St Joseph's Catholic Primary School

Inspired by the life of St Joseph, we live, love and learn together

Calculaton Policy 2022 - 23

Samantha Golding

"Be ready, Stay safe, Show respect"

Approved by:	Date:
Last reviewed on:	
Next review due by:	

About our Calculation Policy

The following calculation policy has been devised to meet requirements of the National Curriculum 2014 for the teaching and learning of mathematics, and is also designed to give pupils a consistent and smooth progression of learning in calculations across the school. Please note that early learning in number and calculation in Reception follows the EYFS statutory framework document, and this calculation policy is designed to build on progressively from the content and methods established in the Early Years Foundation Stage, some examples have been included in this document.

Age stage expectations:

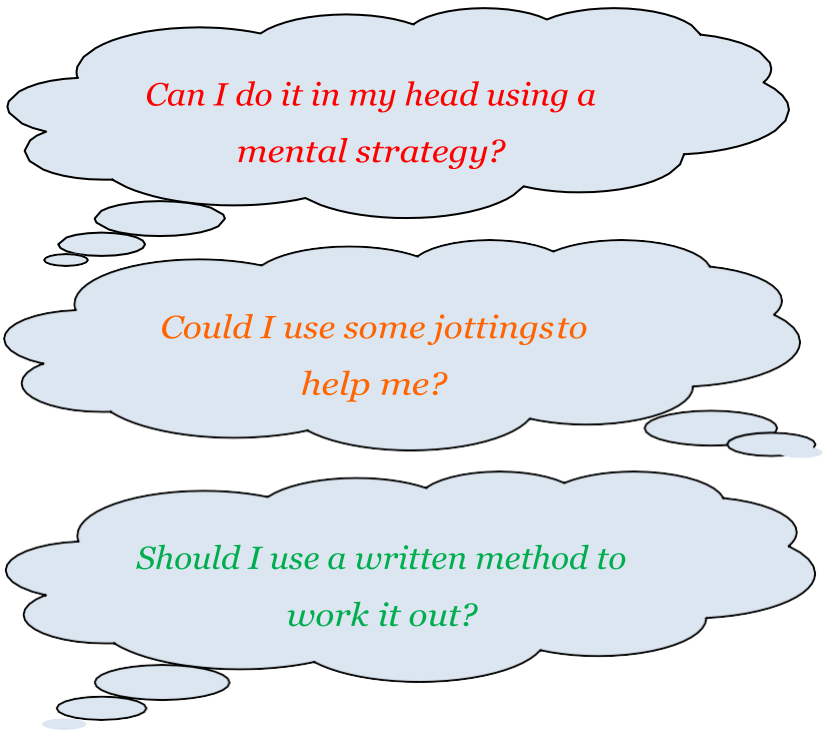
The calculation policy is organised according to age stage expectations as set out in the National Curriculum 2014, **however it is vital that pupils are taught according to the pathway that they are currently working at and children are showing to have 'mastered' a pathway before moving on to the next one.** However, children who are showing to be secure in a skill can be challenged to the next pathway as necessary.

Providing a context for calculation:

It is important that any type of calculation is given a real life context or problem solving approach to help build children's understanding of the purpose of calculation, and to help them recognise when to use certain operations and methods when faced with problems. This must be a priority within calculation lessons.

Choosing a calculation method:

