Chancel Primary School

Calculation Policy

Progression in methods
Reception to Year Six

Our Calculation Policy

This policy meets the requirements set out in the National Curriculum 2014 for the teaching and learning of mathematics. It has been developed by the mathematics subject leader and all teaching staff so that the understanding of mathematical principles and methods is consistent and progressive.

Expectations for progression

The calculation policy reflects the age-related expectations of the National Curriculum 2014. At Chancel we feel it is vital that children have complete accuracy in using an appropriate method, and are able to confidently use and apply their understanding of a given method before they move on. Only once this has been demonstrated and the teacher is confident that the child has mastered a particular method, will they move on to the next. Therefore the set methods for each year group may not reflect the methods that every child in that group is using. Where appropriate, the CPA approach is used to ensure understanding before progressing to the next stage.

Contextual application of methods

Children will be provided with 'real-life' scenarios so that they can see the value and relevance of learning an efficient method for calculating. Methods will also be practised regularly to ensure confidence and accuracy in application. This will help children to both value their learning and become more confident as independent mathematicians. Children will not progress to the next efficient method until they have demonstrated accuracy of method in using and applying and contextual problem solving.

Choosing and using a calculation method

Children will be encouraged to use a common process in deciding which calculation/s will be needed to solve a problem. This will ensure that they select the most appropriate method for the numbers involved.

The following concepts must be taught from the earliest opportunity to ensure a firm grounding in logical reasoning and accuracy.

When presented with problem, children should answer the following questions:

- What am I being asked to calculate?
- Can I use any mental maths knowledge?
- Will jottings help me to work it out?
- Do I need to make use of a formal method?

Prior to calculating and when calculating:

- What would a sensible answer be close to? (Approximate)
- Is my method/calculation appropriate/accurate? (Calculate)
- Does my answer sound feasible? (Sensible)
- Can I use a method to check? (Inverse)

CPA Approach

Concrete, Pictorial, Abstract (CPA) is a highly effective approach to teaching that develops a deep and sustainable understanding of maths in pupils. CPA was developed by American psychologist Jerome Bruner. It is an essential technique within the Singapore method of teaching maths for mastery.

At a glance

- An essential technique of maths mastery that builds on a child's existing understanding
- A highly effective framework for progressing pupils to abstract concepts like fractions
- Involves concrete materials and pictorial/representational diagrams
- Based on research by psychologist Jerome Bruner
- Along with bar modelling and number bonds, it is an essential maths mastery strategy

Background to the CPA framework

Children (and adults!) can find maths difficult because it is abstract. The CPA approach builds on children's existing knowledge by introducing abstract concepts in a concrete and tangible way. It involves moving from concrete materials, to pictorial representations, to abstract symbols and problems.
The CPA framework is so established in Singapore maths teaching that the Ministry of Education will not approve any teaching materials that do not use the approach.

Concrete step of CPA

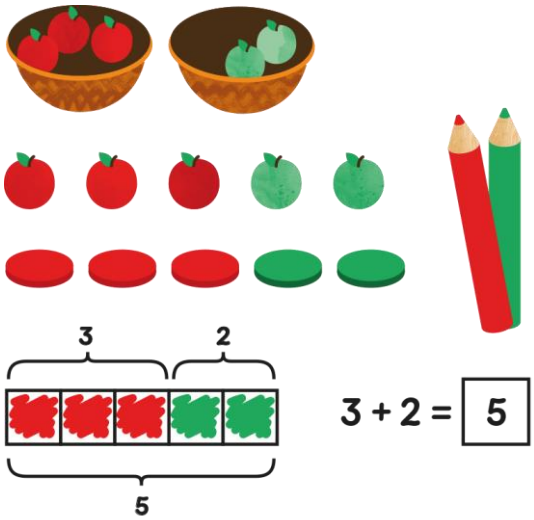
Concrete is the "doing" stage. During this stage, students use concrete objects to model problems. Unlike traditional maths teaching methods where teachers demonstrate how to solve a problem, the CPA approach brings concepts to life by allowing children to experience and handle physical (concrete) objects. With the CPA framework, every abstract concept is first introduced using physical, interactive concrete materials.
For example, if a problem involves adding pieces of fruit, children can first handle actual fruit. From there, they can progress to handling abstract counters or cubes which represent the fruit.

Pictorial step of CPA

Pictorial is the "seeing" stage. Here, visual representations of concrete objects are used to model problems. This stage encourages children to make a mental connection between the physical object they just handled and the abstract pictures, diagrams or models that represent the objects from the problem.
Building or drawing a model makes it easier for children to grasp difficult abstract concepts (for example, fractions). Simply put, it helps students visualise abstract problems and make them more accessible.

Abstract step of CPA

Abstract is the “symbolic” stage, where children use abstract symbols to model problems. Students will not progress to this stage until they have demonstrated that they have a solid understanding of the concrete and pictorial stages of the problem. The abstract stage involves the teacher introducing abstract concepts (for example, mathematical symbols). Children are introduced to the concept at a symbolic level, using only numbers, notation, and mathematical symbols (for example, +, –, x, /) to indicate addition, multiplication or division.



Making CPA work for you

Although CPA is presented as three distinct stages, teachers can go back and forth between each stage to reinforce concepts.

Children should be encouraged to vary the apparatus that they use in class. For example, students might one day use counters, another day they might use a ten frame. Likewise, children are encouraged to represent the day’s maths problem in a variety of ways. For example, drawing an array, a number bond diagram or a bar model.

By systematically varying the apparatus and methods used to solve a problem, children can craft powerful mental connections between the concrete, pictorial, and abstract phases.

When teaching young children numbers, counters and multi-link cubes are more commonly used in the UK. However, concrete materials are frequently shelved by the time children reach KS2 — many teachers believe them to be too childish or distracting. Removing concrete materials exposes children to abstract concepts too early. As a result, they miss out on the opportunity to build a conceptual mathematical understanding that can propel them through their education.

It is important to recognise that the CPA model is a progression. By the end of KS1, children need to be able to go beyond the use of concrete equipment to access learning using either pictorial representations or abstract understanding. What is important, therefore, is that all learners, however young, can see the connections between each representation.

The National Curriculum

Purpose of Study

Mathematics is a creative and highly interconnected discipline that has been developed over centuries, providing the solution to some of history's most intriguing problems. It is essential to everyday life, critical to science, technology and engineering, and necessary for financial literacy and most forms of employment. A high-quality mathematics education therefore provides a foundation for understanding the world, the ability to reason mathematically, an appreciation of the beauty and power of mathematics, and a sense of enjoyment and curiosity about the subject.

Aims

The national curriculum for mathematics aims to ensure that all pupils:

- become fluent in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately
- reason mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language
- can solve problems by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions

Mathematics is an interconnected subject in which pupils need to be able to move fluently between representations of mathematical ideas. The programmes of study are, by necessity, organised into apparently distinct domains, but pupils should make rich connections across mathematical ideas to develop fluency, mathematical reasoning and competence in solving increasingly sophisticated problems. They should also apply their mathematical knowledge to science and other subjects.

The expectation is that the majority of pupils will move through the programmes of study at broadly the same pace. However, decisions about when to progress should always be based on the security of pupils' understanding and their readiness to progress to the next stage. Pupils who grasp concepts rapidly should be challenged through being offered rich and sophisticated problems before any acceleration through new content. Those who are not sufficiently fluent with earlier material should consolidate their understanding, including through additional practice, before moving on.

Information and communication technology (ICT)

Calculators should not be used as a substitute for good written and mental arithmetic. They should therefore only be introduced near the end of key stage 2 to support pupils' conceptual understanding and exploration of more complex number problems, if written and mental arithmetic are secure. In both primary and secondary schools, teachers should use their judgement about when ICT tools should be used.

Spoken Language

The national curriculum for mathematics reflects the importance of spoken language in pupils' development across the whole curriculum – cognitively, socially and linguistically. The quality and variety of language that pupils hear and speak are key factors in developing their mathematical vocabulary and presenting a mathematical justification, argument or proof. They must be assisted in making their thinking clear to themselves as well as others, and teachers should ensure that pupils build secure foundations by using discussion to probe and remedy their misconceptions.

School Curriculum

The programmes of study for mathematics are set out year-by-year for key stages 1 and 2. Schools are, however, only required to teach the relevant programme of study by the end of the key stage. Within each key stage, schools therefore have the flexibility to introduce content earlier or later than set out in the programme of study. In addition, schools can introduce key stage content during an earlier key stage, if appropriate. All schools are also required to set out their school curriculum for mathematics on a year-by-year basis and make this information available online.

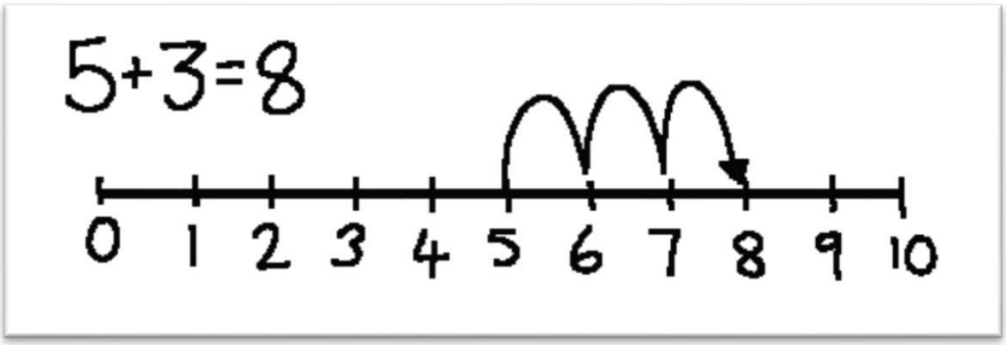
Attainment Targets

By the end of each key stage, pupils are expected to know, apply and understand the matters, skills and processes specified in the relevant programme of study.

