lines and: Children should extend addition with renaming to numbers with at least four digits and numbers with varying amounts of decimal places using place value counters or relevant resources.

Children should experiment with order of operations, investigating the effect of positioning the brackets in different places, e.g. 20 – 5 x 3 = 5; (20 – 5) x 3 = 45



Children should know where mental or written methods are more appropriate for any given calculation.

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.

Vocabulary
millions, tens of millions, BODMAS

Generalisations

From this, children will begin to 'regroup' and 'rename' ABOVE the numbers. They MUST understand that the '1' carried over represents 10 if it's in the TENS column, or 100 in the HUNDREDS column etc.

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

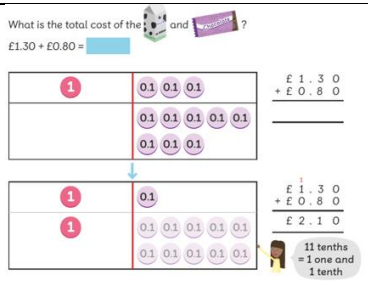
Using similar methods, children will:

- 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.

Vocabulary
add, addition, sum, more, plus, increase, sum, total, altogether, double, near double, how many more to make..? how much more? ones boundary, tens boundary, hundreds boundary, thousands boundary, tenths boundary, hundredths boundary, inverse, how many more/fewer? Equals sign, is the same as.

Generalisations
Investigate when re-ordering works as a strategy for subtraction. Eg. 20 – 3 – 10 = 20 – 10 – 3, but 3 – 20 – 10 would give a different answer.

Some Key Questions
What do you notice?
What's the same? What's different?
Can you convince me?
How do you know?



Children may need to use zeroes as place holders in order to lay the columns out

Vocabulary
tens of thousands boundary,
Also see previous years

Generalisation
Sometimes, always or never true? The difference between a number and its reverse will be a multiple of 9.
What do you notice about the differences between consecutive square numbers?
Investigate a – b = (a-1) – (b-1) represented visually.

Some Key Questions
What do you notice?
What's the same? What's different?
Can you convince me?
How do you know?

Order of operations: brackets first, then multiplication and division (left to right) before addition and subtraction (left to right). Children could learn an acrostic such as BOMDAS, or could be encouraged to design their own ways of remembering.
Sometimes, always or never true?
Subtracting numbers makes them smaller.

Some Key Questions
What do you notice?
What's the same? What's different?
Can you convince me?
How do you know?

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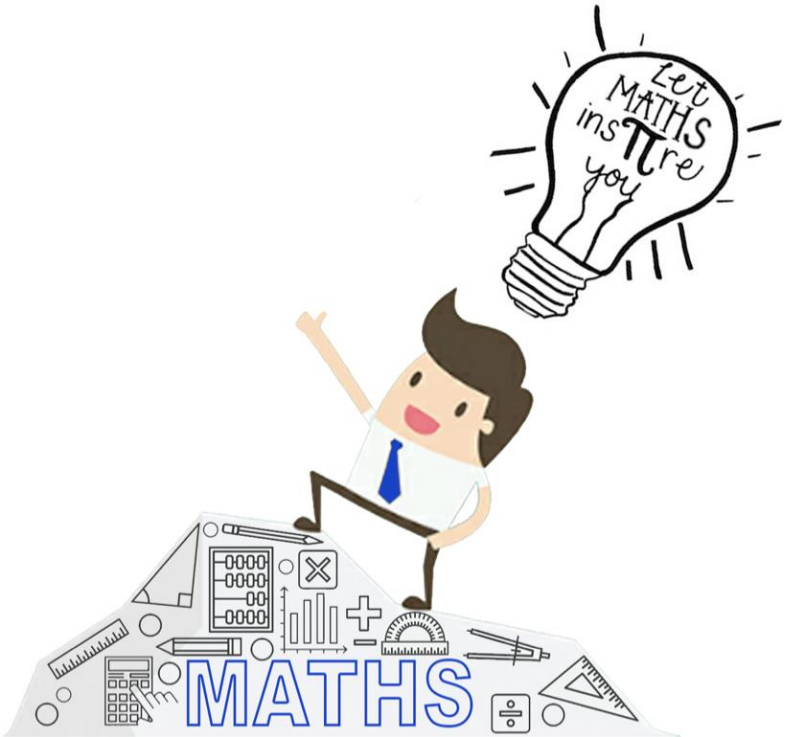
Subtraction



Subtraction

Mental Subtraction

Pupils will complete 2 minutes guided fluency every day focusing on one of the 4 operation strands suited to the Year Group expectations. Longer fluency sessions will commence in autumn 2018 in addition to structured 2 part lessons.

Year 1 NC Objectives

- read, write and interpret mathematical statements involving addition (+), subtraction (–) and equals (=) signs
- represent and use number bonds and related subtraction facts within 20
- add and subtract one-digit and two-digit numbers to 20, including 0
- solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as 7 = ? – 9

Year 2 NC Objectives

- count in steps of 2, 3, and 5 from 0, and in 10s from any number, forward and backward
- solve problems with addition and 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 addition and subtraction facts to 20 fluently, and derive and use related facts up to 100
- add and subtract numbers using concrete objects, pictorial representations, and mentally, including:
  - a two-digit number and 1s
  - a two-digit number and 10s
  - 2 two-digit numbers
  - adding 3 one-digit numbers
- show that addition of 2 numbers can be done in any order (commutative) and subtraction of 1 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 NC Objectives

- count from 0 in multiples of 4, 8, 50 and 100; find 10 or 100 more or less than a given number
- add and subtract numbers mentally, including:
  - a three-digit number and 1s
  - a three-digit number and 10s
  - a three-digit number and 100s
- add and subtract numbers with up to 3 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
- problems and practical problems involving these ideas

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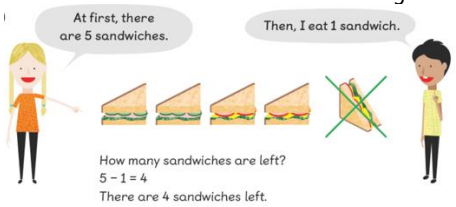
Children should experience regular counting on and back from different numbers in 1s and in multiples of 2, 5 and 10.

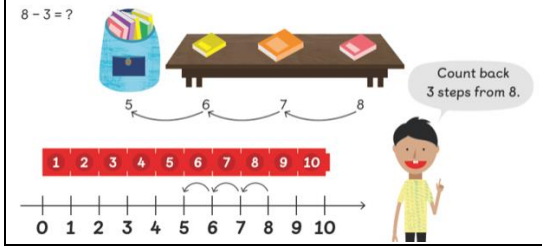
Children should memorise and reason with number bonds for numbers to 20, experiencing the = sign in different positions. e.g. 7 = □ - 9; 20 - □ = 9; 15 – 9 = □; □ - □ = 11; 16 – 0 = □

Use concrete objects and pictorial representations including part whole (whole takeaway part =part). If appropriate, progress from using number lines with every number shown to number lines with significant numbers shown. Understand subtraction as take-away:



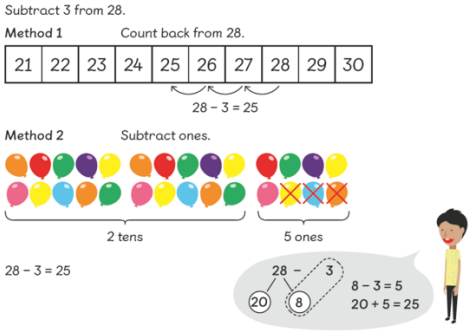
Use bundles of straws and Dienes to model partitioning teen numbers into tens and ones.

Children should begin to understand subtraction as both taking away and finding the difference between, and should find small differences by counting on or back.

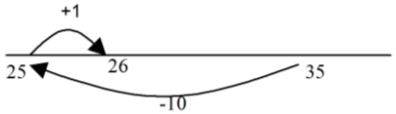


Children should count regularly, on and back, in steps of 2, 3, 5 and 10. Counting back in tens from any number should lead to subtracting multiples of 10.
Missing number problems e.g. 52 – 8 = □; □ – 20 = 25; 22 = □ – 21; 6 + □ + 3 = 11

It is valuable to use a range of representations (also see Y1) including bar model and part whole diagrams. Continue to use number lines to model take-away and difference.



Number lines should continue to be an important image to support thinking, for example to model how to subtract 9 by adjusting.



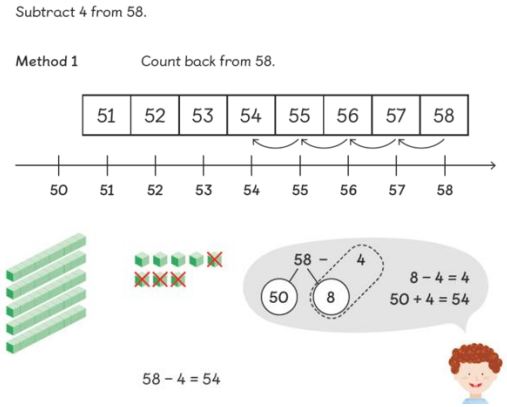
Children should practise subtraction to 20 to become increasingly fluent. They should use the facts they know to derive others, e.g using 10 - 7 = 3 and 7 = 10 - 3 to calculate 100 - 70 = 30 and 70 = 100 - 30.

As well as number lines, 100 squares could be used to model calculations such as 74 – 11, 77 – 9 or 36 – 14, where partitioning or adjusting are used.

Children should learn to check their calculations using the inverse, including by adding to check.

Children should continue to count regularly, on and back, now including multiples of 4, 8, 50, and 100, and steps of 1/10. Missing number problems e.g. □ = 43 – 27; 145 – □ = 138; 274 – 30 = □; 245 – □ = 195; 532 – 200 = □; 364 – 153 = □

Children should continue to develop, supported by a range of models and images, including the number line. The bar & part whole model should continue to be used to help with problem solving. Children should make choices about whether to use addition or counting back, depending on the numbers involved.



Children should continue to partition numbers in difference ways. They should be encouraged to choose the mental strategies which are most efficient for the numbers involved, e.g. counting up (difference, or addition) for 201 – 198; counting back (taking away / partition into tens and ones) for 201 – 12.

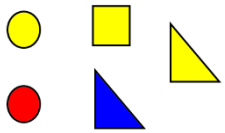
Written methods (progressing to 3-digits)
Building on Year 2 column subtraction introduce the more compact formal written method with no decomposition, modelled with place value counters (Dienes could be used for those who need a less abstract representation) then progress to

Vocabulary
Subtraction, subtract, take away, distance between, difference between, more than, minus, less than, equals = same as, most, least, pattern, odd, even, digit,

Generalisations

- True or false? Subtraction makes numbers smaller
- When introduced to the equals sign, children should see it as signifying equality. They should become used to seeing it in different positions.
- Children could see the image below and consider, "What can you see here?" e.g.

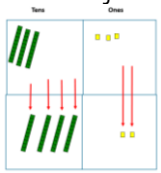
3 yellow, 1 red, 1 blue. 3 + 1 + 1 = 5
2 circles, 2 triangles,
1 square. 2 + 2 + 1 = 5
I see 2 shapes with curved lines and 3 with straight lines. 5 = 2 + 3
5 = 3 + 1 + 1 = 2 + 2 + 1 = 2 + 3



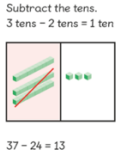
Some Key Questions
How many more to make…? How many more is… than…? How much more is…? How many are left/left over? How many have gone? One less, two less, ten less… How many fewer is… than…? How much less is…?
What can you see here?
Is this true or false?

They should continue to see subtraction as both take away and finding the difference, and should find a small difference by counting up.
They should use Dienes to model partitioning into tens and ones and learn to partition numbers in different ways e.g. 23 = 20 + 3 = 10 + 13.

Towards written methods
Recording addition and subtraction in expanded columns can support understanding of the quantity aspect of place value and prepare for efficient written methods with larger numbers.
They can be introduced to a formal calculation alongside a pictorial representation – place value must be secure before this is introduced. Expanded versions may be more appropriate to introduce first.