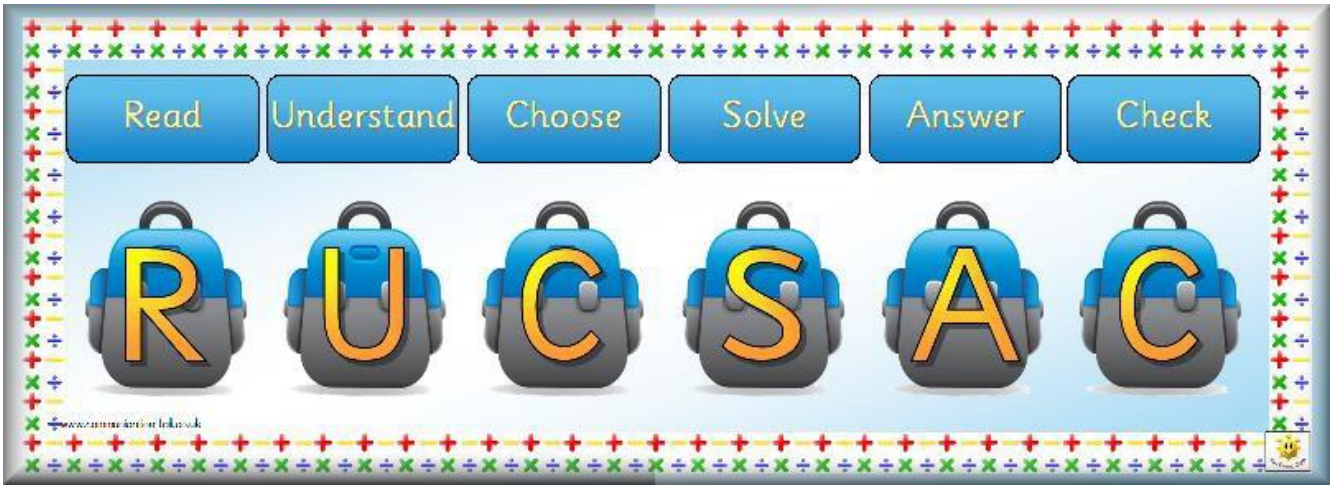
Children need to be taught and encouraged to use the following processes in deciding what approach they will take to a calculation, to ensure they select the most appropriate method for the numbers involved:



To work out a tricky calculation:
Approximate,
Calculate,
Check it mate!

Choosing a problem solving method:

When presented with a problem solving question/task the children need to be familiar with RUCSAC and use this strategy to approach the problem step by step. Older children who are challenged with multi-step problems will need to develop their own problem solving techniques, which should show their secure understanding of using and applying number. All problem solving questions need to be answered in context to ensure children have an understanding of the task set.



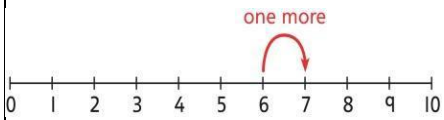
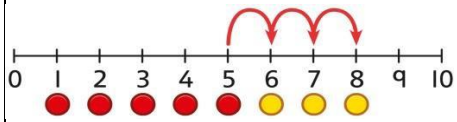
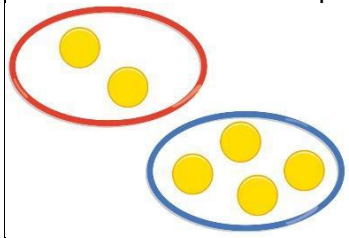
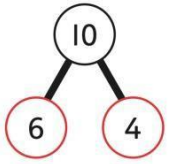
Access to resources:

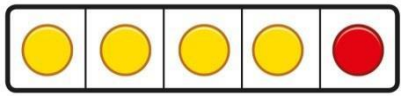
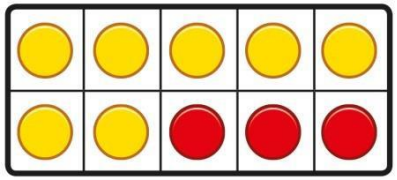
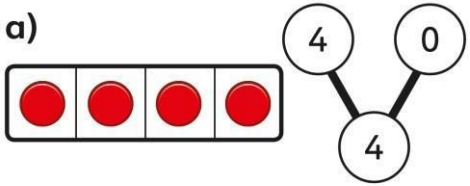
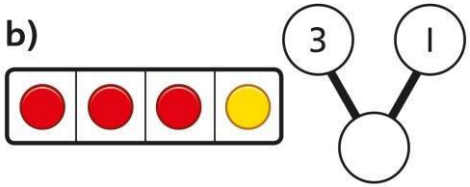
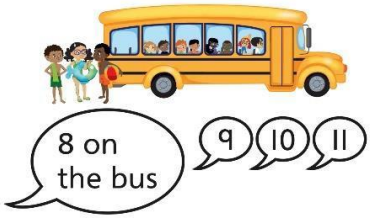
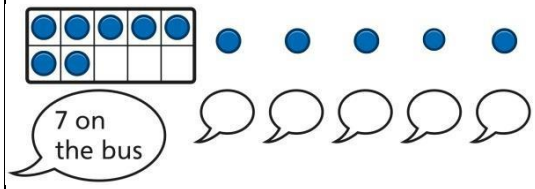
Children in all year groups need to have access to a range of mathematical resources during the math's lesson. Children should be encouraged to use number lines, 100 squares, counters, beads and Numicon to support their calculations and carry out methods in a visual context.