Addition

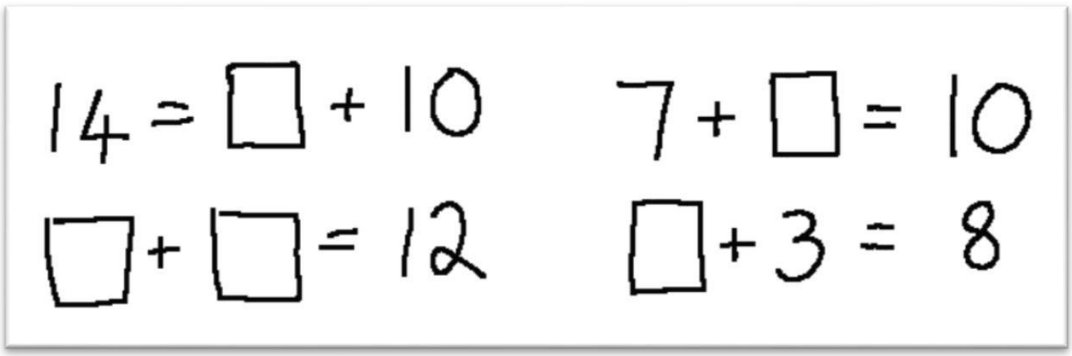
Reception/Year 1 - Add with numbers up to 20

Use numbered number lines to add, by counting on in ones. Encourage children to start with the **larger** number and count on. E.g.: 5 + 3



Children should:
Have access to a wide range of counting equipment, everyday objects, number tracks and number lines, and be shown numbers in different con-texts.
Read and write the addition (+) and equals (=) signs within number sentences.

Interpret addition number sentences and solve missing box problems, using concrete objects and number line addition to solve them:



Key vocabulary: *add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line*

Key skills for addition at Y1:

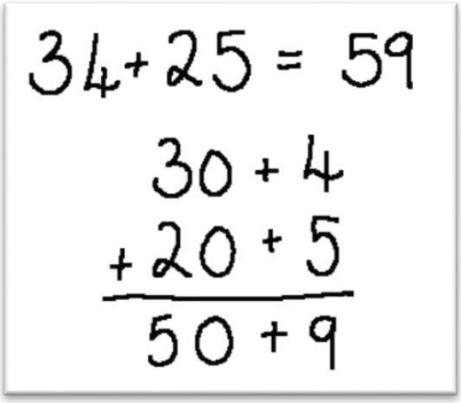
- Read and write numbers to 100 in numerals, incl. 1—20 in words
- Recall bonds to 10 and 20, and addition facts within 20
- Count to and across 100
- Count in multiples of 1 2, 5 and 10
- Solve simple 1-step problems involving addition, using objects, number lines and pictorial representations.

Addition

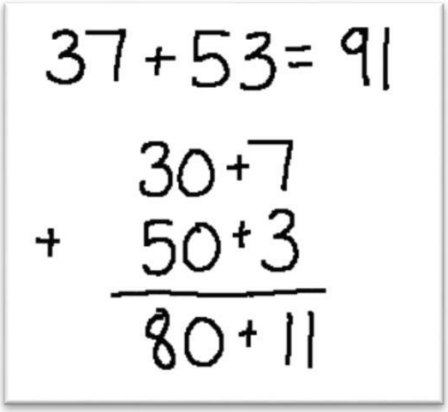
Year 1/2 - Add with 2 digit numbers

Add pairs of 2-digit numbers, moving to the partitioned column method when secure adding tens and units:

STEP 1: Only provide examples that do **NOT** cross the tens boundary until they are secure with the method itself.



STEP 2: Once children can add a multiple of ten to a 2-digit number mentally (e.g. 50+13), they are ready for adding pairs of 2-digit numbers that DO cross the tens boundary (e.g. 37 + 53).



STEP 3: Children who are confident and accurate with this stage should move onto the expanded addition methods with 2 and 3-digit numbers. At this point they should continue to learn to apply to a wider range of more challenging addition problems in real-life contexts.

Key vocabulary: *add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, addition, column, tens boundary*

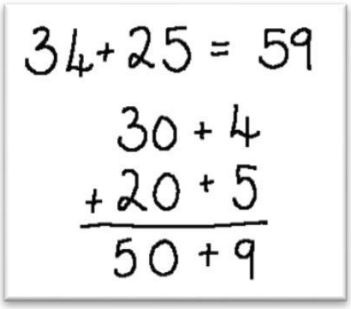
Key skills for addition at Y2:

- Add a 2-digit number and ones (e.g. 27 + 6)
- Add a 2-digit number and tens (e.g. 23 + 40)
- Add pairs of 2-digit numbers (e.g. 35 + 47)
- Add three single-digit numbers (e.g. 5 + 9 + 7)
- Show that adding can be done in any order (the commutative law).
- Recall bonds to 20 and bonds of tens to 100 (30 + 70 etc.)
- Count in steps of 2, 3 and 5 and count in tens from any number.
- Understand the place value of 2-digit numbers (tens and ones)
- Compare and order numbers to 100 using < > and = signs.
- Read and write numbers to at least 100 in numerals and words.
- Solve problems with addition, using concrete objects, pictorial representations, involving numbers, quantities and measures, and applying mental and written methods.

Addition

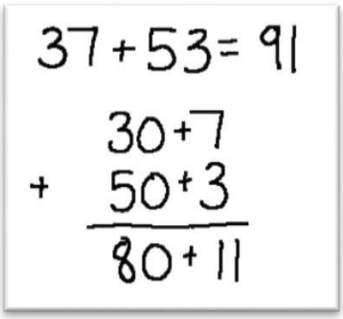
Year 2 - Add with 2 digit numbers

Add pairs of 2-digit numbers, moving to the partitioned column method when secure adding tens and units:

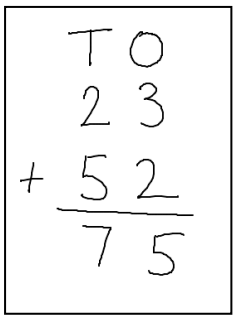


STEP 1: Consolidate examples that do **NOT** cross the tens boundary until they are secure with the method itself.

STEP 2: Once children can add a multiple of ten to a 2-digit number mentally (e.g. 50+13), they are ready for adding pairs of 2-digit numbers that DO cross the tens boundary (e.g. 37 + 53).



STEP 3: Children who are confident and accurate with this stage should move onto the expanded addition (Similar to Y3) with 2 numbers. At this point they should continue to learn to apply to a wider range of more challenging addition problems in real-life contexts.



When secure with this method, move onto column addition with no partitioning.

Key vocabulary: *add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, addition, column, tens boundary*

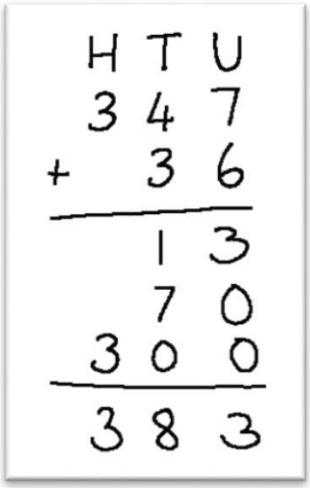
Key skills for addition at Y2:

- Add a 2-digit number and ones (e.g. 27 + 6)
- Add a 2-digit number and tens (e.g. 23 + 40)
- Add pairs of 2-digit numbers (e.g. 35 + 47)
- Add three single-digit numbers (e.g. 5 + 9 + 7)
- Show that adding can be done in any order (the commutative law).
- Recall bonds to 20 and bonds of tens to 100 (30 + 70 etc.)
- Count in steps of 2, 3 and 5 and count in tens from any number.
- Understand the place value of 2-digit numbers (tens and ones)
- Compare and order numbers to 100 using < > and = signs.
- Read and write numbers to at least 100 in numerals and words.
- Solve problems with addition, using concrete objects, pictorial representations, involving numbers, quantities and measures, and applying mental and written methods.

Addition

Year 3 - Add with 3 digit numbers

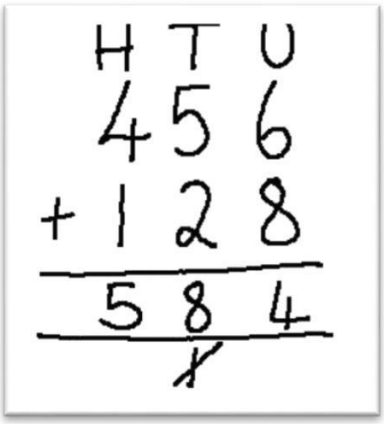
Introduce the **expanded column addition** method:
Add the **units** first, in preparation for the compact method.



In order to carry out this method of addition:

Children need to recognise the value of the hundreds, tens and units without recording the partitioning.

Pupils need to be able to add in columns.