70 5
-40 2
30 3



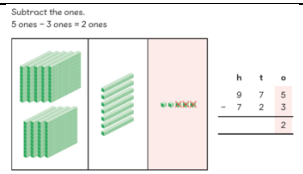
	tens	ones
	3	7
–	2	4
	1	3

Vocabulary
Subtraction, subtract, take away, difference, difference between, minus, tens, ones, partition, Near multiple of 10, tens boundary, Less than, one less, two less… ten less… one hundred less, More, one more, two more… ten more… one hundred more

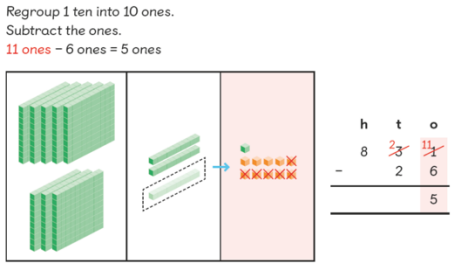
Generalisation

- Noticing what happens when you count in tens (the digits in the ones column stay the same)
- Odd – odd = even; odd – even = odd; etc.
- show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot

Some Key Questions
How many more to make…? How many more is… than…? How much



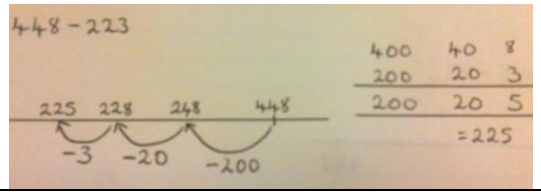
Regrouping is introduced afterwards, following secure understanding, but it is key that concrete practice is introduced beforehand and alongside the written methods.



Vocabulary
Hundreds, tens, ones, estimate, partition, recombine, difference, decrease, near multiple of 10 and 100, inverse, rounding, column subtraction, exchange
See also Y1 and Y2

Generalisations
Noticing what happens to the digits when you count in tens and hundreds.
Odd – odd = even etc. (see Year 2)
Inverses and related facts – develop fluency in finding related addition and subtraction facts.
Develop the knowledge that the inverse relationship can be used as a checking method.

Key Questions
What do you notice? What patterns can you see?

	more is…? How many are left/left over? How many fewer is… than…? How much less is…? Is this true or false? If I know that 7 + 2 = 9, what else do I know? (e.g. 2 + 7 = 9; 9 – 7 = 2; 9 – 2 = 7; 90 – 20 = 70 etc). What do you notice? What patterns can you see?	When comparing two methods alongside each other: What's the same? What's different? Look at this number in the formal method; can you see where it is in the expanded method / on the number line 

Subtraction

Mental Subtraction

Pupils will complete 2 minutes guided fluency every day focusing on one of the 4 operation strands suited to the Year Group expectations. Longer fluency sessions will commence in autumn 2018 in addition to structured 2 part lessons.

Year 4 NC Objectives	Year 5 NC Objectives	Year 6 NC Objectives
• 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	• 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	• perform mental calculations, including with mixed operations and large numbers • use their knowledge of the order of operations to carry out calculations involving the 4 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
Children should continue to count regularly, on and back, now including multiples of 6, 7, 9, 25 and 1000, and steps of 1/100. Missing number/digit problems: 456 + □ = 710; 1□7 + 6□ = 200; 60 + 99 + □ = 340; 200 – 90 – 80 = □; 225 - □ = 150; □ – 25 = 67; 3450 – 1000 = □; □ - 2000 = 900 **Written methods (progressing to 4-digits)** Building on Year 3 column subtraction is introduced, modelled with place value counters, progressing to calculations with 4-digit numbers.	Children should continue to count regularly, on and back, now including steps of powers of 10. See Year 3 and 4. The number line and visual representations should continue to be used as an important image to support thinking, and the use of informal jottings should be encouraged where appropriate.	Mental methods should continue to develop, supported by a range of models and images, including the number line. The bar model should continue to be used to help with problem solving. Children should experiment with order of operations, investigating the effect of positioning the brackets in different places, e.g. 20 – 5 x 3 = 5; (20 – 5) x 3 = 45

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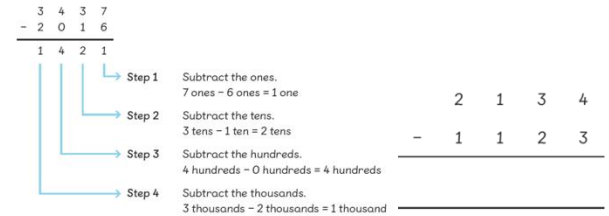


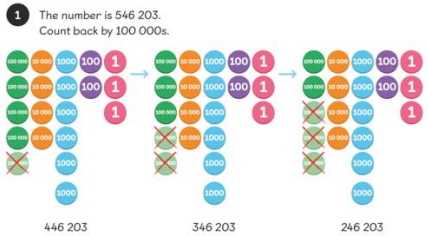
Models should continue to be used as an important image to support thinking, and the use of informal jottings should be encouraged where appropriate. Children should continue to partition numbers in different ways.

Children should be encouraged to choose from a range of strategies:

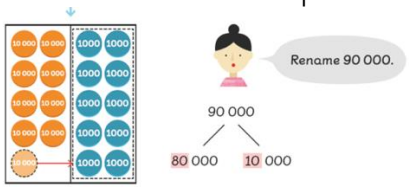
- Counting forwards and backwards: 124 – 47, count back 40 from 124, then 4 to 80, then 3 to 77
- Reordering: 28 + 75, 75 + 28 (thinking of 28 as 25 + 3)
- Partitioning: counting on or back: 5.6 + 3.7, 5.6 + 3 + 0.7 = 8.6 + 0.7
- Partitioning: bridging through multiples of 10: 6070 – 4987, 4987 + 13 + 1000 + 70
- Partitioning: compensating – 138 + 69, 138 + 70 - 1
- Partitioning: using 'near' doubles - 160 + 170 is double 150, then add 10, then add 20, or double 160 and add 10, or double 170 and subtract 10
- Partitioning: bridging through 60 to calculate a time interval – What was the time 33 minutes before 2.15pm?
- Using known facts and place value to find related facts.

Vocabulary

add, addition, sum, more, plus, increase, sum, total, altogether, double, near double, how many more to make...? how much more? one's boundary, tens boundary, hundreds boundary, thousands boundary, tenths boundary, hundredths boundary, inverse, how many more/fewer? Equals

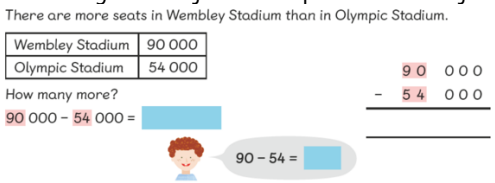


Children should continue to partition numbers in different ways.



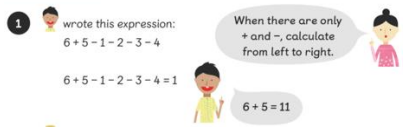
They should be encouraged to choose from a range of strategies:

- Counting forwards and backwards in tenths and hundredths: 1.7 + 0.55
- Reordering: 4.7 + 5.6 – 0.7, 4.7 – 0.7 + 5.6 = 4 + 5.6
- Partitioning: counting on or back - 540 + 280, 540 + 200 + 80
- Partitioning: bridging through multiples of 10:
- Partitioning: compensating: 5.7 + 3.9, 5.7 + 4.0 – 0.1
- Partitioning: using 'near' double: 2.5 + 2.6 is double 2.5 and add 0.1 or double 2.6 and subtract 0.1
- Partitioning: bridging through 60 to calculate a time interval: It is 11.45. How many hours and minutes is it to 15.20?
- Using known facts and place value to find related facts.



Vocabulary

tens of thousands boundary,
Also see previous years



Missing number/digit problems: □ and & each stand for a different number. & = 34. & + & = □ + □ + &. What is the value of □? What if & = 28? What if & = 21
10 000 000 = 9 000 100 + □
7 – 2 x 3 = □; (7 – 2) x 3 = □; (□ - 2) x 3 = 15

Written methods

As year 5, progressing to larger numbers, aiming for both conceptual understanding and procedural fluency with decomposition to be secured.

Teachers may also choose to introduce children to other efficient written layouts which help develop conceptual understanding. For example:

326
-148
-2
-20
200
178

Vocabulary

BODMAS

Generalisations

Order of operations: brackets first, then multiplication and division (left to right) before addition and subtraction (left to

sign, is the same as. **Generalisations** Investigate when re-ordering works as a strategy for subtraction. Eg. 20 – 3 – 10 = 20 – 10 – 3, but 3 – 20 – 10 would give a different answer. **Some Key Questions** What do you notice? What's the same? What's different? Can you convince me? How do you know?	**Generalisation** Sometimes, always or never true? The difference between a number and its reverse will be a multiple of 9. What do you notice about the differences between consecutive square numbers? **Some Key Questions** What do you notice? What's the same? What's different? Can you convince me? How do you know?	right). Children could learn an acrostic such as BODMAS. Sometimes, always or never true? Subtracting numbers makes them smaller. **Some Key Questions** What do you notice? What's the same? What's different? Can you convince me? How do you know?

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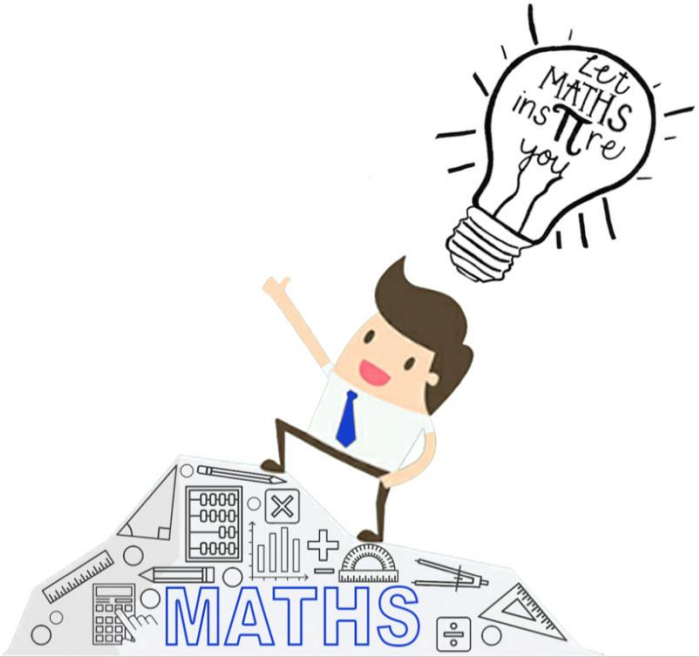
Multiplication



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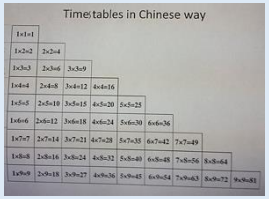
Multiplication

Mental Multiplication & Times tables:

Pupils will complete 2 minutes guided fluency every day focusing on one of the 4 operation strands suited to the Year Group expectations. Longer fluency sessions will commence in autumn 2018 in addition to structured 2 part lessons.



Chanting & Times tables: Teachers will use the spring 2018 INSET as a model for these sessions. The vocabulary will be modelled on IWB saved centrally to ensure consistency throughout the school, but will follow this structure: 1 x 2 = 2, 2 x 2 = 4, 3 x 2 = 6. (one times two is two) At this point we will state the 'times' as an operation. Division will always be practised alongside times tables to build on this relationship.

Currently children learn all 12x 12 facts for each times table, the Chinese 45 facts model will be introduced from autumn 2019 once children have built a stronger foundation in number sense and a stronger focus around 10.

Year 1 NC Objectives

- solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.
- recognise, find and name a half as 1 of 2 equal parts of an object, shape or quantity
- recognise, find and name a quarter as 1 of 4 equal parts of an object, shape or quantity

Year 2 NC Objectives

- recall and use multiplication and 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 multiplication (×), division (÷) and equals (=) signs
- show that multiplication of 2 numbers can be done in any order (commutative) and division of 1 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

Year 3 NC Objectives

- 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

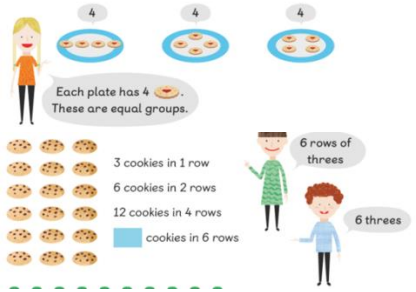
Maths no problem (further multiplication unit) to be replaced by grid method using NCETM or WRH guidance.