When problem solving children should be allowed to choose any resources they feel are needed to solve the problem and make jottings as they feel necessary.

Maths scheme of learning:

The White Rose Maths curriculum is designed to provide students with a solid foundation in mathematics. Students will gain a deep understanding of mathematics and enjoy solving mathematical problems. The primary curriculum puts a significant emphasis on mathematical skills, curriculum content and has to be well sequenced in order to promote a depth of understanding.

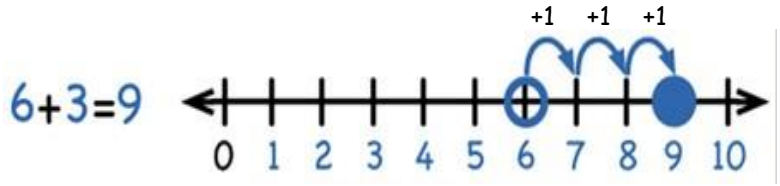
EYFS			
	Concrete	**Pictorial**	**Abstract**
EYFS Addition	**Counting and adding more** Children add one more person or object to a group to find one more.	**Counting and adding more** Children add one more cube or counter to a group to represent one more.  *One more than 4 is 5.*	**Counting and adding more** Use a number line to understand how to link counting on with finding one more.  *One more than 6 is 7.* *7 is one more than 6.* Learn to link counting on with adding more than one.  *5 + 3 = 8*
	Understanding part-part-whole relationship Sort people and objects into parts and understand the relationship with the whole.  *The parts are 2 and 4. The whole is 6.*	**Understanding part-part-whole relationship** Children draw to represent the parts and understand the relationship with the whole.  *The parts are 1 and 5. The whole is 6.*	**Understanding part-part-whole relationship** Use a part-whole model to represent the numbers.   *6 + 4 = 10*

	Knowing and finding number bonds within 10 Break apart a group and put back together to find and form number bonds.  *3 + 4 = 7*  *6 = 2 + 4*	**Knowing and finding number bonds within 10** Use five and ten frames to represent key number bonds.  *5 = 4 + 1*  *10 = 7 + 3*	**Knowing and finding number bonds within 10** Use a part-whole model alongside other representations to find number bonds. Make sure to include examples where one of the parts is zero. a)  b)  *4 + 0 = 4* *3 + 1 = 4*
	Adding by counting on Children use knowledge of counting to 20 to find a total by counting on using people or objects.  	**Adding by counting on** Children use counters to support and represent their counting on strategy.  	

Addition

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.



Children should:

- Have access to a wide range of counting equipment, everyday objects, number tracks and number lines, and be shown numbers in different contexts.
- 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: 8 + 3 = ☐ 15 + 4 = ☐ 5 + 3 + 1 = ☐ ☐ + ☐ = 6

This builds on from prior learning of adding by combining two sets of objects into one group (5 cubes and 3 cubes) in Early Years.

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

8 + 5

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

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.

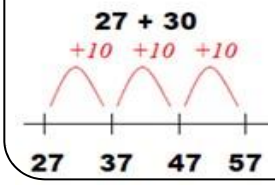
Video: Using a range of equipment and strategies to reinforce addition statements **/ bonds to 10**

Addition

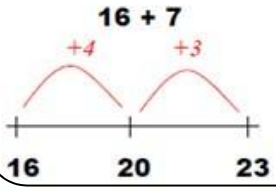
Year 2 Add with 2-digit numbers

Developing mental fluency with addition and place value involving 2-digit numbers, then establish more formal methods.

Add 2-digit numbers and tens:

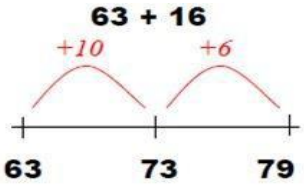


Add 2-digit numbers and ones:

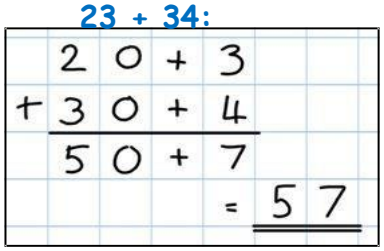


Use empty number lines, concrete equipment, hundred squares etc. to build confidence and fluency in mental addition skills.