Move to the compact **column addition** method (with carrying) when children are secure. Children should compare the expanded method to the compact column method to develop an understanding of the process and the reduced number of steps involved.

Key vocabulary: *add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, plus, addition, column, tens boundary,* ***hundreds boundary, increase, vertical, carry', expanded, compact***

Key skills for addition at Y3:

- Read and write numbers to 1000 in numerals and words.
- Add 2-digit numbers mentally, incl. those exceeding 100.
- **Add a three-digit number and ones mentally (175 + 8)**
- **Add a three-digit number and tens mentally (249 + 50)**
- **Add a three-digit number and hundreds mentally (381 + 400)**
- Estimate answers to calculations, using inverse to check answers.
- Solve problems, including missing number problems, using number facts, place value, and more complex addition.
- Recognise place value of each digit in 3-digit numbers (hundreds, tens, ones.)
- Continue to practise a wide range of mental addition strategies, ie. number bonds, adding the nearest multiple of 10, 100, 1000 and adjusting, using near doubles, partitioning and recombining.

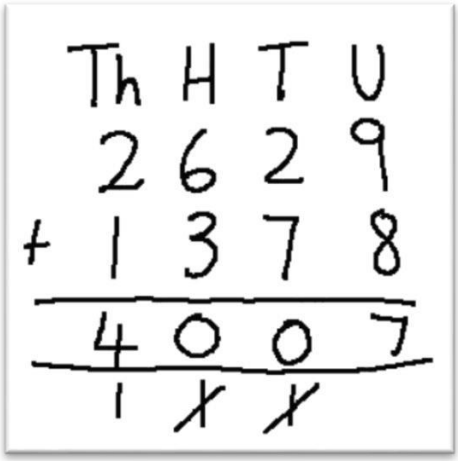
Addition

Year 4 - Add with 4 digit numbers

Move from expanded addition to the compact column method, **adding units first**, and 'carrying' numbers **underneath** the calculation. Also include money and measures contexts.

Introduce the **compact column addition** method by asking children to add the two given numbers together using the method that they are familiar with (expanded column addition—see Y3). Teacher models the compact method with carrying, asking children to discuss similarities and differences and establish how it is carried out.

E.g.: 2629 + 1378 = 4007



Key vocabulary: *add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, plus, addition, column, tens boundary, hundreds boundary, increase, vertical, „carry", expanded, compact,* ***thousands, hundreds, digits, inverse***

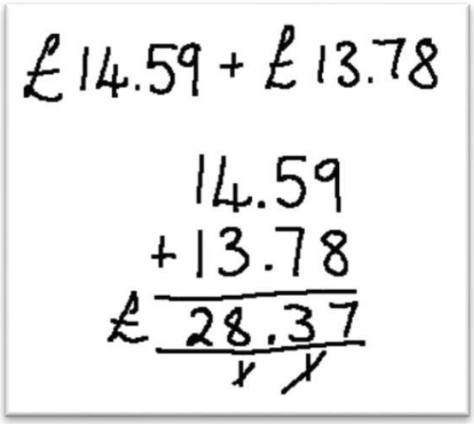
Key skills for addition at Y4:

- Select most appropriate method: mental, jottings or written and explain why.
- Recognise the place value of each digit in a four-digit number.
- Round any number to the nearest 10, 100 or 1000.
- Estimate and use inverse operations to check answers.
- Solve 2-step problems in context, deciding which operations and methods to use and why.
- Find 1000 more or less than a given number.
- Continue to practise a wide range of mental addition strategies, ie. number bonds, add the nearest multiple of 10, 100, 1000 and adjust, use near doubles, partitioning and recombining.
- Add numbers with up to 4 digits using the formal written method of column addition
- Solve 2-step problems in contexts, deciding which operations and methods to use and why.
- Estimate and use inverse operations to check answers to a calculation.

Addition

Year 5 - Add with more than 4 digits including decimals

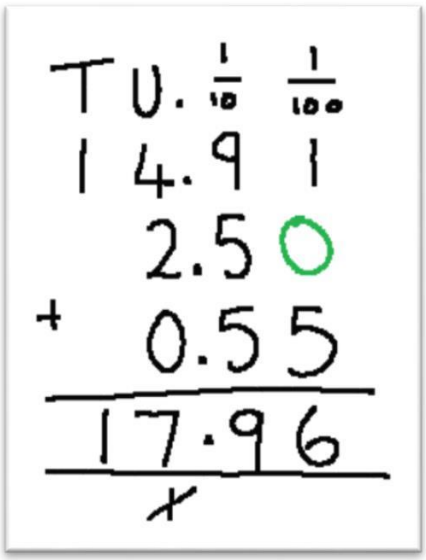
The decimal point should be aligned in the same way as the other place value columns, and must remain in the same column in the answer row.



Children should understand the place value of tenths and hundredths and use this to align numbers with different numbers of decimal places.

Pupils should be able to add **more than two values**, carefully aligning place value columns.

Teacher should model and use the values of tenths and hundredths so that children can use these to align numbers accurately.



Empty decimal places can be filled with zero to show the place value in each column.

E.g.: 2.5 + 14.91 + 0.55

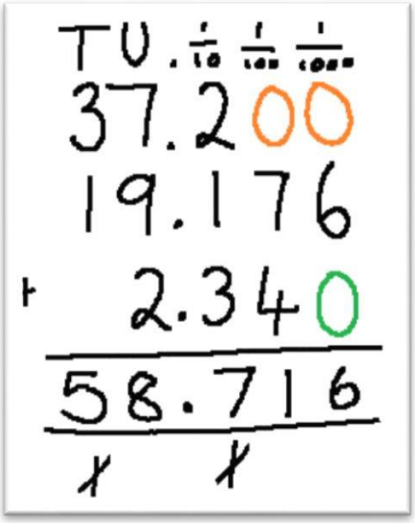
Key vocabulary: *add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, plus, addition, column, tens boundary, hundreds boundary, increase, „carry", expanded, compact, vertical, thousands, hundreds, digits, inverse* & ***decimal places, decimal point, tenths, hundredths, thousandths***

Key skills for addition at Y5:

- Add numbers mentally with increasingly large numbers, using and practising a range of mental strategies ie. add the nearest multiple of 10, 100, 1000 and adjust; use near doubles, inverse, partitioning and re-combining; using number bonds.
- Use rounding to check answers and accuracy.
- Solve multi-step problems in contexts, deciding which operations and methods to use and why.
- Read, write, order and compare numbers to at least 1 million and determine the value of each digit.
- Round any number up to 1, 000, 000 to the nearest 10, 100, 1000, 10,000 and 100,000.
- Add numbers with more than 4 digits using formal written method of columnar addition.

Addition

Year 6 - Add several numbers with increasing complexity



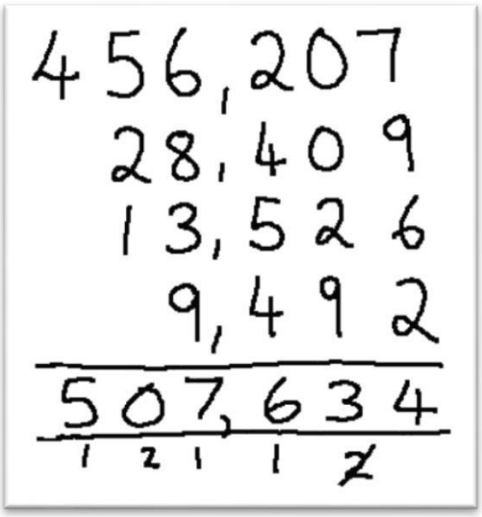
Adding several numbers with different numbers of decimal places (including money and measures):

Tenths, hundredths and thousandths should be correctly aligned, with the decimal point lined up vertically including in the answer row.

Empty decimal places should be filled with zero to show the place value in each column.

E.g.: 2.34 + 19.176 + 37.2

Adding several numbers with more than four digits:



Key vocabulary: *add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, plus, addition, column, tens boundary, hundreds boundary, increase, „carry", expanded, compact, vertical, thousands, hundreds, digits, inverse, decimal places, decimal point, tenths, hundredths, thousandths*

Key skills for addition at Y6:

- Perform mental calculations, including with mixed operations and large numbers, using and practising a range of mental strategies.
- Solve multi-step problems in context, deciding which operations and methods to use and why.
- Use estimation to check answers to calculations and determine, in the context of a problem, levels of accuracy.
- Read, write, order and compare numbers up to 10 million and determine the value of each digit.
- Round any whole number to a required degree of accuracy.
- Pupils understand how to add mentally with larger numbers and calculations of increasing complexity.

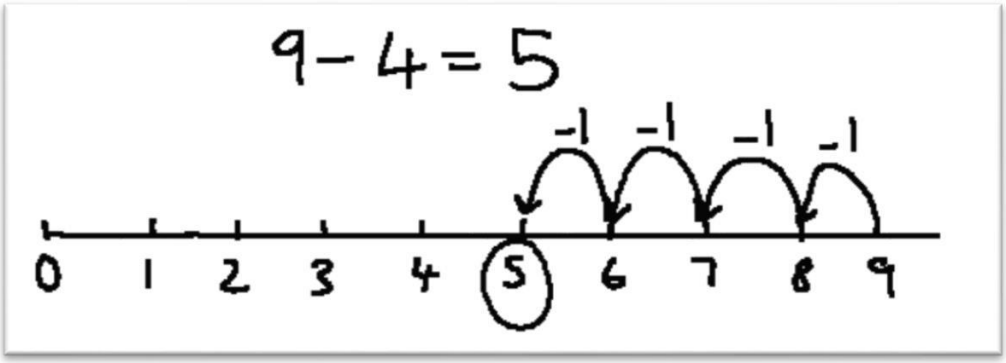
Subtraction

Reception/Year 1- Subtract from numbers up to 20

Children consolidate understanding of subtraction practically, showing subtraction on bead strings, using cubes etc. and in familiar contexts, and are introduced to more formal recording using number lines.