Through grouping and sharing small quantities, children begin to understand: multiplication and division; doubling numbers and quantities; and finding simple fractions of objects, numbers and quantities.

They make connections between arrays, number patterns, and counting in 2s, 5s and 10s.

Children should experience regular counting on and back from different numbers in 1s and in multiples of 2, 5 and 10.

Understand multiplication is linked to making equal groups and equal rows



This is then related to doubling

They should see ways to represent odd and even numbers. This will help them to understand the pattern in numbers.

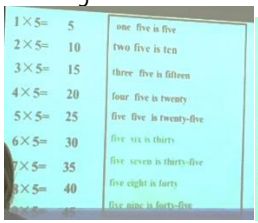
Children should begin to understand multiplication as scaling in terms of double and half. (e.g. that tower of cubes is double the height of the other tower)

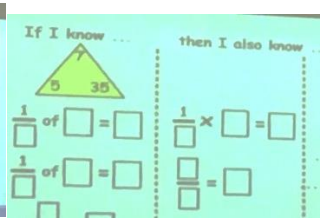
Problem solving with concrete objects (including money and measures

Children are introduced to the multiplication tables. They practise to become fluent in the 2, 5 and 10 multiplication tables and connect them to each other. They connect the 10 multiplication table to place value, and the 5 multiplication table to the divisions on the clock face. They begin to use other multiplication tables and recall multiplication facts, including using related division facts to perform written and mental calculations.

Children work with a range of materials and contexts in which multiplication and division relate to grouping and sharing discrete and continuous quantities, to arrays and to repeated addition. They begin to relate these to fractions and measures (for example, 40 ÷ 2 = 20, 20 is a half of 40). They use commutativity and inverse relations to develop multiplicative reasoning (for example, 4 × 5 = 20 and 20 ÷ 5 = 4).

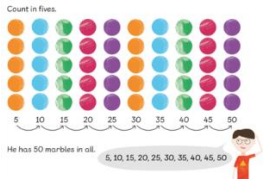
Children should count regularly, on and back, in steps of 2, 3, 5 and 10. Number lines should continue to be an important image to support thinking.





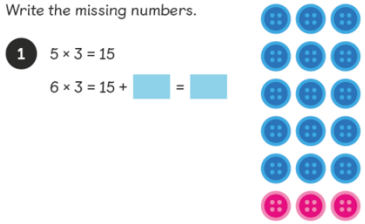
Expressing multiplication as a number sentence using x Using understanding of the inverse and practical resources to solve missing number problems and fact families.

Develop understanding of multiplication using array and number lines (see Year 1). Include multiplications not in the 2, 5 or 10 times tables.



Children should continue to count regularly, on and back, now including multiples of 4, 8, 50, and 100, and steps of 1/10.
The number line should continue to be used as an important image to support thinking, and the use of informal jottings and drawings to solve problems should be encouraged.

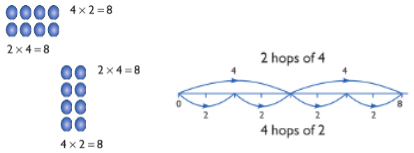
Facts are derived from known facts (6x3 = 5x3 +3)



Written methods (progressing to 2d x 1d)
Developing written methods using understanding of visual images
Develop onto the grid method
Give children opportunities for children to explore this and deepen understanding using Dienes apparatus and place value counters

Use cuissenaire and bar method to develop the vocabulary relating to 'times' – 'Pick up five, 4 times'

Use arrays to understand multiplication can be done in any order (commutative)



Children are taught half and quarter as 'fractions of' discrete and continuous quantities by solving problems using shapes, objects and quantities. For example, they could recognise and find half a length, quantity, set of objects or shape. Children connect halves and quarters to the equal sharing and grouping of sets of objects and to measures, as well as recognising and combining halves and quarters as parts of a whole.

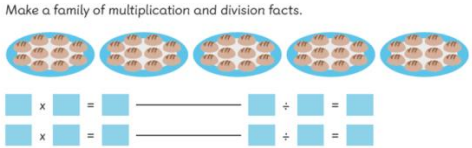
Vocabulary
Ones, groups, lots of, doubling
repeated addition
groups of, lots of, times, columns, rows
longer, bigger, higher etc
times as (big, long, wide …etc)

Generalisations
Understand 6 counters can be arranged as 3+3 or 2+2+2
Understand that when counting in twos, the numbers are always even.

Some Key Questions
Why is an even number an even number?
What do you notice?
What's the same? What's different?
Can you convince me?
How do you know?

Begin to develop understanding of multiplication as scaling (3 times bigger/taller)
Doubling numbers up to 10 + 10. Link with understanding scaling
Using known doubles to work out double 2d numbers
(double 15 = double 10 + double 5)

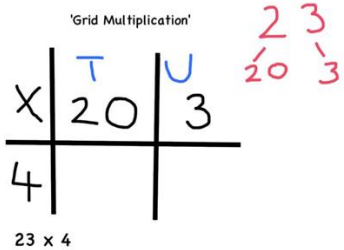
Know the relationship between multiplication and division



Vocabulary
multiple, multiplication array, multiplication tables / facts
groups of, lots of, times, columns, rows

Generalisation
Commutative law shown on array
Repeated addition can be shown mentally on a number line
Inverse relationship between multiplication and division. Use an array to explore how numbers can be organised into groups.

Some Key Questions
What do you notice?
What's the same? What's different?
Can you convince me?
How do you know?



Vocabulary
partition
grid method
inverse

Generalisations
Connecting x2, x4 and x8 through multiplication facts

Comparing times tables with the same times tables which is ten times bigger. If 4 x 3 = 12, then we know 4 x 30 = 120. Use place value counters to demonstrate this.

When they know multiplication facts up to x12, do they know what x13 is? (i.e. can they use 4x12 to work out 4x13 and 4x14 and beyond?)

Some Key Questions
What do you notice?
What's the same? What's different?
Can you convince me?
How do you know?

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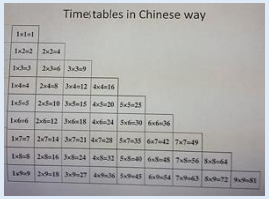
Multiplication

Mental Multiplication & Times tables:
Pupils will complete 2 minutes guided fluency every day focusing on one of the 4 operation strands suited to the Year Group expectations. Longer fluency sessions will commence in autumn 2018 in addition to structured 2 part lessons.



Chanting & Times tables: Teachers will use the spring 2018 INSET as a model for these sessions. The vocabulary will be modelled on IWB saved centrally to ensure consistency throughout the school, but will follow this structure: 1 x 2 = 2, 2 x 2 = 4, 3 x 2 = 6. (one times two is two) At this point we will state the 'times' as an operation. Division will always be practised alongside times tables to build on this relationship.

Currently children learn all 12x 12 facts for each times table, the Chinese 45 facts model will be introduced from autumn 2019 once children have built a stronger foundation in number sense and a stronger focus around 10.

Year 4 NC Objectives

- 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 3 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 1 digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects

Year 5 NC Objectives

- identify multiples and factors, including finding all factor pairs of a number, and common factors of 2 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
- multiply and divide whole numbers and those involving decimals by 10, 100 and 1,000
- 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

Year 6 NC Objectives

- 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 4 operations
- use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy

Children continue to practise recalling and using multiplication tables and related division facts to aid fluency. Children practise mental methods and extend this to 3-digit numbers to derive facts, (for example 600 ÷ 3 = 200 can be derived from 2 x 3 = 6). Children practise to become fluent in the formal written method of short multiplication and short division with exact answer. Children write statements about the equality of expressions (for example, use the distributive law 39 × 7 = 30 × 7 + 9 × 7 and associative law (2 × 3) × 4 = 2 × (3 × 4)). They combine their knowledge of number facts and rules of arithmetic to solve mental and written calculations for example, 2 x 6 x 5 = 10 x 6 = 60. Children solve two-step problems in contexts, choosing the appropriate operation, working with increasingly harder numbers. This should include correspondence questions such as the numbers of choices of a meal on a menu, or 3 cakes shared equally between 10 children. **Mental methods** ○ Children should continue to count regularly, on and back, in multiples of 6, 7, 9, 25 and 1000, and steps of 1/100. ○ Become fluent and confident to recall all tables to 12 x 12. Evidence suggests that an effective sequence for teaching the tables is: 10 ×, 5 ×, 2 ×, 4 ×, 8 ×, 3 ×, 6 ×, 9 ×, 7 ×. ○ Solve practical problems where children need to scale up. Relate to known number facts. (e.g. how tall would a 25cm sunflower be if it grew 6 times taller?) **Written methods (progressing to 3d x 2d)**	Children practise and extend their use of the formal written methods of short multiplication and short division. They apply all the multiplication tables and related division facts frequently, commit them to memory and use them confidently to make larger calculations. They use and understand the terms factor, multiple and prime, square and cube numbers. Children interpret non-integer answers to division by expressing results in different ways according to the context, including with remainders, as fractions, as decimals or by rounding (for example, 98 ÷ 4 = $\frac{98}{4}$ = 24 r 2 = 24 $\frac{1}{2}$ = 24.5 ≈ 25). Children use multiplication and division as inverses to support the introduction of ratio in year 6, for example, by multiplying and dividing by powers of 10 in scale drawings or by multiplying and dividing by powers of a 1,000 in converting between units such as kilometres and metres. They understand the terms factor, multiple and prime, square and cube numbers and use them to construct equivalence statements (for example, 4 x 35 = 2 x 2 x 35; 3 x 270 = 3 x 3 x 9 x 10 = 9^2 x 10). Children use and explain the equals sign to indicate equivalence, including in missing number problems (for example 13 + 24 = 12 + 25; 33 = 5 x ?). **Mental methods** ○ Children should continue to count regularly, on and back, now including steps of powers of 10. ○ Multiply by 10, 100, 1000, including decimals (moving digits) ○ Use practical resources and jottings to explore equivalent statements (e.g. 4 x 35 = 2 x 2 x 35) ○ Recall of prime numbers up 19 and identify prime numbers up to 100 (with reasoning) ○ Solving practical problems where children need to scale up. Relate to known number facts. ○ Identify factor pairs for numbers	Children practise addition, subtraction, multiplication and division for larger numbers, using the formal written methods of columnar addition and subtraction, short and long multiplication, and short and long division. They undertake mental calculations with increasingly large numbers and more complex calculations. Children continue to use all the multiplication tables to calculate mathematical statements in order to maintain their fluency. Children round answers to a specified degree of accuracy, for example, to the nearest 10, 20, 50, etc., but not to a specified number of significant figures. Children explore the order of operations using brackets; for example, 2 + 1 x 3 = 5 and (2 + 1) x 3 = 9. Common factors can be related to finding equivalent fractions. **Mental and written methods are further developed as in Year**

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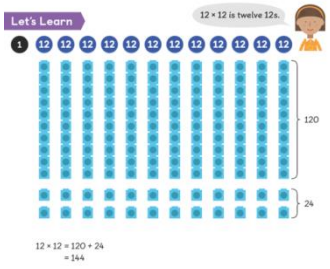
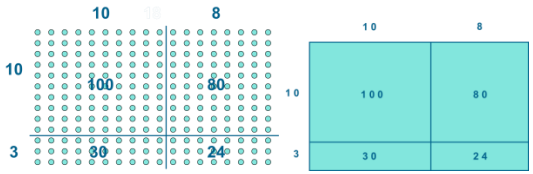
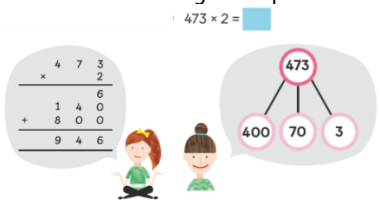
Children to progress their understanding of the grid method (Y3) to multiply 2d x 2d. This method is still linked back to their understanding of arrays and place value counters.



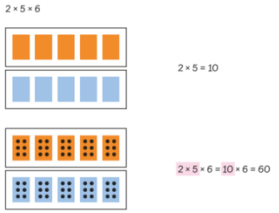


Children progress on the expanded method of formal multiplication to multiply 3d by 1d using partitioning to support methods. (Renaming on top).