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



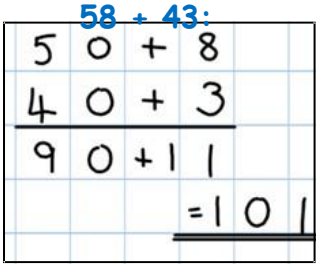
23 + 34:



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. 80+11), they are ready for adding pairs of 2-digit numbers that DO cross the tens boundary (e.g. 58 + 43).

58 + 43:



STEP 3: Children who are confident and accurate with this stage should move onto mastery style question to deeper their understanding.

To support understanding, pupils may physically make and carry out the calculation with Diennes Base 10 apparatus or place value counters, then compare their practical version to the written form, to help them to build an understanding of it.

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

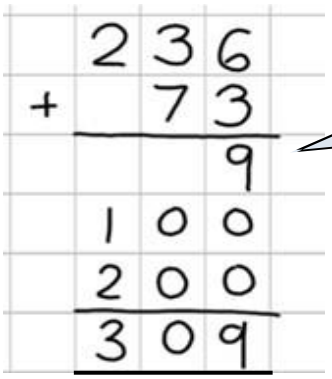
Key skills for addition at Y2:

- 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 numbers with up to 3-digits

Introduce the **expanded column addition** method:



Add the **ONES** 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 ones without recording the partitioning.

Pupils need to be able to add in columns.

Move to the compact column **addition** method, with exchanging:

Add **one s** first.

'Exchange' numbers **underneath** the bottom line.

```
  236
+  73
 309
   1
```

Children who are very secure and confident with 3-digit expanded column addition should be moved onto the **compact column addition** method, being introduced to exchanging for the first time. Compare the expanded method to the compact column method to develop an understanding of the process and the reduced number of steps involved.

Remind pupils the actual value is '**three tens** add **seven tens**', not **three add seven**', which equals **ten** tens.

Key vocabulary: *add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, numberline, sum, tens, ones, partition, plus, addition, column, tens boundary,* ***hundreds boundary, increase, vertical, exchange, 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. i.e. Number Bonds, adding the nearest multiple of 10, 100, 100 and adjusting, using near doubles, partitioning and recombining.

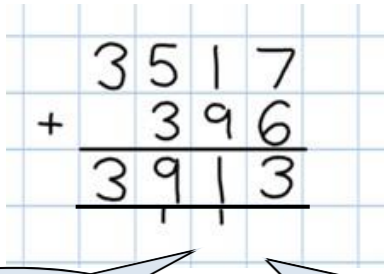
Video: Demonstration of expanded 3-digit column addition

Addition

Year 4 Add numbers with up to 4 digits

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

e.g. 3517 + 396 = 3913



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 exchanging, asking children to discuss similarities and differences and establish how it is carried out. Make sure that pupils draw a line underneath the final calculation.

Add **ones** first.

'**Exchange**' numbers **underneath** the bottom line.

Reinforce correct place value by reminding them the actual value is **5 hundreds** add **3 hundreds**, **not 5 add 3**, for example.

Use and apply this method to money and measurement values.

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

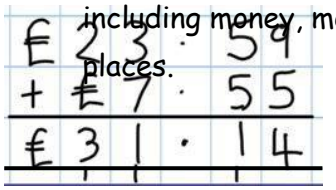
Key skills for addition at Y4:

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

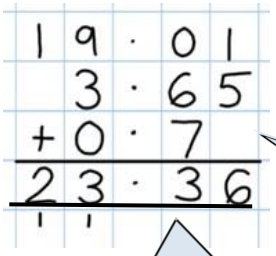
Year 5 Add numbers with more than 4 digits

including money, measures and decimals with different numbers of decimal places.



The decimal point should be aligned in the same way as the other place value columns, and must be in the same column in the answer. (Keep reminding pupils about the line under the final calculation)

Numbers should exceed 4 digits.



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

Say '**6 tenths add 7 tenths**' to reinforce place value.

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

Children should:

Understand the place value of **tenths and hundredths** and use this to align numbers with different numbers of decimal places.