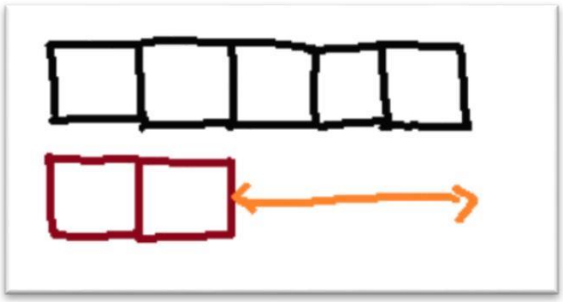
Subtract by taking away

Count back in ones on a numbered number line to take away, with numbers up to 20:



Find the difference

This will be introduced practically with the language **'find the difference between'** and 'h**ow many more?**' in a range of familiar contexts. E.g.: How many more black cubes are there than red ones?



Mental subtraction

Children should start recalling subtraction facts up to **and within** 10 and 20, and should be able to subtract zero.

Key vocabulary: *equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer / less than, most, least, count back, how many left, how much less is_?*

Key skills for subtraction at Y1:

- Given a number, say **one more or one less.**
- Count to and over 100, **forward and back**, from any number.
- Represent and use **subtraction facts to 20 and within 20**.
- Subtract with **one-digit and two-digit** numbers to 20, including zero.
- Solve one-step problems that involve addition and subtraction, using concrete objects (ie bead string, objects, cubes) and pictures, and missing number problems.
- Read and write numbers from 0 to 20 in numerals and words.

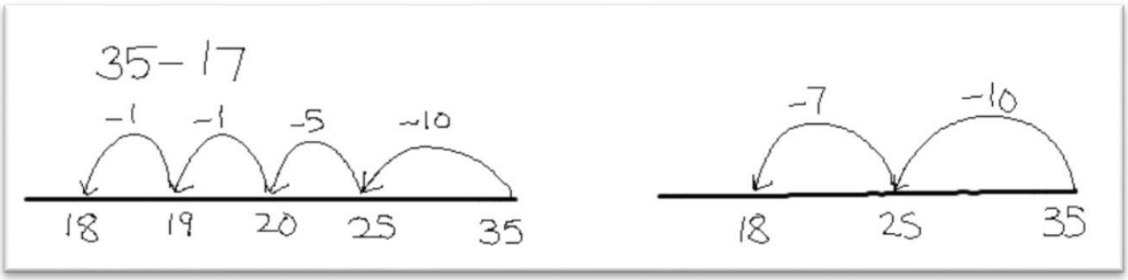
Subtraction

Year 2 - Subtract with 2-digit numbers

Subtract on a number line by counting back, aiming to develop mental subtraction skills.

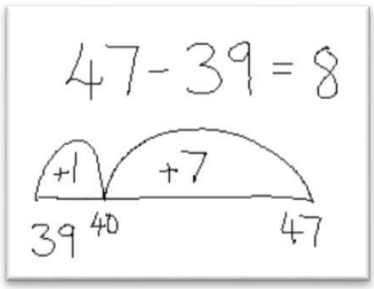
This strategy will be used for:
•2-digit numbers subtract units (by taking away / counting back) e.g. 36—7
•2-digit numbers subtract tens (by taking away / counting back) e.g. 48—30
•Subtracting pairs of 2-digit numbers: E.g.: 35 **- 17 =18.** Partition the second number and subtract it in tens and units, as below:

Subtract tens first. Then subtract units (singularly or in group)



Move towards more efficient jumps back, as above.

Children should **also be taught** to recognise that when numbers are close together, it is more **efficient to count on** and find the difference.



Key vocabulary: *equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer / less than, most, least, count back , how many left, how much less is_?* ***difference, count on, strategy, partition, tens, units***

Key skills for subtraction at Y2:

- Recognise the place value of each digit in a two-digit number.
- Recall and use subtraction facts to 20 fluently, and derive and use related facts up to 100.
- Subtract using concrete objects, pictorial representations, 100 squares and mentally, including: a two-digit number and ones, a two-digit number and tens, and two two-digit numbers.
- Show that subtraction of one number from another cannot be done in any order.
- Recognise and use inverse relationship between addition and subtraction, using this to check calcula-tions and missing number problems.
- Solve simple addition and subtraction problems including measures, using concrete objects, pictorial representation, and also applying their increasing knowledge of mental and written methods.
- Read and write numbers to at least 100 in numerals and in words.

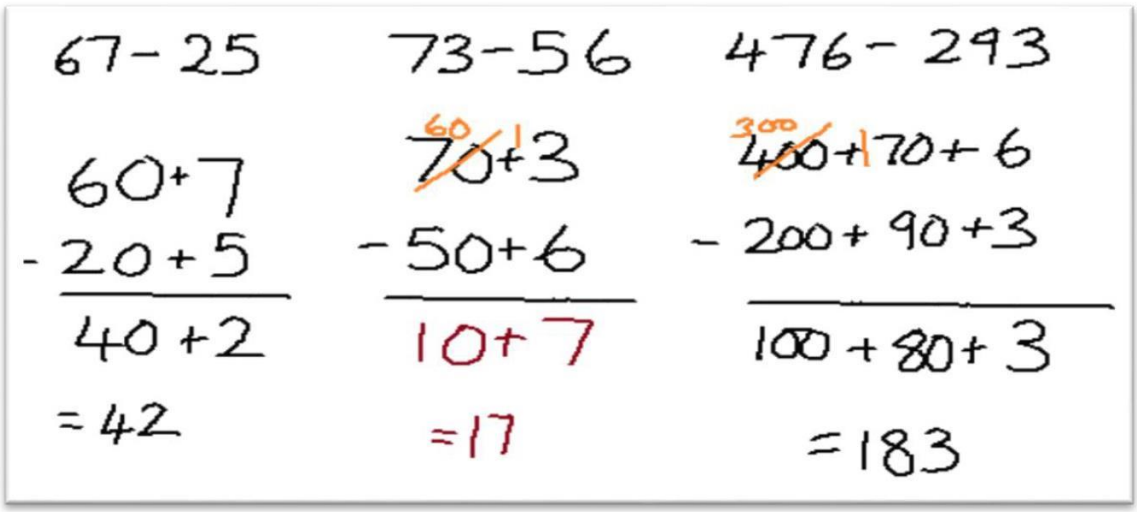
Subtraction

Year 3 – Subtracting with 2 and 3-digit numbers

The **partitioned column subtraction** method.

1: Introduce where **no exchange** is required.
2: Introduce exchange through practical subtraction. Children should learn about partitioning in different ways to illustrate that the values are the same but the **partitioning is different**.
3: **Progress** towards 3 digit numbers including money (£1.28 = £1+ 20p + 8p).

Step 1 Step 2 Step 3



Continue to reinforce counting **on** as a strategy for **close-together numbers** (e.g. 121—118), and also for numbers that are "nearly" multiples of 10, 100, 1000 or £s, which make it easier to count on (e.g. 102-89, 131—79, or calculating change from £1 etc.).

Key vocabulary: *equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer / less than, most, least, count back , how many left, how much less is_? difference, count on, strategy, partition, tens, units* ***exchange, decrease, hundreds, value, digit***

Key skills for subtraction at Y3:

- Subtract mentally a: **3-digit number and ones, 3-digit number and tens, 3-digit number and hundreds** .
- Estimate answers and use inverse operations to check. ● Solve problems, including missing number problems.
- Find 10 or 100 more or less than a given number.
- Recognise the place value of each digit in a 3-digit number .
- Counting up differences as a mental strategy when numbers are close together or near multiples of 10
- Read and write numbers up to 1000 in numerals and words

.

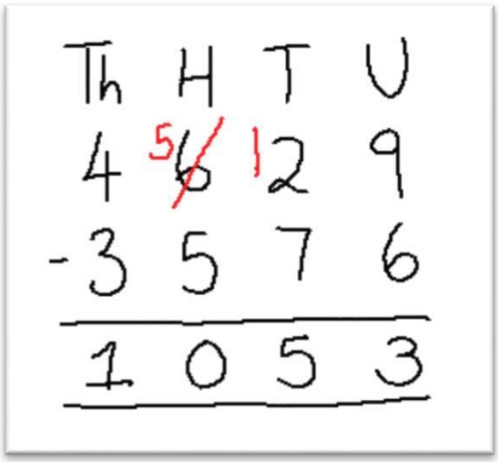
Subtraction

Year 4 – Subtracting up to 4-digit numbers

The **partitioned column subtraction** method (decomposition) to continue and should now include more complex numbers with greater opportunity for 'borrowing'. This feeds into the compact column subtraction method which is develop through Years 4,5 and 6.

To introduce the compact method, ask children to perform a subtraction calculation with the familiar partitioned column subtraction then display the compact version for the calculation they have done.