400 × 2 = 800
70 × 2 = 140
3 × 2 = 6
473 × 2 = 946

Children are introduced how to multiply 3 numbers together

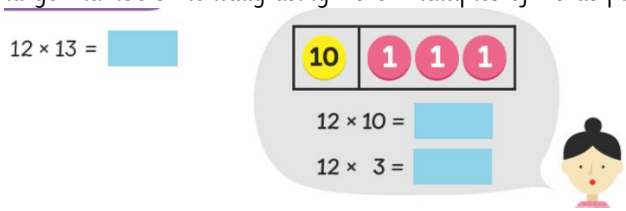


They should be encouraged to choose from a range of strategies to solve problems mentally:

- Partitioning using x10, x20 etc
- Doubling to solve x2, x4, x8
- Recall of times tables
- Use of commutativity of multiplication

If children know the times table facts to 12 x 12. Can they use this to recite other times tables (e.g. the 13 times tables or the 24 times table)?

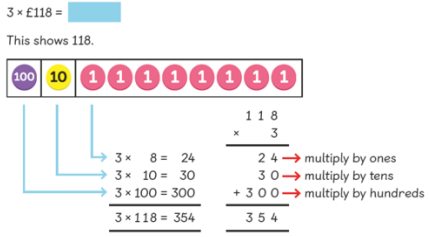
Mental methods need to be developed to see links between multiplying larger numbers mentally using 10 or multiples of 10 as place holders.



Written methods

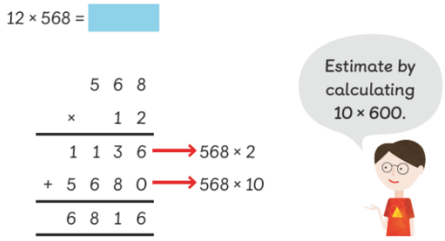
Expanded formal column addition is built on from Year 4

Formal multiplication using expanded method first must be taught alongside place value counters



Compact formal column addition is introduced

Renaming must be shown on the top row of numbers. This is completed alongside counters or other concrete materials.



Children should experiment with order of operations, investigating the effect of positioning the brackets in different places, e.g. 20 – 5 x 3 = 5; (20 – 5) x 3 = 45

9 – 4 + 2 – 1 + 3 = 5

9 – 4 + 2 – 1 + 3 = 3

9 – 4 × 2 – 1 + 3 = 6

They should be encouraged to choose from a range of strategies to solve problems mentally:

- Partitioning using x10, x20 etc
- Doubling to solve x2, x4, x8
- Recall of times tables
- Use of commutativity of multiplication

If children know the times table facts to 12 x 12. Can they use this to recite other times tables (e.g. the 13 times tables or the 24 times table)

Vocabulary

See previous years

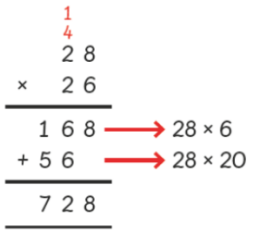
Children should be encouraged to choose from a range of strategies:

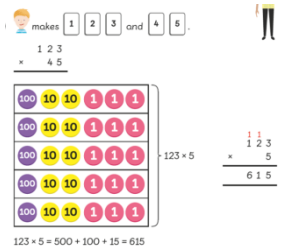
- Partitioning using x10, x20 etc.
- Doubling to solve x2, x4, x8
- Recall of times tables
- Use of commutativity of multiplication

Vocabulary
Factor

Generalisations
Children given the opportunity to investigate numbers multiplied by 1 and 0.
When they know multiplication facts up to x12, do they know what x13 is? (i.e. can they use 4x12 to work out 4x13 and 4x14 and beyond?)

Some Key Questions
What do you notice?
What's the same? What's different?
Can you convince me?
How do you know?





Vocabulary
cube numbers
prime numbers
square numbers
common factors
prime number, prime factors
composite numbers

Generalisation
Relating arrays to an understanding of square numbers and making cubes to show cube numbers.
Understanding that the use of scaling by multiples of 10 can be used to convert between units of measure (e.g. metres to kilometres means to times by 1000)

Some Key Questions
What do you notice?
What's the same? What's different?
Can you convince me?
How do you know?
How do you know this is a prime number?

common factor

Generalisations
Order of operations: brackets first, then multiplication and division (left to right) before addition and subtraction (left to right). Children could learn an acrostic such as PEMDAS, or could be encouraged to design their own ways of remembering.
Understanding the use of multiplication to support conversions between units of measurement.

Some Key Questions
What do you notice?
What's the same? What's different?
Can you convince me?
How do you know?

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Division

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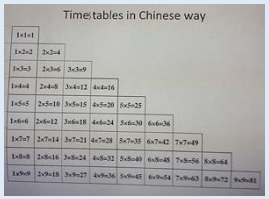
Division

Mental Division & Times tables Inverse:

Pupils will complete 2 minutes guided fluency every day focusing on one of the 4 operation strands suited to the Year Group expectations. Longer fluency sessions will commence in autumn 2018 in addition to structured 2 part lessons.



Chanting & Times tables: Teachers will use the spring 2018 INSET as a model for these sessions. The vocabulary will be modelled on IWB saved centrally to ensure consistency throughout the school, 10 / 5 = 2 but will follow this structure (ten divided by five is two) Division will always be practised alongside times tables to build on this relationship.

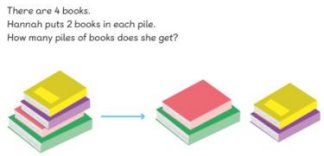
Currently children learn all 12x 12 facts for each times table, the Chinese 45 facts model will be introduced from autumn 2019 once children have built a stronger foundation in number sense and a stronger focus around 10. Children must be confident in all related division facts for these 12 x 12 tables.

Year 1 NC Objectives	Year 2 NC Objectives	Year 3 NC Objectives
• solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher. • recognise, find and name a half as 1 of 2 equal parts of an object, shape or quantity recognise, find and name a quarter as 1 of 4 equal parts of an object, shape or quantity	• recall and use multiplication and 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 multiplication (×), division (÷) and equals (=) signs • show that multiplication of 2 numbers can be done in any order (commutative) and division of 1 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	• 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

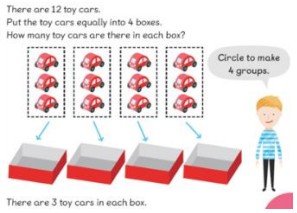
Through grouping and sharing small quantities, children begin to understand: multiplication and division; doubling numbers and quantities; and finding simple fractions of objects, numbers and quantities.

They make connections between arrays, number patterns, and counting in 2s, 5s and 10s. Children should begin to understand division as both sharing and grouping.

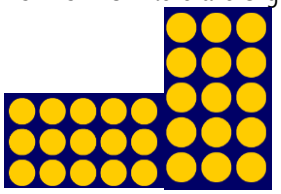
Grouping equally



Sharing equally



Use of arrays as a pictorial representation for division. 15 ÷ 3 = 5 There are 5 groups of 3.
15 ÷ 5 = 3 There are 3 groups of 5.

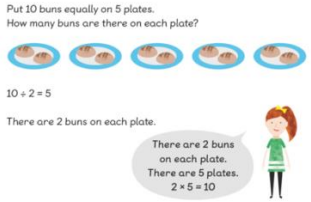


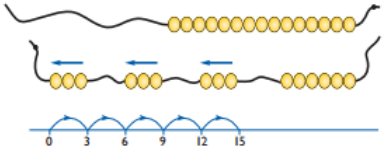
Children should use objects to group and share

Children recall multiplication facts, including using related division facts to perform written and mental calculations.

They work with a range of materials and contexts in which multiplication and division relate to grouping and sharing discrete and continuous quantities, to arrays and to repeated addition. They begin to relate these to fractions and measures (for example, 40 ÷ 2 = 20, 20 is a half of 40). They use commutativity and inverse relations to develop multiplicative reasoning (for example, 4 × 5 = 20 and 20 ÷ 5 = 4).

Children should progress their Year 1 understanding of division as sharing **and** grouping and begin to create fact families to show the inverse between multiplication and division.





Continue work on arrays. Support children to understand how multiplication and division are inverse. Look at an array – what do you see?

Grouping using a numberline

Group from zero in jumps of the divisor to find our 'how many groups of 3 are there in 15?'.
15 ÷ 3 = 5

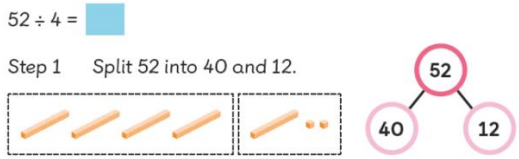
Children should be given opportunities to find a half, a quarter and a third of shapes, objects, numbers and quantities. Finding a fraction of a number of objects to be related to sharing.

Children develop efficient mental methods, for example, using commutativity and associativity (for example, 4 × 12 × 5 = 4 × 5 × 12 = 20 × 12 = 240) and multiplication and division facts (for example, using 3 × 2 = 6, 6 ÷ 3 = 2 and 2 = 6 ÷ 3) to derive related facts (30 × 2 = 60, 60 ÷ 3 = 20 and 20 = 60 ÷ 3).

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

Children will make use multiplication and division facts they know to make links with other facts.
3 x 2 = 6, 6 ÷ 3 = 2, 2 = 6 ÷ 3
30 x 2 = 60, 60 ÷ 3 = 20, 2 = 60 ÷ 30

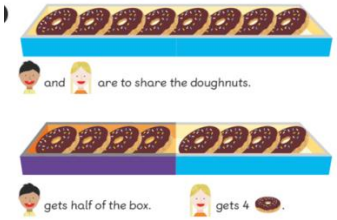
Division is progressed from Y1 and Y2 to include regrouping (further multiplication) based on knowledge of number relationships.



Children will be given opportunities to solve grouping and sharing problems practically. Chunking *can* be explored as part of an extension (once children have a thorough understanding of grouping and sharing)

amounts to develop understanding of division in a practical sense.
e.g. using Numicon to find out how many 5's are in 30? How many pairs of gloves if you have 12 gloves?

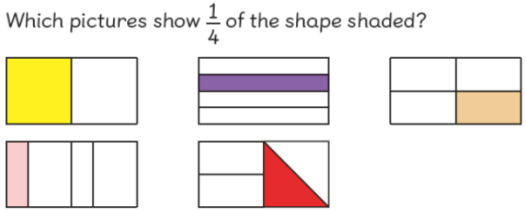
Children should begin to explore finding ½ and ¼ of objects, numbers and quantities.



Vocabulary
share, share equally, one each, two each…, group, groups of, lots of, array

Generalisations
- True or false? I can only halve even numbers.
- Grouping and sharing are different types of problems. Some problems need solving by grouping and some by sharing. Encourage children to practically work out which they are doing.

Some Key Questions
How many groups of…?
How many in each group?
Share… equally into…
What can do you notice?

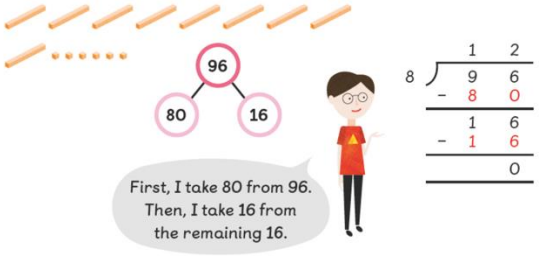


They will explore visually and understand how some fractions are equivalent – e.g. two quarters is the same as one half.

Vocabulary
group in pairs, 3s … 10s etc
equal groups of
divide, ÷, divided by, divided into, remainder

Generalisations
Noticing how counting in multiples if 2, 5 and 10 relates to the number of groups you have counted (introducing times tables)
An understanding of the more you share between, the less each person will get (e.g. would you prefer to share these grapes between 2 people or 3 people? Why?)
Secure understanding of grouping means you count the number of groups you have made. Whereas sharing means you count the number of objects in each group.

Some Key Questions
How many 10s can you subtract from 60?
I think of a number and double it. My answer is 8. What was my number?
If 12 x 2 = 24, what is 24 ÷ 2?
Questions in the context of money and measures (e.g. how many 10p coins do I need to have 60p? How many 100ml cups will I need to reach 600ml?)



Vocabulary
See Y1 and Y2
inverse

Generalisations
Inverses and related facts – develop fluency in finding related multiplication and division facts.
Develop the knowledge that the inverse relationship can be used as a checking method.