Key vocabulary: *add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, numberline, sum, tens, ones, partition, plus, addition, column, tens boundary, hundreds boundary, increase, 'exchange', 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. i.e. Add the nearest multiple of 10, 100, 100 and adjust; use near doubles, inverse, partitioning and re-combining; using number bonds

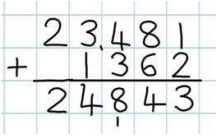
Use rounding to check answers and accuracy

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

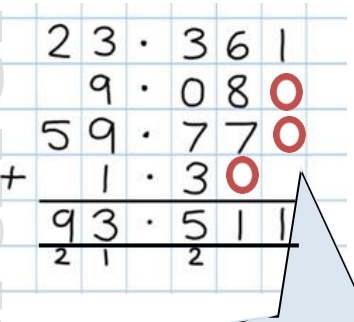
Round any number up to 1 000 000 to the nearest 10, 100, 1000, 10 000 and 100 000

Add numbers with more than 4 digits using formal written method of columnar addition.



Addition

Year 6 Add several numbers of increasing complexity

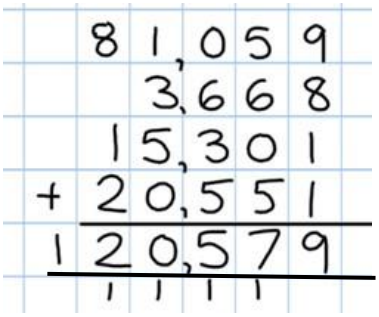


Empty decimal places can be filled with zero to show the place value in each column.

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.

Zeros could be added into any empty decimal places, to show there is no value to add.

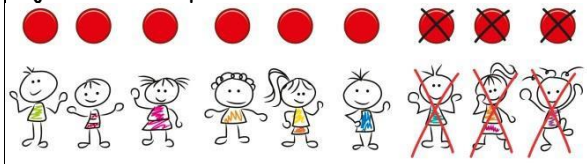
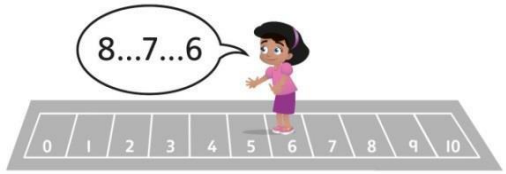
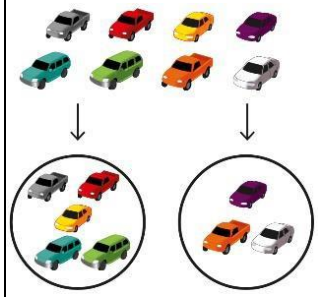
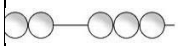
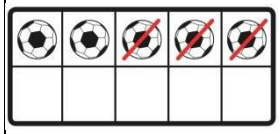


Adding several numbers with more than 4 digits.

Key vocabulary: *add,more,plus,and,make,altogether,total,equalto,equals,double,most,counton, numberline, sum, tens, ones, partition, plus, addition, column, tens boundary, hundreds boundary, increase, 'exchange', 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.

EYFS			
	Concrete	**Pictorial**	**Abstract**
EYFS Subtraction	**Counting back and taking away** Children arrange objects and remove to find how many are left.  *1 less than 6 is 5.* *6 subtract 1 is 5.*	**Counting back and taking away** Children draw and cross out or use counters to represent objects from a problem.  9 – ☐ = ☐ There are ☐ children left.	**Counting back and taking away** Children count back to take away and use a number line or number track to support the method.  *9 – 3 = 6*
	Finding a missing part, given a whole and a part Children separate a whole into parts and understand how one part can be found by subtraction.*8 – 5 = ?*  **Subtraction within 10** Understand when and how to subtract 1s efficiently. Use a bead string to subtract 1s efficiently.  *5 – 3 = 2*	**Subtraction within 10** Understand when and how to subtract 1s efficiently.  *5 – 3 = 2*	**Subtraction within 10** Understand how to use knowledge of bonds within 10 to subtract efficiently. *5 – 3 = 2*

Subtraction

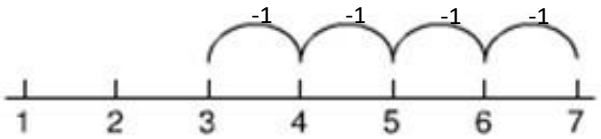
Year 1 Subtract from numbers up to 20

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 as below:

Read, write and interpret number sentences with - and = signs.