For example: **4629-3576** = 1053



In any calculation a **sensible estimation** should be made prior to the calculation.

It's also important to remind children that in the tens column where we are calculating 2-7 (20-70) we must emphasise not that 2-7 (20-70) is not possible but that 2-7 (20-70) will give us a negative number (-5 or -50) so this is why we need to 'borrow'.

Children should also be taught to use the inverse to check their calculations.

Key vocabulary: *equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer / less than, most, least, count back , how many left, how much less is_? difference, count on, strategy, partition, tens, units exchange, decrease, hundreds, value, digit,* ***inverse***

Key skills for subtraction at Y4:

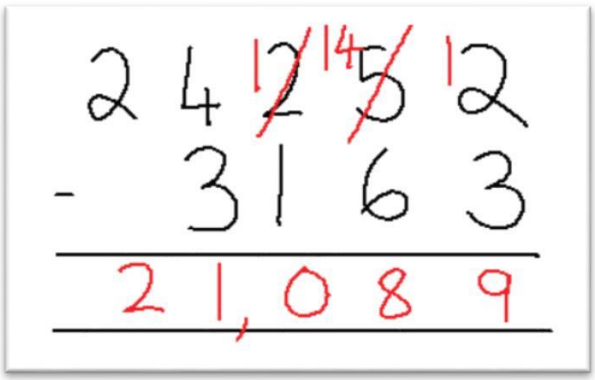
- Subtract by counting on where numbers are close together or they are near to multiples of 10, 100 etc.
- Children select the most appropriate and efficient methods for given subtraction calculations.
- Estimate and use inverse operations to check answers.
- Solve addition and subtraction 2-step problems, choosing which operations and methods to use and why.
- Solve simple measure and money problems involving fractions and decimals to two decimal places.
- Find 1000 more or less than a given number.
- Count backwards through zero, including negative numbers.
- Recognise place value of each digit in a 4-digit number Round any number to the nearest 10, 100 or 1000
- Solve number and practical problems that involve the above, with increasingly large positive numbers.

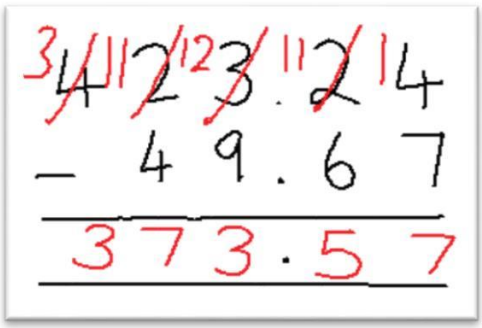
Subtraction

Year 5 – Subtracting with at least 4-digits

Children who are still not secure with number facts and place value will need to remain on the partitioned column method until ready for the compact method.

Compact column subtraction (with exchange)





Subtract with decimal values, including mixtures of integers and decimals, aligning the decimal point.

Key vocabulary: *equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer / less than, most, least, count back , how many left, how much less is_? difference, count on, strategy, partition, tens, units exchange, decrease, hundreds, value, digit,* ***inverse***

Key skills for subtraction at Y5:

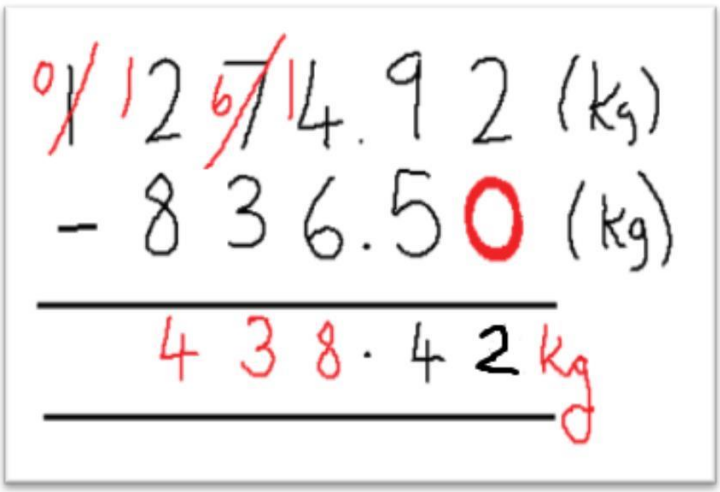
- Subtract numbers mentally with increasingly large numbers .
- Use rounding and estimation to check answers to calculations and determine, in a range of contexts, levels of accuracy .
- Read, write, order and compare numbers to at least 1 million and determine the value of each digit.
- Count forwards or backwards in steps of powers of 10 for any given number up to 1 million.
- Interpret negative numbers in context, counting forwards and backwards with positive and negative integers through zero.
- Round any number up to 1 million to the nearest 10, 100, 1000, 10,000 and 100,000

Subtraction

Year 6 – Subtracting with decimals, larger and increasingly more complex numbers

Using the compact column method to subtract more complex integers

Using the compact column method to subtract money and measures, including decimals with different numbers of decimal places.



Empty decimal places can be filled with **zero** to show the place value in each column.

Pupils should be able to apply their knowledge of a range of mental strategies, mental recall skills, and informal and formal written methods when selecting **the most appropriate method** to work out subtraction problems.

Key vocabulary: *equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer / less than, most, least, count back , how many left, how much less is_? difference, count on, strategy, partition, tens, units exchange, decrease, hundreds, value, digit, inverse,* ***tenths, hundredths, decimal point, decimal***

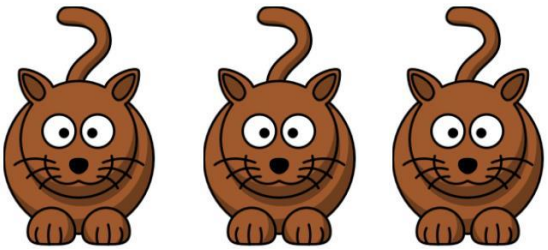
Key skills for subtraction at Y6:

- Solve addition and subtraction multi-step problems in context, deciding which operations and methods to use and why.
- Read, write, order and compare numbers up to 10 million and determine the value of each digit
- Round any whole number to a required degree of accuracy
- Use negative numbers in context, and calculate intervals
- across zero.
- Children need to utilise and consider a range of mental subtraction strategies, jottings and written methods before choosing how to calculate.

Mutiplication

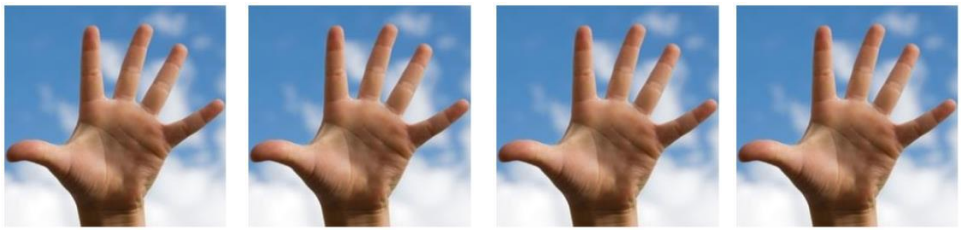
Reception/Year 1 - Multiply with concrete objects, arrays and pictorial representations.

How many ears will three cats have?



2+ 2+2 =6

How many fingers on 4 hands??



5 + 5 + 5+ 5 = 20

Give children experience of counting equal group of objects in 2s, 5s and 10s.

Present practical problem solving activities involving counting equal sets or groups, as above

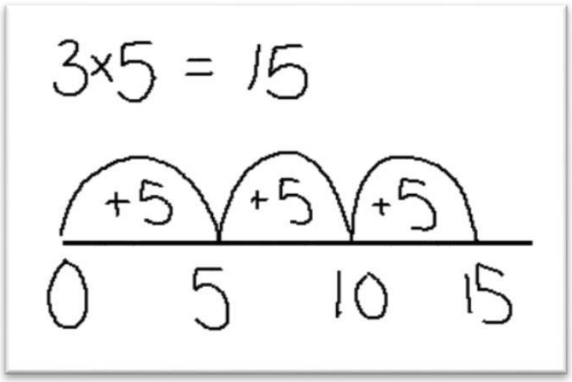
Key vocabulary: *groups of, lots of, times, array, altogether, multiply, count*

Key skills for multiplication at Y1:

- Count in multiples of 2, 5 and 10.
- Solve one-step problems involving multiplication, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.
- Make connections between arrays, number patterns, and counting in twos, fives and tens. Begin to understand doubling using concrete objects and pictorial representations.

Mutiplication

Year 2 - Multiply using arrays and repeated addition (using at least 2s, 5s and 10s)



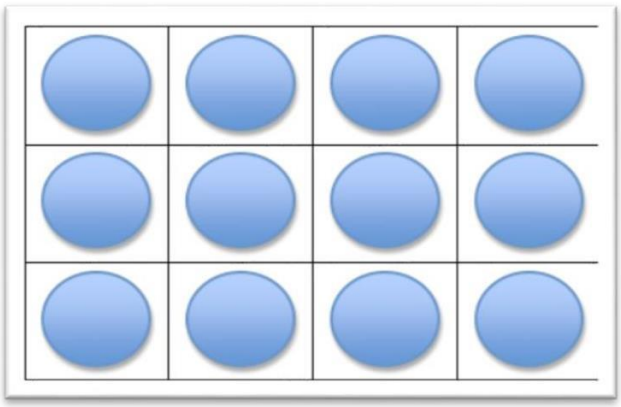
Use repeated addition on a number line: 3 x 5 = **5 +5 +5 (Three lots of 5)**

Use arrays to help teach children to understand the commutative law of multiplication.