Some Key Questions
Questions in the context of money and measures that involve remainders (e.g. How many lengths of 10cm can I cut from 81cm of string? You have £54. How many £10 teddies can you buy?)
What is the missing number? 17 = 5 x 3 + __
__ = 2 x 8 + 1

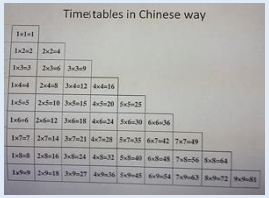
Grouville School Calculation Policy 2018

UNRC Article 28: Every child is a right to an education.
UNRC Article 29: Every child has the right to be the best they can be
Well-being and achievement are at the heart of Grouville School so that we can all develop as Lifelong Learners and take responsibility for ourselves and the community.

Division

Mental Division & Times tables Inverse:

Pupils will complete 2 minutes guided fluency every day focusing on one of the 4 operation strands suited to the Year Group expectations. Longer fluency sessions will commence in autumn 2018 in addition to structured 2 part lessons.



Chanting & Times tables: Teachers will use the spring 2018 INSET as a model for these sessions. The vocabulary will be modelled on IWB saved centrally to ensure consistency throughout the school, 10 / 5 = 2 but will follow this structure (ten divided by five is two) Division will always be practised alongside times tables to build on this relationship.

Currently children learn all 12x 12 facts for each times table, the Chinese 45 facts model will be introduced from autumn 2019 once children have built a stronger foundation in number sense and a stronger focus around 10. Children must be confident in all related division facts for these 12 x 12 tables.

Year 4 NC Objectives

- 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 3 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 1 digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects

Year 5 NC Objectives

- 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 1,000
- 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

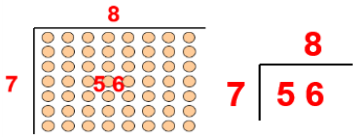
Year 6 NC Objectives

- divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context
- divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context
- perform mental calculations, including with mixed operations and large numbers
- use their knowledge of the order of operations to carry out calculations involving the 4 operations

Children should experience regular counting on and back from different numbers in multiples of 6, 7, 9, 25 and 1000.

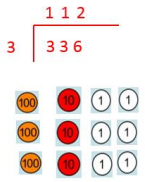
Children will be building on their previous knowledge to begin writing formal methods. (Liaison between class teachers to clarify whether further division unit was taught children)

Towards a formal written method
Alongside pictorial representations and the use of models and images, children should progress onto short division using the bus stop method.



Place value counters can be used to support children apply their knowledge of grouping. Reference should be made to the value of each digit in the dividend.

Each digit as a multiple of the divisor
'How many groups of 3 are there in the hundreds column?'
'How many groups of 3 are there in the tens column?'
'How many groups of 3 are there in the units/ones column?'



Children practise and extend their use of the formal written methods of short multiplication and short division. They apply all the multiplication tables and related division facts frequently, commit them to memory and use them confidently to make larger calculations.

They use and understand the terms factor, multiple and prime, square and cube numbers.

Children interpret non-integer answers to division by expressing results in different ways according to the context, including with remainders, as fractions, as decimals or by rounding (for example, $98 \div 4 = \frac{98}{4} = 24 \text{ r } 2 = 24\frac{1}{2} = 24.5 \approx 25$).

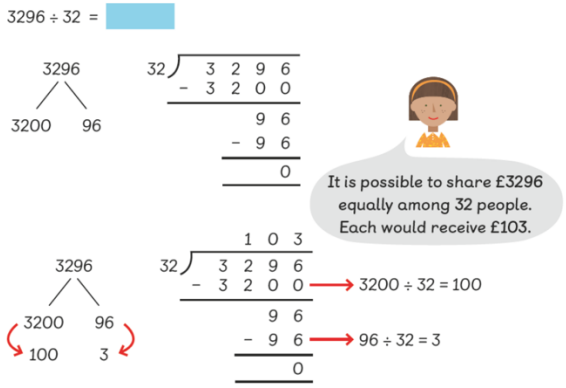
Children should count regularly using a range of multiples, and powers of 10, 100 and 1000, building fluency.
Children should practice and apply the multiplication facts to 12 x 12.

Fluency in number bonds and a developed number sense would make these approaches more efficient than a traditional bus stop or chunking method.

Children practise addition, subtraction, multiplication and division for larger numbers, using the formal written methods of columnar addition and subtraction, short and long multiplication, and short and long division (see Mathematics appendix 1).

They undertake mental calculations with increasingly large numbers and more complex calculations.

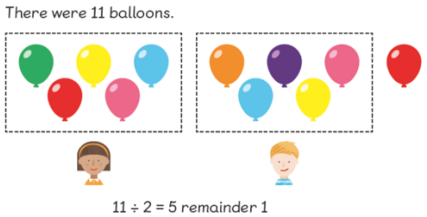
Common factors can be related to finding equivalent fractions.
Children are introduced to 2 digit 'long' division using chunking as an efficient method. They are introduced to other mental methods including partitioning.



Quotients should be expressed as decimals and fractions

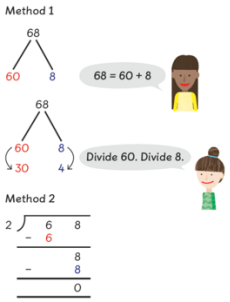
Generalisations
Order of operations: brackets first, then multiplication and division (left to right) before addition and subtraction (left to right). Children could learn an acrostic such as PEMDAS, or could be encouraged to

When children have conceptual understanding and fluency using the bus stop method without remainders, they can then progress onto 'renaming' their remainder across to the next digit.

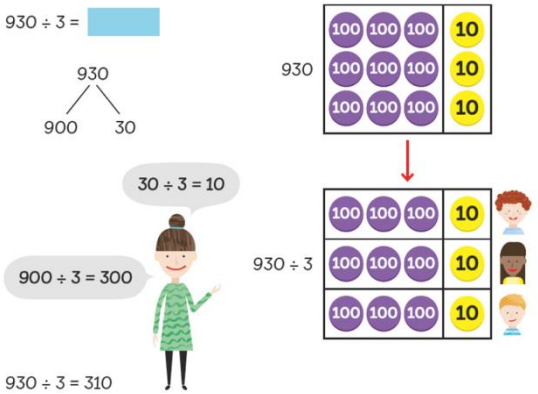


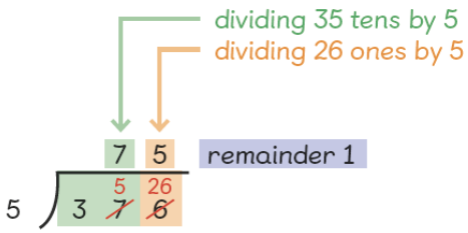
Children begin to practically develop their understanding of how express the remainder as a decimal or a fraction. Ensure practical understanding allows children to work through this (e.g. what could I do with this remaining 1? How could I share this between 6 as well?)

A variety of methods can be used including portioning, formal written and chunking.



Fluency in number bonds and a developed number sense would make this an efficient approach for simple division.





376 ÷ 5 = 75 remainder 1

Vocabulary

common factors
prime number, prime factors
composite numbers
short division
square number
cube number
inverse
power of

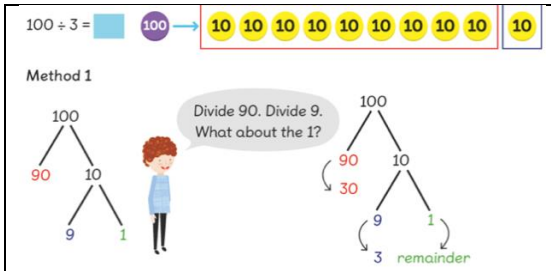
Generalisations

design their own ways of remembering.

Sometimes, always, never true questions about multiples and divisibility. e.g.: If a number is divisible by 3 and 4, it will also be divisible by 12. (also see year 4 and 5, and the hyperlink from the Y5 column)

Using what you know about rules of divisibility, do you think 7919 is a prime number? Explain your answer.

Some Key Questions for Year 4 to 6
What do you notice?
What's the same? What's different?
Can you convince me?
How do you know?



Vocabulary
see years 1-3
divide, divided by, divisible by, divided into
share between, groups of
factor, factor pair, multiple
times as (big, long, wide …etc)
equals, remainder, quotient, divisor
inverse

Generalisations
True or false? Dividing by 10 is the same as dividing by 2 and then dividing by 5. Can you find any more rules like this?
Is it sometimes, always or never true that □ ÷ Δ = Δ ÷ □?
Inverse and deriving facts. 'Know one, get lots free!' e.g.: 2 x 3 = 6, so 3 x 2 = 6, 6 ÷ 2 = 3, 60 ÷ 20 = 3, 600 ÷ 3 = 200 etc.

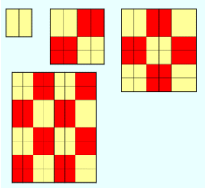
Sometimes, always, never true questions about multiples and divisibility. (When looking at the examples on this page, remember that they **may not** be 'always true'!) E.g.

- Multiples of 5 end in 0 or 5.
- The digital root of a multiple of 3 will be 3, 6 or 9.
- The sum of 4 even numbers is divisible by 4.

The = sign means equality. Take it in turn to change one side of this equation, using multiplication and division, e.g.
Start: **24 = 24**
Player 1: **4 x 6 = 24**
Player 2: **4 x 6 = 12 x 2**
Player 1: **48 ÷ 2 = 12 x 2**

Sometimes, always, never true questions about multiples and divisibility. E.g.:

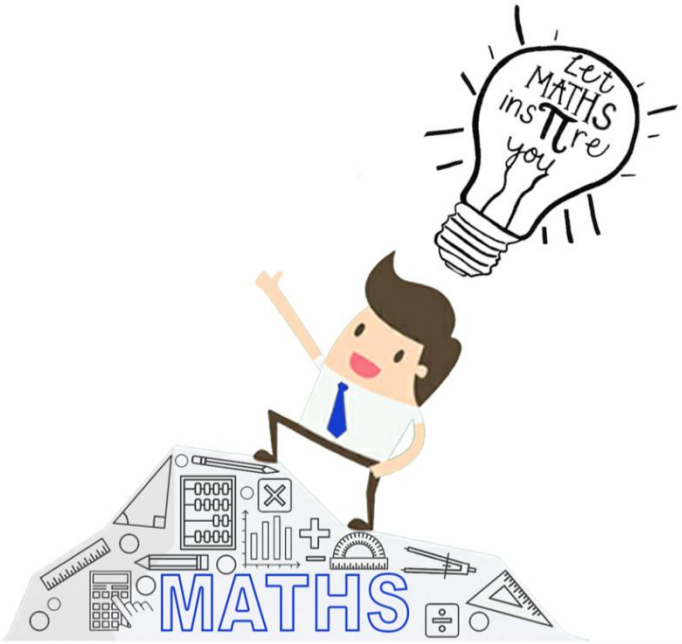
- If the last two digits of a number are divisible by 4, the number will be divisible by 4.
- If the digital root of a number is 9, the number will be divisible by 9.
- When you square an even number the result will be divisible by 4 (one example of 'proof' shown right)



GROUVILLE SCHOOL

Life-long learning, Responsibility & Community

EYFS



Mathematics in EYFS

Young learners' future understanding of mathematics requires an early foundation based on a high-quality, challenging, and accessible mathematics education. Young children in every setting should experience mathematics through effective, research-based curricula and teaching practices. Such practices in turn require that teachers have the support of policies, organisational structures, and resources that enable them to succeed in this challenging and important work.

Research on children's learning in the first six years of life demonstrates the importance of early experiences in mathematics. An engaging and encouraging climate for children's early encounters with mathematics develops their confidence in their ability to understand and use mathematics. These positive experiences help children to develop dispositions such as curiosity, imagination, flexibility, inventiveness, and persistence, which contribute to their future success in and out of school (Clements & Conference Working Group, 2004).

The NCETM states that Early childhood educators should actively introduce mathematical concepts, methods, and language through a variety of appropriate experiences and research-based teaching strategies. Teachers should guide children in seeing connections of ideas within mathematics as well as with other subjects, developing their mathematical knowledge throughout the day and across the curriculum. They must encourage children to communicate, explaining their thinking as they interact with important mathematics in deep and sustained ways.