Subtract by taking away

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

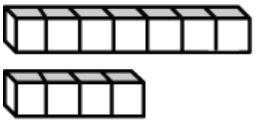


$7 - 4 = 3$

Model subtraction using hundred squares and numbered number lines/tracks and practically.

Find the 'distance between'

This will be introduced practically with the language **'find the distance between'** and **„how many more?** in a range of familiar contexts.



Seven is 3 more than four

The difference

I am 2 years older than my sister

Mental subtraction

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

Key vocabulary: *equalto, take, takeaway, 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 (i.e. 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.

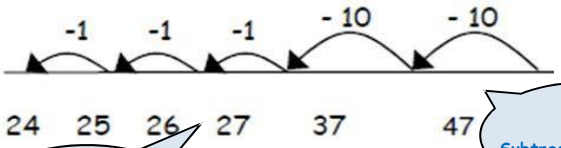
Use Diennes blocks for subtraction calculations too.

This strategy will be used for:

- **2-digit numbers subtract ones** (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** (see below:)

Subtracting pairs of 2-digit numbers on a number line:

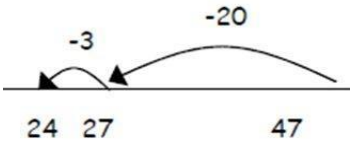
47 - 23 = 24 Partition the second number and subtract it in tens and ones, as below:



Then subtract ones.

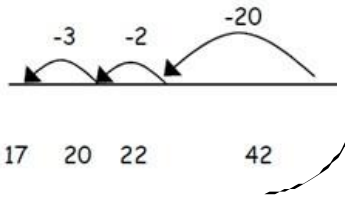
Subtract tens first

Move towards more efficient jumps back, as below:



Combine methods with use of a hundred square to reinforce understanding of number value and order.

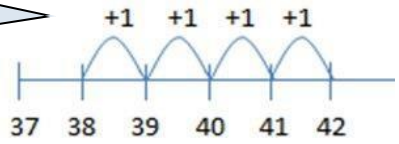
Teaching children to **bridge through ten** can help them to become more efficient, for example 42—25:



Mental strategy - subtract numbers close together by **counting on:**

Start with the smaller number and count on to the largest.

42 – 38 = 4



Many mental strategies are taught. Children are taught to recognise that when numbers are close together, it is more efficient to **count on** the difference. They need to be clear about the relationship between addition and subtraction.

Key vocabulary: *equal to, take, takeaway, less, minus, subtract, leaves, distance between, how many more, how manyfewer/lessthan,most,least,count back,how many left,how much less is_? ,* ***difference, count on, strategy, partition, tens, ones***

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
- calculations 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.

Introduce **partitioned column subtraction** method.

STEP 1: introduce this method with examples where **no exchanging** is required.

89 – 35 = 54

80 + 9

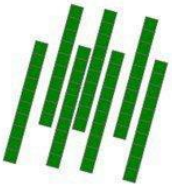
- 30 + 5

50 + 4

When learning to „exchange, explore partitioning in different ways so that pupils understand that when you exchange, the **VALUE** is the same i.e. **72** = 70+2 = 60+12 = 50+22 etc. Emphasise that the **value hasn't changed**, we have just partitioned it in a different way.

STEP 2: introduce „exchanging" through practical subtraction. Make the larger number with Base 10, then subtract 47 from it.

72 - 47



60 1

~~70~~ + 2

~~- 40 + 7~~

20 + 5 = ~~25~~

Before subtracting '7' from the 72 blocks, they will need to exchange a row of 10 for ten ones. Then subtract 7, and subtract 4 tens.

STEP 3: Once pupils are secure with the understanding of " exchanging" , they can use the partitioned column method to subtract any 2 and 3-digit numbers.

238 - 146 = 92

100

~~200~~ + 130 + 8

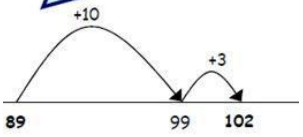
- 100 + 40 + 6

0 + 90 + 2

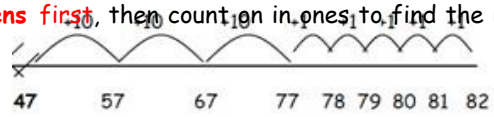
Subtracting money: partition into e.g. £1 + 30p + 8p

Counting on as a mental strategy for subtraction:

Because counting on in tens is the way we use a 100 square.