4 x 3 = 12 (3 + 3 + 3 +3)

and

3 x 4 =12 (4 + 4 + 4)



Key vocabulary: *groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, commutative, sets of, equal groups, times as big as, once, twice, three times...*

Key skills for multiplication at Y2:

- Count in steps of 2, 3 and 5 from zero, and in 10s from any number.
- Recall and use multiplication facts from the **2, 5 and 10** multiplication tables, including recognising odds and evens.
- Write and calculate number statements **using the x and = signs**.
- Show that multiplication can be done in any order (commutative).
- Solve a range of problems involving multiplication, using concrete objects, arrays, repeated addition, mental methods, and multiplication facts.
- Pupils use a variety of language to discuss and describe multiplication.

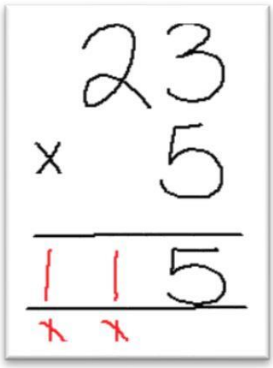
Mutiplication

Year 3 - Multiply 2-digits by a single digit number

Teach **short multiplication** if and when children are confident and accurate using known number facts that do not involve carrying (A). This can then progress to multiplications involving carrying, **once they are** confident in "carrying" for written addition (B).

A

B



NB. As this method ignores place value, opportunities to teach place value within multiplication must also take place regularly.

Key vocabulary: *groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated ad-dition, column, row, commutative, sets of, equal groups, times, _times as big as, once, twice, three times..., **partition, grid method, multiple, product, tens, units, value***

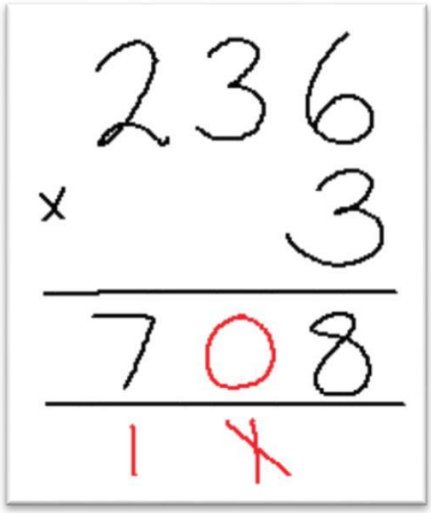
Key skills for multiplication:

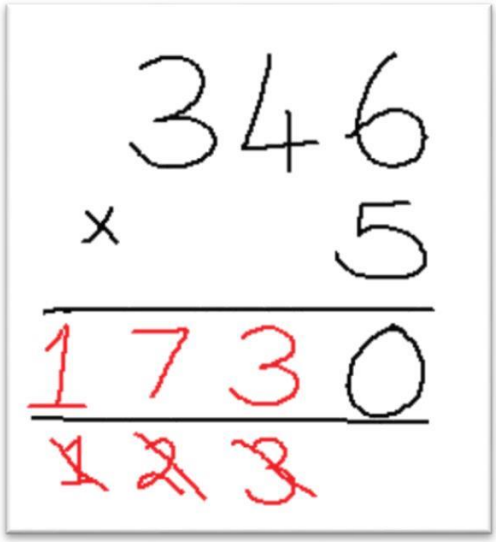
- Recall and use multiplication facts for the **2, 3, 4, 5, 8 and 10** multiplication tables, and multiply multiples of 10.
- Write and calculate number statements using the multiplication tables they know, including **2-digit x single digit**, drawing upon mental methods, and progressing to reliable written methods.
- Solve multiplication problems, including missing number problems.
- Develop mental strategies using commutativity (e.g. 4 x 12 x 5 = 4 x 5 x 12 = 20 x 12 = 240)
- Solve simple problems in contexts, deciding which operations and methods to use.
- Develop efficient mental methods to solve a range of problems e.g using commutativity (**4 × 12 × 5** = 4 × 5 × 12 **= 20 × 12** = 240) and for missing number problems _ x 5 = 20,3 x _ = 18, _ x _ = 32

Mutiplication

Year 4 - Multiply 2 and 3-digits by a single digit number (short)

Build on previous method to include multiplication of three digit numbers by a single digit that includes carrying more than once.





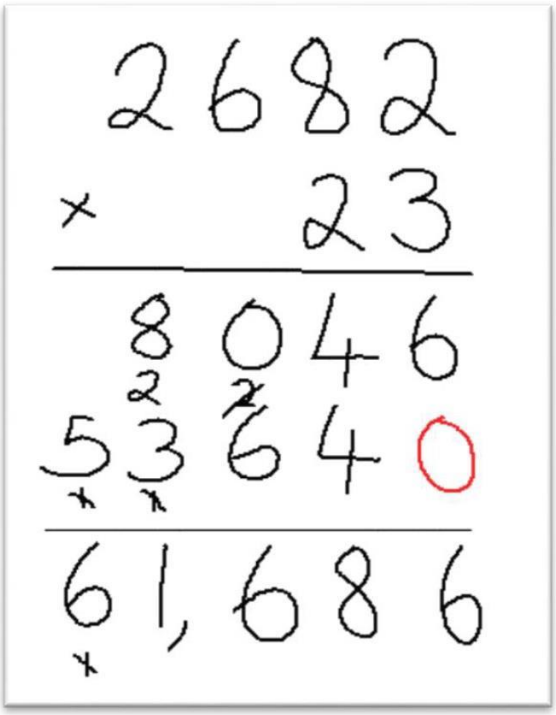
Key vocabulary: *groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, array, column, row, commutative, groups of, sets of, lots of, equal groups, times, multiply, times as big as, once, twice, three times... partition, grid method, total, multiple, product, sets of,* ***inverse***

Key skills for multiplication at Y4:

- Count in multiples of 6, 7, 9, 25 and 1000
- Recall multiplication facts for **all multiplication tables up to 12 x 12.**
- Recognise place value of digits in up to 4-digit numbers
- Use place value, known facts and derived facts to multiply mentally, e.g. multiply by 1, 10, 100, by 0, or to multiply 3 numbers.
- Use commutativity and other strategies mentally 3 x 6 = 6 x 3 , 2 x 6 x 5 = 10 x 6 , 39x7 = 30 x 7 + 9 x 7.
- Solve problems with increasingly complex multiplication in a range of contexts.
- Count in multiples of 6, 7, 9, 25 and 1000
- Recognise the place value of each digit in a four-digit number (thousands, hundreds, tens, and units

Mutiplication

Year 5 - Multiply 4-digit numbers and greater by a one or two digit number (long)



On the first row **2682 is being multiplied by 3**(units) giving an answer of 8046 and that on the second row **2682 is being multiplied by 20** giving an answer of 53,640. In this instance 0 is used as a place value holder.

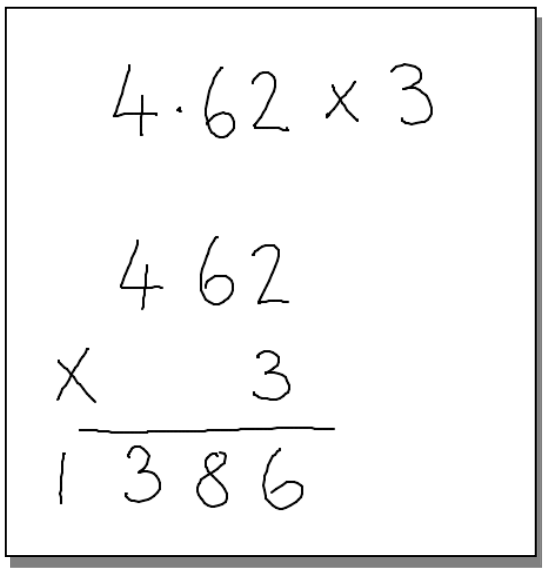
Key vocabulary *groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated ad-dition, column, row, commutative, sets of, equal groups, _times as big as, once, twice, three times..., parti-tion, grid method, total, multiple, product, inverse,* ***square, factor, integer, decimal, short/long multi-plication,_ carry'***

Key skills for multiplication at Y5:

- Identify multiples and factors, using knowledge of **multiplication tables to 12x12.** Solve problems where larger numbers are decomposed into their factors
- Multiply and divide integers and decimals by 10, 100 and 1000 Recognise and use square and cube numbers and their notation
- Solve problems involving combinations of operations, choosing and using calculations and methods appropriately.

Mutiplication

Year 6 – Short and long multiplication including decimal multiplication by a single digit up to 2.d.p



(1) Take out the decimal points

(2) There were two decimal points in the question

so there must be two in the answer.

(3) So 4.62 x 0.3 would be 1.386

***Some children may be able to look at multiplying a decimal by a two digit number and then decimal x decimal*.**

Children will be able to:

Use rounding and place value to make approximations before calculating and use these to check answers against.