The areas of learning and development

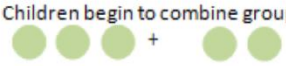
Mathematics within EYFS involves providing children with opportunities to develop and improve their skills in counting, understanding and using numbers, calculating simple addition and subtraction problems; and to describe shapes, spaces, and measure.

Mathematics Numbers: children count reliably with numbers from 1 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.

Shape, space and measures: children use everyday language to talk about size, weight, capacity, position, distance, time and money to compare quantities and objects and to solve problems. They recognise, create and describe patterns. They explore characteristics of everyday objects and shapes and use mathematical language to describe them.

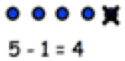
Addition

Maths for young children should be meaningful. Where possible, concepts should be taught in the context of real life.

GUIDANCE / MODELS AND IMAGES	KEY VOCABULARY
If available, Numicon shapes are introduced straight away and can be used to: • identify 1 more/less • combine pieces to add. • find number bonds. • add without counting.  Children can record this by printing or drawing around Numicon pieces. Children begin to combine groups of objects using concrete apparatus  Construct number sentences verbally or using cards to go with practical activities. Children are encouraged to read number sentences aloud in different ways "Three add two equals 5" "5 is equal to three and two" Children make a record in pictures, words or symbols of addition activities already carried out. Solve simple problems using fingers  5 + 1 = 6 Number tracks can be introduced to count up on and to find one more: 1 2 3 4 5 6 What is 1 more than 4? 1 more than 13? Number lines can then be used alongside number tracks and practical apparatus to solve addition calculations and word problems.  **Children will need opportunities to look at and talk about different models and images as they move between representations.**	**Games and songs can be a useful way to begin using vocabulary involved in addition e.g.** Alice the Camel 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…?

Subtraction

Maths for young children should be meaningful. Where possible, concepts should be taught in the context of real life.

GUIDANCE / MODELS AND IMAGES	KEY VOCABULARY
Children begin with mostly pictorial representations X X X [X X] Concrete apparatus is used to relate subtraction to taking away and counting how many objects are left. Concrete apparatus models the subtraction of 2 objects from a set of 5.  5 - 1 = 4 Construct number sentences verbally or using cards to go with practical activities. Children are encouraged to read number sentences aloud in different ways "five subtract one leaves four" "four is equal to five subtract one" Children make a record in pictures, words or symbols of subtraction activities already carried out. Solve simple problems using fingers  5 - 1 = 4 Number tracks can be introduced to count back and to find one less: [1 2 3 4 5 6] What is 1 less than 9? 1 less than 20? Number lines can then be used alongside number tracks and practical apparatus to solve subtraction calculations and word problems. Children count back under the number line. 8 - 3 = 5  **Children will need opportunities to look at and talk about different models and images as they move between representations.**	**Games and songs can be a useful way to begin using vocabulary involved in subtraction e.g.** Five little men in a flying saucer 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

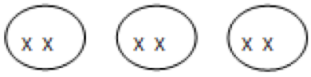
Multiplication

Maths for young children should be meaningful. Where possible, concepts should be taught in the context of real life.

GUIDANCE / MODELS AND IMAGES	KEY VOCABULARY
The link between addition and multiplication can be introduced through doubling. If available, Numicon is used to visualise the repeated adding of the same number. These can then be drawn around or printed as a way of recording. Children begin with mostly pictorial representations:   How many groups of 2 are there? Real life contexts and use of practical equipment to <u>count in repeated groups of the same size</u>:   How many wheels are there altogether? How much money do I have? Count in twos; fives; tens both aloud and with  objects Children are <u>given multiplication problems set in a real life context</u>. Children are encouraged to visualise the problem. How many fingers on two hands? How many sides on three triangles? How many legs on four ducks? Children are encouraged to read number sentences aloud in different ways "five times two makes ten" "ten is equal to five multiplied by two"	lots of groups of times multiply multiplied by multiple of once, twice, three times… ten times… …times as (big, long, wide… and so on) repeated addition double

Division and fractions

Maths for young children should be meaningful. Where possible, concepts should be taught in the context of real life.

GUIDANCE / MODELS AND IMAGES	KEY VOCABULARY
The ELG states that children **solve problems, including doubling, halving and sharing.** Children need to see and hear representations of division as both grouping and sharing. Division can be introduced through halving. Children begin with mostly pictorial representations linked to real life contexts:  **Grouping model** Mum has 6 socks. She grouped them into pairs – how many pairs did she make?  **Sharing model** I have 10 sweets. I want to share them with my friend. How many will we have each? Children have a go at recording the calculation that has been carried out.	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

FRACTIONS

GUIDANCE / MODELS AND IMAGES	KEY VOCABULARY
Although not explicit in the Development Matters document, the sharing model is a useful way of introducing young children to fractions and calculating with fractions. Setting the problems in real life context and solving them with <u>concrete apparatus</u> will support children's understanding. "I have got 5 bones to share between my two dogs. How many bones will they get each?"  Children have a go at recording the calculation that has been carried out. 2 ½ + 2 ½ = 5	As division vocabulary plus: fraction half halves third thirds

Appendix 1: Glossary of Terms

This calculation policy uses mathematical terminology that may be new or unfamiliar. They are terms that children should be familiar with, depending on their Year Group.

Bridging through ten: When performing additions or subtractions, counting through a TENS boundary is called 'bridging through ten'. It helps to count up to the boundary first, then through it. e.g.: 18 + 4 will bridge through the boundary from 19 to 20, so we would count 18 + 2, then 20 + 2.

Counting back: As with counting on, but in subtraction.

Counting on: When performing a calculation, such as 8 + 3, start at 8 and count: 9, 10, 11. You can count on or back in TENS or HUNDREDS etc. as well as ONES.

Chunking: A method of written division where groups of the divisor are counted within the dividend. At Grouville, chunks of the divisor are added up to the total of the dividend, rather than subtracting from it to zero. This is more intuitive and makes more sense for the children. e.g. 28 ÷ 7; we will count chunks of the divisor (7) in 28. There are 4 chunks of 7 because 7+7+7+7 = 28.

Commutative Law: The law that states that: a multiplication or addition can be made in any order to arrive at the same product or sum respectively. e.g.: 8+5+2 = 15; 2+5+8 = 15; 5+8+2 = 15 3x4x10 = 120; 10x4x3 = 120 etc. These calculations are said to demonstrate commutativity.

Difference: The result of a subtraction calculation.

Dividend: A number that is to be divided in a calculation.

Divisor: The number that the dividend is to be divided by.

Empty Number-Lines: A number-line without numbers. They are used when calculations involving numbers greater than 10. It would be impractical to calculate 87 – 23 with a printed number-line starting at 0. A line is drawn and the only numbers written on the line are the starting number (which depends on the method used) and the numbers arrived at whilst 'jumping' along it.

Factors: Factors are whole numbers that can be multiplied to make a given whole number. e.g. 4 and 3 are factors of 12, so are 6 and 2.

Grid Method: A method for introducing written multiplications where the numbers involved are partitioned before multiplying. The products are recombined as they will obey Commutative Law.

Inverse Operations: The opposite of an operation. Inverse operations are used to find a missing value in a number sentence. The inverse of an addition is a subtraction and vice-versa. The inverse of a multiplication is a divide. However, the inverse of a divide calculation is not always a multiplication 5 + 15 = 20, 20 – 5 = 15 (and vice-versa), 3 x 4 = 12, 12 ÷ 4 = 3 BUT… 12 ÷ 4 = 3, 3 x 12 is not 4! (You have to do 12 ÷ 3 to get 4).

Multiplicand: A quantity which is to be multiplied by another (the multiplier).

Multiplier: A quantity by which a given number (the multiplicand) is to be multiplied.

Number Sentence: An equation written in maths. Like in literacy, they must make sense. = means 'the same as'; G means 'more than' and q means 'less than' e.g. 6 + 8 = 20 WRONG 6 + 8 G 20 WRONG 6 + 8 q 20 CORRECT because it makes sense.

Number Bonds: Number 'facts' that children will learn in KS1 and continue using to aid mental calculations. Number bonds to ten are the following: 1+9; 2+8; 3+7; 4+6 and 5+5 There are also number bonds to 20, 100, 1000 and so on.

Operation: A procedure that produces a new value from two or more input values. + - x and are the four main arithmetic operations.

Partitioning: Splitting a number greater than 10 into its constituent THOUSANDS, HUNDREDS, TENS and ONES. e.g.: 43 = 40 and 3, 356 = 300 and 50 and 6, 4723 = 4000 and 700 and 20 and 3.

Place Value: Place value determines the value of a digit depending on where it sits in the written number. e.g. 4562 ◊ The '5' represents 500 in this case. When performing column methods, it is important that the children are secure with place value in order to line the numbers with TENS under TENS etc. Children need to understand place value in order to write numbers accurately, such as: four-hundred and 2. A child without place value understanding may write 4002 (i.e. 400, then 2).

Prime Number: A number with only one factor. EVERY whole number greater than one is a product of prime numbers. Product: The result of a multiplication calculation.

Quotient: The result of a division calculation. It is arrived at by counting chunks of the divisor up to the total of the dividend.

Recombining: After partitioning and calculating, putting the numbers 'back together'.

Remainder: When dividing, the remainder is how much of the divisor is needed to reach the dividend total when the quotient is not a whole number.

Sum: The result of an addition calculation.

Appendix 2: Year Group Coverage

Key Learning in Mathematics at Grouville Primary School – Year 1

Number – number and place value

- Count to and across 100, forwards and backwards, beginning with 0 or 1, or from any given number
- Count in multiples of twos, fives and tens
- Read and write numbers to 100 in numerals
- Read and write numbers from 1 to 20 in numerals and words
- *Begin to recognise the place value of numbers beyond 20 (tens and ones)*
- Identify and represent numbers using objects and pictorial representations including the number line & Numicon
- Use the language of: equal to, more than, less than (fewer), most, least
- Given a number, identify one more and one less
- *Recognise and create repeating patterns with numbers, objects and shapes*
- *Identify odd and even numbers linked to counting in twos from 0 and 1*
- *Solve problems and practical problems involving all of the above*

Number – fractions

- *Understand that a fraction can describe part of a whole*
- *Understand that a unit fraction represents* ***one equal part of a whole***
- Recognise, find and name a **half as one of two equal parts of an object shape or quantity *(including measure)***
- Recognise, find and name a quarter as one of four equal parts of an object, shape or quantity *(including measure)*

Number – addition and subtraction

- Read, write and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs
- Represent and use number bonds and related subtraction facts within 20
- Add and subtract one-digit and two-digit numbers to 20, including zero *(using concrete objects and pictorial representations)*
- Solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and **missing number problems such as 7 = ☐ - 9**

Geometry – properties of shapes

- Recognise and name common 2-D shapes, including **rectangles (including squares)**, circles and triangles
- Recognise and name common 3-D shapes, including cuboids (including cubes), pyramids and spheres

Geometry – position and direction

- **Describe movement, including whole, half, quarter and three-quarter turns**
- *Recognise and create repeating patterns with objects and shapes*
- Describe position and direction

Statistics

- *Sort objects, numbers and shapes to a given criterion and their own*
- *Present and interpret data in block diagrams using practical equipment*
- *Ask and answer simple questions by counting the number of objects in each category*
- *Ask and answer questions by comparing categorical data*

Number – multiplication and division

- *Recall and use doubles of all numbers to 10 and corresponding halves*
- Solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher

Measurement

- Measure and begin to record:
  - lengths and heights, *using non-standard and then manageable standard units (m/cm)*
  - mass/weight, *using non-standard and then manageable standard units (kg/g)*
  - capacity and volume *using non-standard and then manageable standard units (litres/ml)*
  - time (hours/minutes/seconds)

  within children's range of counting competence
- Compare, describe and solve practical problems for:
  - lengths and heights (for example, long/short, longer/shorter, tall/short, double/half)
  - mass/weight (for example, heavy/light, heavier than, lighter than)
  - capacity and volume (for example, full/empty, more than, less than, half, half full, quarter)
  - time (for example, quicker, slower, earlier, later)
- Recognise and use language relating to dates, including days of the week, weeks, months and years
- Sequence events in chronological order using language (for example, before and after, next, first, today, yesterday, tomorrow, morning, afternoon and evening
- Tell the time to the hour and half past the hour and draw the hands on a clock face to show these times – ref to time daily across curriculum/throughout day
- Recognise and know the value of different denominations of coins and notes