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 £1etc.). Start at the smaller number and count on in **tens** first, then count on in ones to find the rest of the difference:



Key vocabulary: *equalto,take,takeaway,less,minus,subtract,leaves,distancebetween,howmany more, how many fewer/ less than, most, least, count back, how many left,how much less is_?, difference, count on, strategy, partition, tens, ones* ***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 (see examples above)
- Read and write numbers up to 1000 in numerals and words
- Practise mental subtraction strategies, such as subtracting near multiples of 10 and adjusting (e.g. subtracting 19 or 21), and select most appropriate methods to subtract, explaining why.

Approximate,

Calculate,

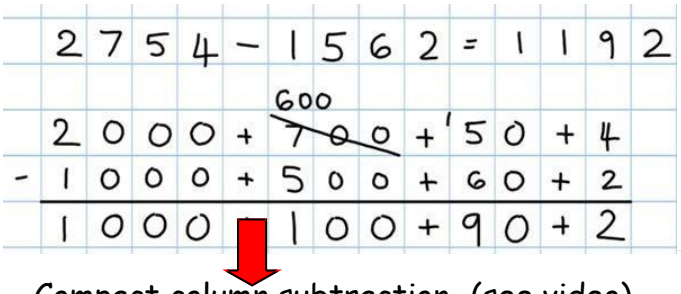
Check it mate!

Videos:1—Subtraction—teaching children to consider the most appropriate methods before calculating 2—Introducing partitioned column subtraction method, from practical to written

Subtraction

Year 4 Subtract with up to 4-digit numbers

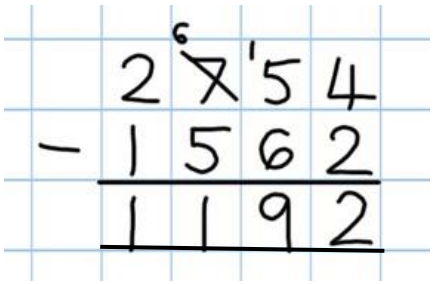
Partitioned column subtraction with exchanging (decomposition):



As introduced in Y3, but moving towards more complex numbers and values. Use **place value counters** to reinforce 'exchanging'.

Subtracting money: partition into £1 + 30 + 5 for example.

Compact column subtraction (see video)



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. Ask pupils to consider how it relates to the method they know, what is similar and what is different, to develop an understanding of it (shown on video).

Give plenty of opportunities to apply this to money and measures.

Always encourage children to consider the best method for the numbers involved— mental, counting on, counting back or written method (see video).

Mental strategies

A variety of mental strategies must be taught and practised, including counting on to find the difference where numbers are closer together, or where it is easier to count on (see video below).

Approximate, Calculate, Check mate!

Key vocabulary: *equal to, take, takeaway, 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, ones 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.

Videos: 1—Subtraction—teaching children to consider the most appropriate methods before calculating

2—Introducing partitioned column subtraction method, from practical to written

3—Moving to the compact column method of subtraction **(youtube)**

Subtraction

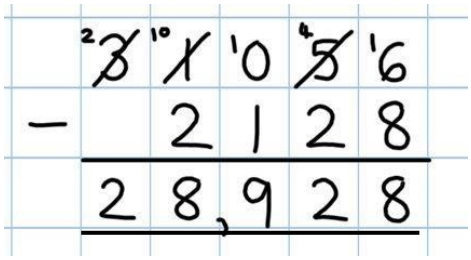
Year 5 Subtract with at least 4-digit numbers

including money, measures, decimals.

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.

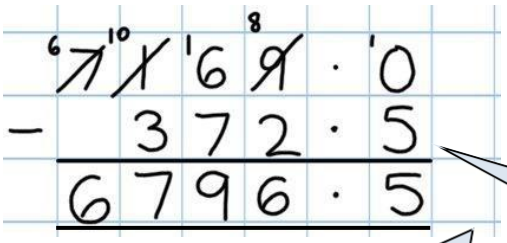
Compact column subtraction

(with 'exchanging').