Use **short multiplication** (see Y5) to multiply numbers with **more than 4-digits by a single digit**; to multiply money and measures, and to **multiply decimals with up to 2d.p. by a single digit.**

Use **long multiplication** (see Y5) to multiply numbers with **at least 4 digits by a 2-digit number.**

Key vocabulary: *groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated ad-dition, array, column, row, commutative, sets of, equal groups, times as big as, once, twice, three times...*
*partition, grid method, total, multiple, product, inverse, square, factor, integer, decimal, short / long mul-tiplication, „carry", **tenths, hundredths, decimal***

Key skills for multiplication at Y6:

- Recall multiplication facts for all times tables up to **12 x 12**
- Multiply multi-digit numbers, up to 4-digit x 2-digit using long multiplication.
- Perform mental calculations with mixed operations and large numbers.
- Solve multi-step problems in a range of contexts, choosing appropriate combinations of opera-tions and methods.
- Estimate answers using round and approximation and determine levels of accuracy.
- Round any integer to a required degree of accuracy.

Times table guidance for Times Table Rock Stars

In 2020 the government will be introducing a statutory multiplication tables check. The multiplication tables check will be carried out nationally by all children in Year 4 and has been designed to help ensure children in primary school know their times tables to 12 off by heart. As well as being critical for everyday life, knowledge of multiplication tables helps children to solve problems quickly and flexibly, and allows them to tackle more complex mathematics later on in school.

To ensure that the pupils at Chancel are fully prepared for the multiplication tables check, we are providing children with as many opportunities as possible to practise their times tables and apply these skills in school including the introduction of Times Table Rock Stars.

To ensure that all children are proficient with their times tables up to 12x12 by the end of Year 4, the National Curriculum recommends that the teaching of tables is broken down across Years 2, 3 and 4.

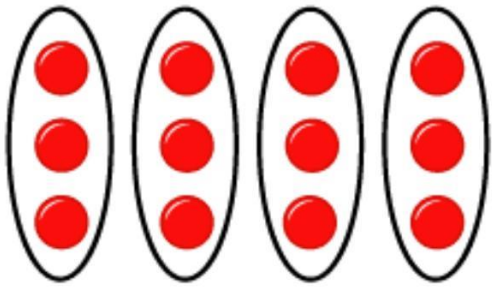
Therefore, when staff are selecting times tables for their year group for the 'garage' section of Times Table Rock Stars, the table below should be followed:

Year Group	Times Tables – Garage (Teacher Set)
1	x2, x5, x10
2	x3, x4, x8, x11
3	x6, x9, x12
4	x7
5	Any times table where a weakness has been identified – See stats area of TTRS
6	Any times table where a weakness has been identified – See stats area of TTRS

Division

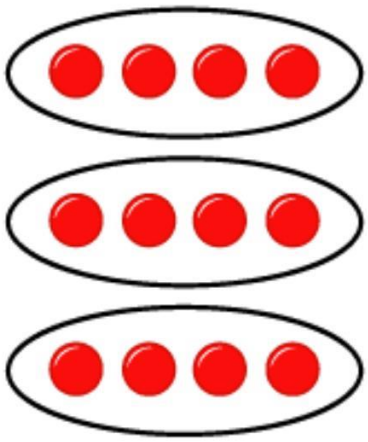
Year 1 – Division by grouping and sharing

Using arrays



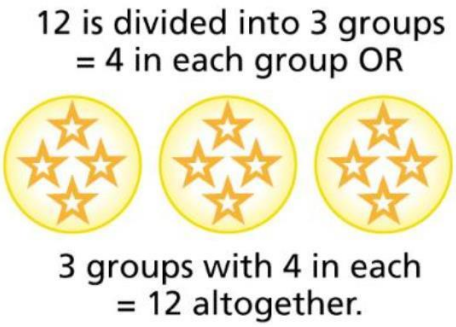
12 ÷ 3 = 4

:



12 ÷ 4 = 3

Using pictorial representations



Pupils should:

- Use lots of practical apparatus, arrays and picture representations
- Be taught to understand the difference between 'grouping' objects (How many groups of 2 can you make?) and 'sharing'(Share these sweets between 2 people)
- Be able to count in multiples of 2s, 5s and 10s.
- Find **half** of a group of objects by sharing into 2 equal groups

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

Key number skills needed for division at Y1:

- Solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations arrays with the support of the teacher
- Through grouping and sharing small quantities, pupils begin to understand, division, and finding simple fractions of objects, numbers and quantities.
- They make connections between arrays, number patterns, and counting in twos, fives and tens.

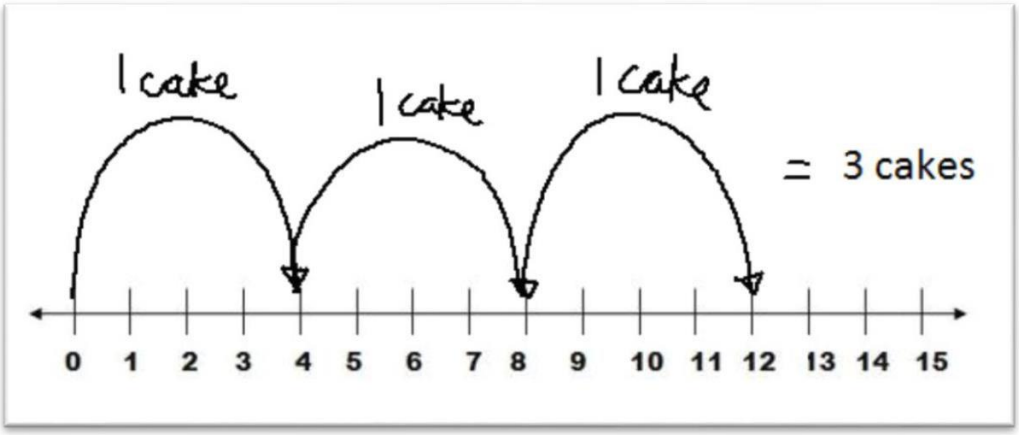
Division

Year 2 – Division by grouping and sharing using the ÷ and = symbols

Children may ***continue to use*** the informal methods of using arrays and pictorial methods and should then be taught to use a number-line to show grouping.

Number line grouping

Group from zero in equal jumps of the divisor to find out "How many groups of _ in _?
Pupils could and using a bead string or practical apparatus to work out problems.
E.g.: A cake costs £4. How many cakes can I buy with a £10 and a £2?



Key Vocabulary: ***share, share equally, one each, two each…, group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over***

Key number skills needed for division at Y2:

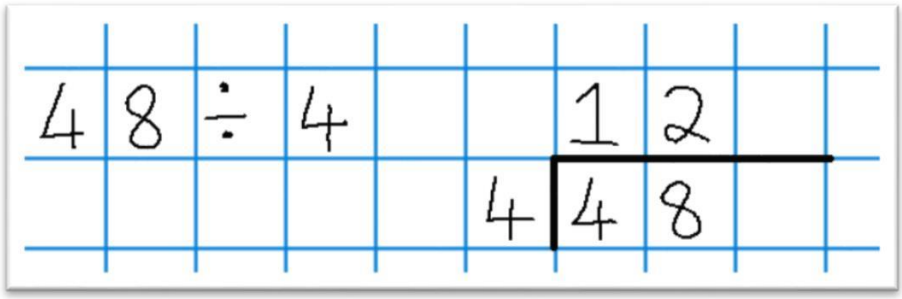
- Count in steps of 2, 3, and 5 from 0
- Recall and use multiplication and division facts for the **2, 5 and 10** multiplication tables, including recognising odd and even numbers.
- Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the x, ÷ and = signs.
- Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot.
- Solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts.

Division

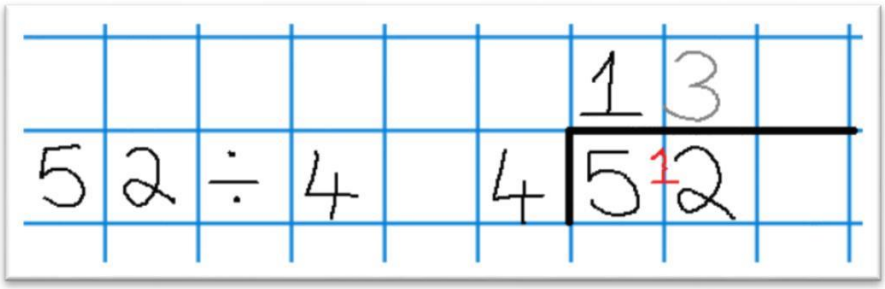
Year 3 – Division using a short formal method for 2-digit numbers (no remainders) in real-life contexts

STEP 1: Children continue to work out unknown division facts by grouping on a number line from zero. They are also now taught the concept of **remainders,** as in the example. This should be introduced practically and with arrays, as well as being translated to a number line. Children should work towards calculating some basic division facts with remainders mentally for 2s, 3s, 4s, 5s, 8s and 10s, ready for 'carrying' remainders across within the short division method.

STEP 2: Once children are secure with division as grouping and demonstrate this using number lines, they should be taught **short division** where larger 2-digit numbers can be introduced. However, initially, calculations with no remainders at any point should be used.



STEP 3: Once children demonstrate an understanding of remainders, and the short division method taught, they can be taught how to use the method when remainders occur within the calculation, and can be taught to 'carry' the remainder onto the next digit.