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Key Learning in Mathematics at Grouville Primary School – Year 2

Number – number and place value

- Count in steps of 2, 3, and 5 from 0, and in tens from any number, forward and backward
- Read and write numbers to at least 100 in numerals and in words
- Recognise the place value of each digit in a two-digit number (tens, ones)
- Identify, represent and estimate numbers using different representations, including the number line & Numicon
- *Partition numbers in different ways (e.g. 23 = 20 + 3 and 23 = 10 + 13)*
- Compare and order numbers from 0 up to 100; **use <, > and =** signs
- *Find 1 or 10 more or less than a given number*
- *Round numbers to at least 100 to the nearest 10*
- *Understand the connection between the 10 multiplication table and place value*
- *Describe and extend simple sequences involving counting on or back in different steps*
- Use place value and number facts to solve problems

Number – fractions

- *Understand and use the terms numerator and denominator*
- *Understand that a fraction can describe part of a set*
- *Understand that the larger the denominator is, the more pieces it is split into and therefore the smaller each part will be*
- 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 $\frac{1}{2}$
- *Count on and back in steps of $\frac{1}{2}$ and $\frac{1}{4}$*

Number – addition and subtraction

- *Choose an appropriate strategy to solve a calculation based upon the numbers involved (recall a known fact, calculate mentally, use a jotting)*
- *Select a mental strategy appropriate for the numbers involved in the calculation*
- Show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot
- *Understand subtraction as take away **and difference** (how many more, how many less/fewer)*
- Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100
- *Recall and use number bonds for multiples of 5 totalling 60 (to support telling time to nearest 5 minutes)*
- Add and 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
  - adding three one-digit numbers
- Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems
- Solve problems with addition and subtraction *including with missing numbers:*
  - using concrete objects and pictorial representations, including those involving numbers, quantities and measures
  - applying their increasing knowledge of mental and written methods

Geometry – properties of shapes

- Identify and describe the properties of 2-D shapes, including the number of sides and line symmetry in a vertical line
- Identify and describe the properties of 3-D shapes, including the number of edges, vertices and faces
- Identify 2-D shapes on the surface of 3-D shapes, [for example, a circle on a cylinder and a triangle on a pyramid]

Geometry – position and direction

- Order/arrange combinations of mathematical objects in patterns/sequences
- Use mathematical vocabulary to describe position, direction and movement, including movement in a straight line and distinguishing between rotation as a turn and in terms of right angles for quarter, half and three-quarter turns (clockwise and anti-clockwise)

Statistics

- Compare and sort *objects, numbers and* common 2-D and 3-D shapes and everyday objects
- Interpret and construct simple pictograms, tally charts, block diagrams and simple tables
- Ask and answer simple questions by counting the number of objects in each category and sorting the categories by quantity
- Ask and answer questions about totalling and comparing categorical data

Number – multiplication and division

- *Understand multiplication as repeated addition*
- *Understand division as sharing and grouping and that a division calculation can have a remainder*
- Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot
- Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers
- *Derive and use doubles of simple two-digit numbers (numbers in which the ones total less than 10)*
- *Derive and use halves of simple two-digit even numbers (numbers in which the tens are even)*
- Calculate mathematical statements for multiplication *using repeated addition)* and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs
- Solve problems involving multiplication and division *(including those with remainders)*, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts

Measurement

- Choose and use appropriate standard units to estimate and measure length/height in any direction (m/cm); mass (kg/g); temperature (°C); capacity and volume (litres/ml) to the nearest appropriate unit, using rulers, scales, thermometers and measuring vessels
- Compare and order lengths, mass, volume/capacity and record the results using >, < and =
- Recognise and use symbols for pounds (£) and pence (p)
- Combine amounts to make a particular value
- Find different combinations of coins that equal the same amounts of money
- Compare and sequence intervals of time
- Tell and write the time to five minutes, including quarter past/to the hour and draw the hands on a clock face to show these times – refer to throughout day/across curriculum
- Know the number of minutes in an hour and the number of hours in a day
- Solve simple problems in a practical context involving addition and subtraction of money of the same unit, including giving change *and measures (including time)*

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Key Learning in Mathematics at Grouville Primary School – Year 3

Number – number and place value

- Count from 0 in multiples of 4, 8, 50 and 100
- Count up and down in tenths
- Read and write numbers up to 1000 in numerals and in words
- *Read and write numbers with one decimal place*
- Identify, represent and estimate numbers using different representations *(including the number line)*
- Recognise the place value of each digit in a three-digit number (hundreds, tens, ones)
- *Identify the value of each digit to one decimal place*
- *Partition numbers in different ways (e.g. 146 = 100+ 40+6 and 146 = 130+16)*
- Compare and order numbers up to 1000
- *Compare and order numbers with one decimal place*
- Find 1, 10 or 100 more or less than a given number
- *Round numbers to at least 1000 to the nearest 10 or 100*
- *Find the effect of multiplying a one- or two-digit number by 10 and 100, identify the value of the digits in the answer*
- *Describe and extend number sequences involving counting on or back in different steps*
- *Read Roman numerals from I to XII*
- Solve number problems and practical problems involving these ideas

Number – addition and subtraction

- *Choose an appropriate strategy to solve a calculation based upon the numbers involved (recall a known fact, calculate mentally, use a jotting, written method)*
- *Select a mental strategy appropriate for the numbers involved in the calculation*
- *Understand and use take away and difference for subtraction, deciding on the most efficient method for the numbers involved, irrespective of context*
- *Recall/use addition/subtraction facts for 100 (multiples of 5 and 10)*
- *Derive and use addition and subtraction facts for 100*
- *Derive and use addition and subtraction facts for multiples of 100 totalling 1000*
- 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 a written method that will lead to a formal written method for addition & 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 +/-

Number – multiplication and division

- *Choose an appropriate strategy to solve a calculation based upon the numbers involved (recall a known fact, calculate mentally, use a jotting, written method)*
- *Understand that division is the inverse of multiplication and vice versa*
- *Understand how multiplication and division statements can be represented using arrays*
- *Understand division as sharing and grouping and use each appropriately*
- Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables
- *Derive and use doubles of all numbers to 100 and corresponding halves*
- *Derive and use doubles of all multiples of 50 to 500*
- 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 written methods which will later progress to formal written methods
- *Use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy*
- Solve problems, including missing number problems, involving multiplication and division *(and interpreting remainders)*, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects

Number – fractions

- *Show practically or pictorially that a fraction is one whole number divided by another (e.g. $\frac{3}{4}$ can be interpreted as 3 ÷ 4)*
- *Understand that finding a fraction of an amount relates to division*
- Recognise that tenths arise from dividing objects 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 [for example, $\frac{5}{7} + \frac{1}{7} = \frac{6}{7}$]
- Compare and order unit fractions, and fractions with the same denominators *(including on a number line)*
- *Count on and back in steps of $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{3}$*
- Solve problems that involve all of the above

Geometry – properties of shapes

- Draw 2-D shapes and make 3-D shapes using modelling materials; recognise 3-D shapes in different orientations and describe them
- Recognise angles as a property of shape or a description of a turn
- Identify right angles, recognise that two right angles make a half-turn, three make three quarters of a turn and four a complete turn; identify whether angles are greater than or less than a right angle
- Identify horizontal and vertical lines and pairs of perpendicular and parallel lines

Geometry – position and direction

- *Describe positions on a square grid labelled with letters and numbers*

Statistics

- *Use sorting diagrams to compare and sort objects, numbers and common 2-D and 3-D shapes and everyday objects*
- Interpret and present data using bar charts, pictograms and tables
- Solve one-step and two-step questions [for example, 'How many more?' and 'How many fewer?'] using information presented in scaled bar charts and pictograms and tables

Measures

- Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)
- *Continue to estimate and measure temperature to the nearest degree (°C) using thermometers*
- *Understand perimeter is a measure of distance around the boundary of a shape*
- Measure the perimeter of simple 2-D shapes
- Tell and write the time from an analogue clock, including using Roman numerals from I to XII, and 12-hour and 24-hour clocks
- Estimate/read time with increasing accuracy to the nearest minute
- Record/compare time in terms of seconds, minutes, hours; use vocabulary such as o'clock, a.m./p.m., morning, afternoon, noon, midnight
- Know the number of seconds in a minute and the number of days in each month, year and leap year
- Compare durations of events [for example to calculate the time taken by particular events or tasks]
- *Continue to recognise and use the symbols for pounds (£) and pence (p) and understand that the decimal point separates pounds/pence*
- *Recognise that ten 10p coins equal £1 and that each coin is $\frac{1}{10}$ of £1*
- Add and subtract amounts of money to give change, using both £ and p in practical contexts
- *Solve problems involving money and measures and simple problems involving passage of time*

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Key Learning in Mathematics at Grouville Primary School – Year 4

Number – number and place value

- Count in multiples of 6, 7, 9, 25 and 1000
- Count backwards through zero to include negative numbers
- Count up and down in hundredths
- *Read and write numbers to at least 10 000*
- *Read and write numbers with up to two decimal places*
- Recognise the place value of each digit in a four-digit number
- *Identify the value of each digit to two decimal places*
- *Partition numbers in different ways (e.g. 2.3 = 2+0.3 & 1+1.3)*
- Identify, represent and estimate numbers using different representations *(including the number line)*
- Order and compare numbers beyond 1000
- *Order and* compare numbers with the same number of decimal places up to two decimal places
- Find *0.1, 1, 10, 100 or* 1000 more or less than a given number
- Round any number to the nearest 10, 100 or 1000
- Round decimals (one decimal place) to the nearest whole number
- Find the effect of dividing a one- or two-digit number by 10 and 100, identifying the value of the digits in the answer
- *Describe and extend number sequences involving counting on or back in different steps, including sequences with multiplication and division steps*
- Read Roman numerals to 100 and know that over time, the numeral system changed to include the concept of zero and place value
- Solve number and practical problems that involve all of the above and with increasingly large positive numbers

Number – fractions and decimals

- *Understand that a fraction is one whole number divided by another (e.g. $\frac{3}{4}$ can be interpreted as 3 ÷ 4)*
- *Recognise, find and write fractions of a discrete set of objects including those with a range of numerators and denominators*
- Recognise that hundredths arise when dividing an object by one hundred and dividing tenths by ten
- *Count on and back in steps of unit fractions*
- *Compare and order unit fractions and fractions with the same denominators (including on a number line)*
- Recognise and show, using diagrams, families of common equivalent fractions
- Recognise and write decimal equivalents of any number of tenths or hundredths
- Recognise and write decimal equivalents to $\frac{1}{4}, \frac{1}{2}, \frac{3}{4}$
- Add and subtract fractions with the same denominator *(using diagrams)*
- Solve problems involving increasingly harder fractions to calculate quantities, and fractions to divide quantities, including non-unit fractions where the answer is a whole number
- Solve simple measure and money problems involving fractions and decimals to two decimal places

Number – addition and subtraction

- *Choose an appropriate strategy to solve a calculation based upon the numbers involved (recall a known fact, calculate mentally, use a jotting, written method)*
- *Select a mental strategy appropriate for the numbers involved in the calculation*
- *Recall and use addition and subtraction facts for 100*
- *Recall and use +/- facts for multiples of 100 totalling 1000*
- *Derive and use addition and subtraction facts for 1 and 10 (with decimal numbers to one decimal place)*
- *Add and subtract mentally combinations of two and three digit numbers and decimals to one decimal place*
- Add and subtract numbers with up to 4 digits *and decimals with one decimal place* using a written method of addition and subtraction where appropriate
- Estimate; 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 (Singapore bar)
- *Solve addition and subtraction problems involving missing numbers*

Geometry – properties of shapes

- Compare and classify geometric shapes, including quadrilaterals and triangles, based on their properties and sizes
- Identify lines of symmetry in 2-D shapes presented in different orientations
- Complete a simple symmetric figure with respect to a specific line of symmetry
- *Continue to identify horizontal and vertical lines and pairs of perpendicular and parallel lines*
- Identify acute and obtuse angles and compare and order angles up to two right angles by size

Geometry – position and direction

- Describe positions on a 2-D grid as coordinates in the first quadrant
- Plot specified points and draw sides to complete a given polygon
- Describe movements between positions as translations of a given unit to the left/right and up/down