Key Vocabulary: *share, share equally, one each, two each…, group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over,* ***inverse, short division,_ carry', remainder, multiple***

Key number skills needed for division at Y3:

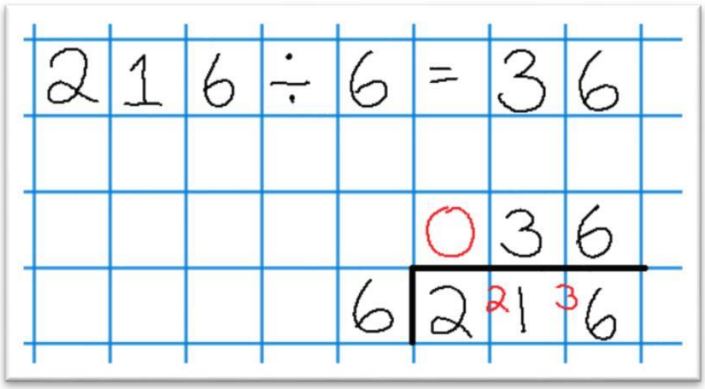
- Recall and use multiplication and division facts for the 2, 3, 4, 5, 8 and 10 multiplication tables (through dou-bling, connect the 2, 4 and 8s).
- Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to for-mal written methods.
- Solve problems, in contexts, and including missing number problems, involving multiplication and division.
- Pupils develop efficient mental methods, for example, using multiplication and division facts (e.g. using 3 × 2 = 6, 6 ÷ 3 = 2 and 2 = 6 ÷ 3) to derive related facts (30 × 2 = 60, so 60 ÷ 3 = 20 and 20 = 60 ÷ 3).
- Pupils develop reliable written methods for division, starting with calculations of 2-digit numbers by 1-digit numbers and progressing to the formal written method of short division.

Division

Year 4 – Division using a short formal method upto 3-digit numbers (no remainders) in real-life contexts

Pupils move onto dividing numbers with up to **3-digits** by a single digit. However, problems and calculations provided should **not result in a final answer with remainder** at this stage**.** Children who show clear understanding may progress to Y5 level.

When the answer for the **first column** is zero (1 ÷ 5, as in example), children should write a zero above to acknowledge its place, and must always 'carry' the number over to the next digit as a remainder.



Key Vocabulary: *share, share equally, one each, two each…, group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, inverse, short division, 'carry', remainder, multiple,* ***divisible by, factor***

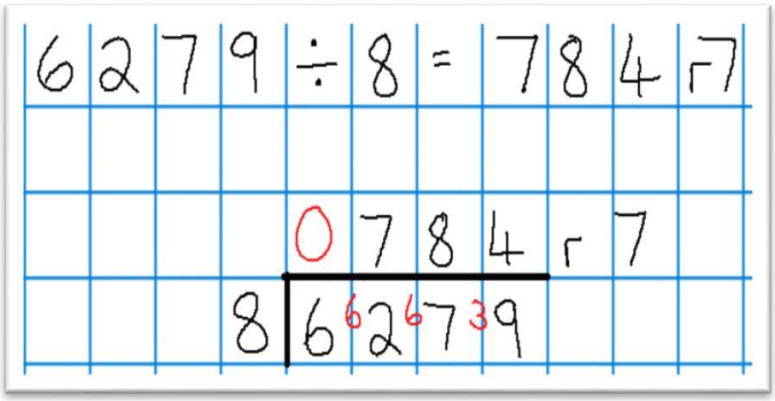
Key number skills needed for division at Y4:

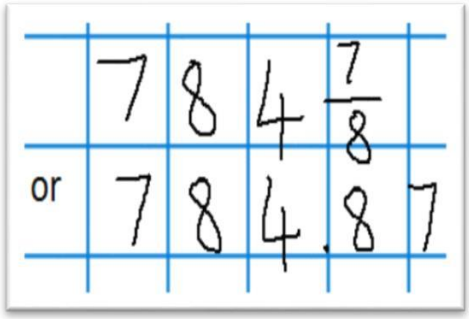
- **Recall multiplication and division facts for all numbers up to 12 x 12.**
- Use place value, known and derived facts to multiply and divide mentally, including: multiplying and dividing by 10 and 100 and 1.
- Pupils practise to become fluent in the formal written method of short division with exact answers when dividing by a one-digit number
- Pupils practise mental methods and extend this to three-digit numbers to derive facts, for example 200 × 3 = 600 so 600 ÷ 3 = 200
- Pupils solve two-step problems in contexts, choosing the appropriate operation, working with increasingly harder numbers. This should include correspondence questions such as three cakes shared equally between 10 children.

Division

Year 5 – Divide 4 digits by a single digit, including those with remainders

Short division with remainders: Now that pupils are introduced to examples that give rise to remainder answers, division needs to have a real life problem solving context, where **pupils consider the meaning of the remainder and how to express it,** i.e. as a fraction, a decimal, or as a rounded number or value , depending upon the context of the problem.





If children are confident and accurate: **Introduce *long division* (Y6 2015) for pupils who are ready to divide any number by a 2-digit number (e.g. 2678 ÷ 19).**

Key Vocabulary: *share, share equally, one each, two each…, group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, inverse, short division, 'carry', remainder, multiple, divisible by, factor, inverse,* ***quotient, prime number, prime factors, composite number (non-prime)***

Key number skills needed for division at Y5:

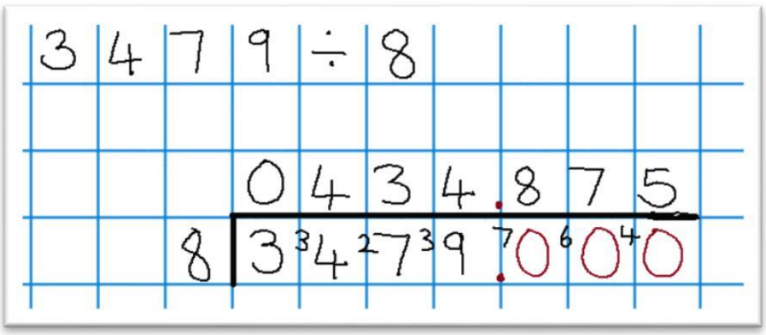
- Recall multiplication and division facts for all numbers up to 12 x 12 (as in Y4).
- Multiply and divide numbers mentally, drawing upon known facts.
- Identify multiples and factors, including finding all factor pairs of a number, and common factors of two number.
- Solve problems involving multiplication and division where larger numbers are decomposed into their factors.
- Multiply and divide whole numbers and those involving decimals by 10, 100 and 1000.
- Use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers.
- Work out whether a number up to 100 is prime, and recall prime numbers to 19.
- Divide numbers up to 4 digits by a one-digit number using the formal written method of short division and inter-pret remainders appropriately for the context
- Use multiplication and division as inverses.
- Interpret non-integer answers to division by expressing results in different ways according to the context, includ-
- ing with remainders, as fractions, as decimals or by rounding (e.g. 98 ÷ 4 = 24 r2 = 24 $_1/_2$ = 24.5 ≈ 25).
- Solve problems involving combinations of all four operations, including understanding of the equals sign, and includ-ing division for scaling by different fractions and problems involving simple rates.

Division

Year 6 – Divide 5 digit numbers and greater by single and double digit numbers that give rise to whole and decimal/fraction/remainder answers

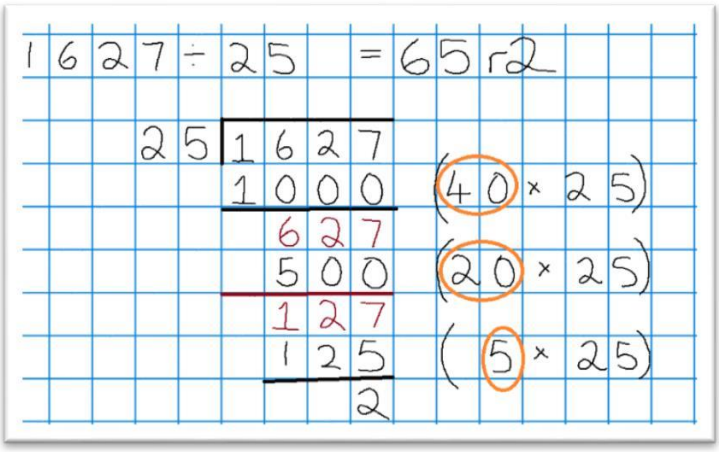
Short division with remainders: Pupils should continue to use this method, but with numbers to at least 4 digits, and understand how to express remainders as fractions, decimals, whole number remainders, or rounded numbers. Real life problem solving contexts need to be the starting point, where pupils have to consider the most appropriate way to express the remainder.

Children should be taught to give decimal answers. Here the remainder is carried on past the decimal point until a given degree of accuracy is reached.



Long division 'Chunking'

When the divisor is a two digit number, children should be taught to use the chunking method. How many chunks using the divisor can they take from the number? They should consider the most appropriate way to give any remainder.



Key Vocabulary: ***All of Y5, plus 'common factor'***

Key number skills needed for division at Y6:

- Recall and use multiplication and division facts for all numbers to 12 x 12 for more complex calculations
- Divide numbers up to 4 digits by a two-digit whole number using the formal written method of long divi-sion, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context. Use short division where appropriate.
- Perform mental calculations, including with mixed operations and large numbers.
- Identify common factors, common multiples and prime numbers.
- Solve problems involving all 4 operations.
- Use estimation to check answers to calculations and determine accuracy, in the context of a problem.
- Use written division methods in cases where the answer has up to two decimal places.
- Solve problems which require answers to be rounded to specified degrees of accuracy.