Statistics

- *Use a variety of sorting diagrams to* compare and classify *numbers and* geometric shapes based on their properties and sizes
- Interpret and present discrete and continuous data using appropriate graphical methods, including bar charts, time graphs
- Solve comparison, sum and difference problems using information presented in bar charts, pictograms, tables and other graphs

Number – multiplication and division

- *Choose an appropriate strategy to solve a calculation based upon the numbers involved (recall a known fact, calculate mentally, use a jotting, written method)*
- Recognise and use factor pairs and commutativity in mental calculations
- Recall multiplication and division facts for multiplication tables up to 12 × 12
- *Use partitioning to double or halve any number, including decimals to one decimal place*
- 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
- Multiply two-digit and three-digit numbers by a one-digit number using a written layout
- *Divide numbers up to 3 digits by a one-digit number using a written method (partial tables) and interpret remainders appropriately for the context*
- *Use estimation and inverse to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy*
- Solve problems involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, *division (including interpreting remainders),* integer scaling problems and harder correspondence problems such as n objects are connected to m objects

Measurement

- Estimate, compare and calculate different measures, including money in pounds and pence
- *Order temperatures including those below 0°C*
- Measure and calculate the perimeter of a rectilinear figure (including squares) in centimetres and metres
- *Know area is a measure of surface within a given boundary*
- Find the area of rectilinear shapes by counting squares
- Convert between different units of measure [e.g. kilometre to metre; hour to minute]
- Read, write and convert time between analogue and digital 12- and 24-hour clocks
- *Write amounts of money using decimal notation*
- *Recognise that one hundred 1p coins equal £1 and that each coin is $\frac{1}{100}$ of £1*
- Solve problems involving converting from hours to minutes; minutes to seconds; years to months; weeks to days *and problems involving money and measures*

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Key Learning in Mathematics at Grouville Primary School – Year 5

Number – number and place value

- Count forwards or backwards in steps of powers of 10 for any given number up to 1 000 000
- *Count forwards and backwards in decimal steps*
- Read, write, order and compare numbers to at least 1 000 000 and determine the value of each digit
- Read, write, order and compare numbers with up to 3 decimal places
- *Identify the value of each digit to three decimal places*
- *Identify represent and estimate numbers using the number line*
- *Find 0.01, 0.1, 1, 10, 100, 100 and other powers of 10 more or less than a given number*
- Round any number up to 1 000 000 to the nearest 10, 100, 1000, 10 000 and 100 000
- Round decimals with two decimal places to the nearest whole number and to one decimal place
- Multiply/divide whole numbers and decimals by 10, 100 and 1000
- Interpret negative numbers in context, count on and back with positive and negative whole numbers, including through zero
- *Describe and extend number sequences including those with multiplication/division steps and where the step size is a decimal*
- Read Roman numerals to 1000 (M); recognise years written as such
- Solve number and practical problems that involve all of the above

Number – fractions, decimals and percentages

- Recognise mixed numbers and improper fractions and convert from one form to the other
- Read and write decimal numbers as fractions (e.g. 0.71 = $\frac{71}{100}$)
- *Count on and back in mixed number steps such as $1\frac{1}{2}$*
- Compare and order fractions whose denominators are all multiples of the same number *(including on a number line)*
- Identify, name and write equivalent fractions of a given fraction, represented visually, including tenths and hundredths
- Recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents
- Add and subtract fractions with denominators that are the same and that are multiples of the same number *(using diagrams)*
- Write statements > 1 as a mixed number (e.g. $\frac{2}{5} + \frac{4}{5} = \frac{6}{5} = 1\frac{1}{5}$)
- Multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams
- Recognise the per cent symbol (%) and understand that per cent relates to 'number of parts per hundred', and write percentages as a fraction with denominator 100, and as a decimal
- *Solve problems involving fractions and decimals to three places*
- Solve problems which require knowing percentage and decimal equivalents of $\frac{1}{2}, \frac{1}{4}, \frac{1}{5}, \frac{2}{5}, \frac{4}{5}$ and fractions with a denominator of a multiple of 10 or 25

Number – addition and subtraction

- *Choose an appropriate strategy to solve a calculation based upon the numbers involved (recall a known fact, calculate mentally, use a jotting, written method)*
- *Select a mental strategy appropriate for the numbers involved in the calculation*
- *Recall and use addition and subtraction facts for 1 and 10 (with decimal numbers to one decimal place)*
- *Derive and use addition and subtraction facts for 1 (with decimal numbers to two decimal places)*
- Add and subtract numbers mentally with increasingly large numbers *and decimals to two decimal places*
- Add and subtract whole numbers with more than 4 digits *and decimals with two decimal places,* including using a written method
- 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
- *Solve addition and subtraction problems involving missing numbers*

Geometry – properties of shapes

- Distinguish between regular and irregular polygons based on reasoning about equal sides and angles
- Use the properties of rectangles to deduce related facts and find missing lengths and angles
- Identify 3-D shapes from 2-D representations
- Know angles are measured in degrees: estimate and compare acute, obtuse and reflex angles
- Draw given angles, and measure them in degrees (°)
- Identify:
  - angles at a point and one whole turn (total 360°)
  - angles at a point on a straight line and half a turn (total 180°)
  - other multiples of 90°

Geometry – position and direction

- *Describe positions on the first quadrant of a coordinate grid*
- *Plot specified points and complete shapes*
- Identify, describe and represent the position of a shape following a reflection or translation, using the appropriate language, and know that the shape has not changed

Statistics

- *Complete and interpret information in a variety of sorting diagrams (including those used to sort properties of numbers and shapes)*
- Complete, read and interpret information in tables and timetables
- Solve comparison, sum and difference problems using information presented in *all types of graph including* a line graph
- *Calculate and interpret the mode, median and range*

Number – multiplication and division

- *Choose an appropriate strategy to solve a calculation based upon the numbers involved (recall a known fact, calculate mentally, use a jotting, written method)*
- 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
- Recognise and use square (^{2}) and cube (^{3}) numbers, and notation
- *Use partitioning to double or halve any number, including decimals to two decimal places*
- Multiply and divide numbers mentally drawing upon known facts
- Solve problems involving multiplication and division including using their knowledge of factors and multiples, squares and cubes
- Multiply numbers up to 4 digits by a one- or two-digit number using a written method
- Divide numbers up to 4 digits by a one-digit number using a written method & interpret remainders appropriately for the context
- *Use estimation/inverse to check answers to calculations; determine, in the context of a problem, an appropriate degree of accuracy*
- 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

Measurement

- *Use, read and write standard units of length and mass*
- Estimate *(and calculate)* volume ((e.g., using 1 cm^3 blocks to build cuboids (including cubes)) and capacity (e.g. using water)
- *Understand the difference between liquid volume and solid volume*
- *Continue to order temperatures including those below 0°C*
- Convert between different units of metric measure
- Understand and use approximate equivalences between metric units and common imperial units such as inches, pounds and pints
- Measure/calculate the perimeter of composite rectilinear shapes
- Calculate and compare the area of rectangle, use standard units square centimetres (cm^2) and square metres (m^2) and estimate the area of irregular shapes
- *Continue to read, write and convert time between analogue and digital 12 and 24-hour clocks*
- Solve problems involving converting between units of time
- Use all four operations to solve problems involving measure using decimal notation, including scaling

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Key Learning in Mathematics at Grouville Primary School – Year 6

Number – number and place value

- *Count forwards or backwards in steps of integers, decimals, powers of 10*
- Read, write, order and compare numbers up to 10 000 000 and determine the value of each digit
- Identify the value of each digit to three decimal places
- *Identify, represent and estimate numbers using the number line*
- *Order and compare numbers including integers, decimals and negative numbers*
- *Find 0.001, 0.01, 0.1, 1, 10 and powers of 10 more/less than a given number*
- Round any whole number to a required degree of accuracy
- *Round decimals with three decimal places to the nearest whole number or one or two decimal places*
- Multiply and divide numbers by 10, 100 and 1000 giving answers up to three decimal places
- Use negative numbers in context, and calculate intervals across zero
- *Describe and extend number sequences including those with multiplication and division steps, inconsistent steps, alternating steps and those where the step size is a decimal*
- Solve number and practical problems that involve all of the above

Number – fractions, decimals and percentages

- Compare and order fractions, including fractions > 1 *(including on a number line)*
- Use common factors to simplify fractions; use common multiples to express fractions in the same denomination
- Recall and use equivalences between simple fractions, decimals and percentages, including in different contexts
- Associate a fraction with division and calculate decimal fraction equivalents (e.g. 0.375 and $\frac{3}{8}$)
- Add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions
- Multiply simple pairs of proper fractions, writing the answer in its simplest form (e.g. $\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$)
- Divide proper fractions by whole numbers (e.g. $\frac{1}{3} \div 2 = \frac{1}{6}$)
- *Find simple percentages of amounts*
- *Solve problems involving fractions*
- Solve problems which require answers to be rounded to specified degrees of accuracy
- Solve problems involving the calculation of percentages (e.g. of measures and such as 15% of 260) and the use of percentages for comparison

Ratio and proportion

- Solve problems involving the relative sizes of two quantities where missing values can be found using integer multiplication/division facts
- Solve problems involving unequal sharing and grouping using knowledge of fractions and multiples
- Solve problems involving similar shapes where the scale factor is known or can be found

Number – addition and subtraction

- *Choose an appropriate strategy to solve a calculation based upon the numbers involved (recall a known fact, calculate mentally, use a jotting, written method)*
- *Select a mental strategy appropriate for the numbers in the calculation*
- *Recall and use addition and subtraction facts for 1 (with decimals to two decimal places)*
- Perform mental calculations including with mixed operations and large numbers *and decimals*
- *Add and subtract whole numbers and decimals using formal written methods (columnar addition and subtraction)*
- Use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy
- Use knowledge of the order of operations to carry out calculations
- Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why
- Solve problems involving all four operations, *including those with missing numbers*

Geometry – properties of shapes

- Compare/classify geometric shapes based on the properties and sizes
- Draw 2-D shapes using given dimensions and angles
- Illustrate and name parts of circles, including radius, diameter and circumference and know that the diameter is twice the radius
- Recognise, describe and build simple 3-D shapes, including making nets
- Recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles
- Find unknown angles in any triangles, quadrilaterals, regular polygons

Geometry – position and direction

- Describe positions on the full coordinate grid (all four quadrants)
- Draw and translate simple shapes on the coordinate plane, and reflect them in the axes

Statistics

- *Continue to complete and interpret information in a variety of sorting diagrams (including sorting properties of numbers and shapes)*
- Interpret and construct pie charts and line graphs and use these to solve problems
- *Solve comparison, sum and difference problems using information presented in all types of graph*
- Calculate and interpret the mean as an average

Algebra

- Use simple formulae
- Generate and describe linear number sequences
- Express missing number problems algebraically
- Find pairs of numbers that satisfy an equation with two unknowns
- Enumerate possibilities of combinations of two variables

Number – multiplication and division

- *Choose an appropriate strategy to solve a calculation based upon the numbers involved (recall a known fact, calculate mentally, use a jotting, written method)*
- Identify common factors, common multiples and prime numbers
- *Use partitioning to double or halve any number*
- Perform mental calculations, including with mixed operations and large numbers
- Multiply multi-digit numbers up to 4 digits by a two-digit whole number using a written method (long multiplication)
- Multiply one-digit numbers with up to two decimal places by whole numbers
- Divide numbers up to 4 digits by a two-digit whole number using a written method and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context
- Use division methods in cases where the answer has up to two decimal places
- Use estimation *and inverse* to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy
- Use knowledge of the order of operations to carry out calculations
- Solve problems involving all four operations, *including those with missing numbers*

Measurement

- Use, read and write standard units of length, mass, volume and time using decimal notation to three decimal places
- Convert between standard units of length, mass, volume and time using decimal notation to three decimal places
- Convert between miles and kilometres
- Recognise that shapes with the same areas can have different perimeters and vice versa
- Calculate the area of parallelograms and triangles
- Recognise when it is possible to use formulae for area and volume of shapes
- Calculate, estimate and compare volume of cubes and cuboids using standard units, including cubic centimetres (cm^3) and cubic metres (m^3), and extending to other units (e.g. mm^3 and km^3)
- *Calculate differences in temperature, including those that involved a positive and negative temperature*
- Solve problems involving the calculation and conversion of units of measure, using decimal notation up to three decimal places where appropriate