Subtracting with larger integers.

See 'moving to the compact method' video.



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

Add a zero in any empty decimal places to aid understanding of what to subtract in that column.

Create lots of opportunities for subtracting and finding differences with money and measures.

Approximate,

Calculate,

Check it mate!

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, ones*

exchange, decrease, hundreds, value, digit, inverse, ***tenths, hundredths, decimal point, decimal***

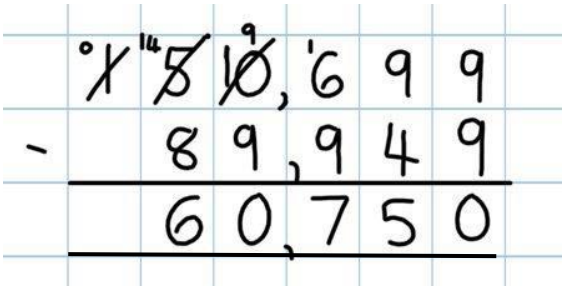
Key skills for subtraction at Y5:

- 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
- Solve addition and subtraction multi-step problems in context, 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 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 0
- Round any number up to 1 million to the nearest 10, 100, 1000, 10 000 and 100 000.

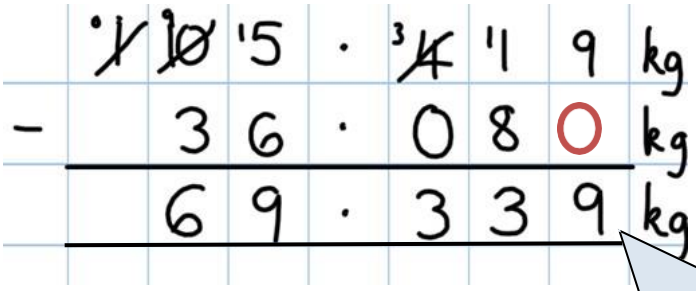
Video: Moving to the compact column method of subtraction (youtube)

Subtraction

Year 6 **Subtracting with increasingly large and more complex numbers and decimal values.**



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.

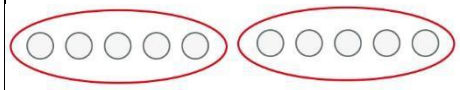
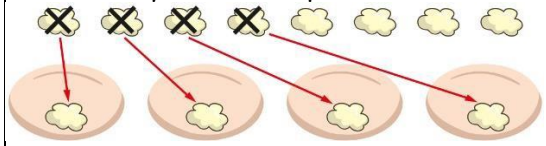
Approximate, Calculate, Check it

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, ones 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.

See previous videos for introducing the compact column method.

EYFS			
	Concrete	**Pictorial**	**Abstract**
EYFS **Double and halving Division**	**Grouping** Learn to make equal groups from a whole and find how many equal groups of a certain size can be made. Sort a whole set people and objects into equal groups.  *There are 10 children altogether. There are 2 in each group.* *There are 5 groups.*	**Grouping** Represent a whole and work out how many equal groups.  *There are 10 in total. There are 5 in each group.* *There are 2 groups.*	
	Sharing Share a set of objects into equal parts and work out how many are in each part. 		

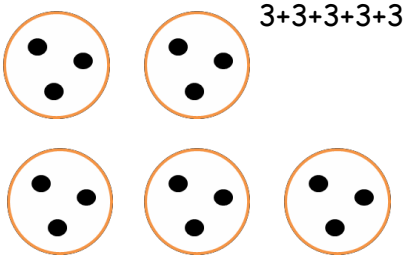
Multiplication

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

How many legs will 3 teddies have?

2 + 2 + 2 = 6

There are 3 sweets in one bag.
How many sweets are in 5 bags altogether?



3+3+3+3+3 = 15

- 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:

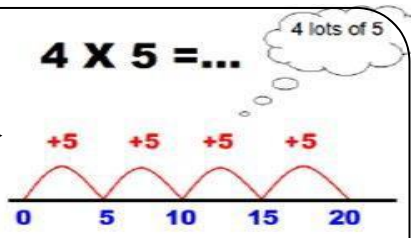
- Count in multiples of 2, 5 and 10
- Solve one-step problems involving multiplication, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher
- Make connections between arrays, number patterns, and counting in twos, fives and tens
- Begin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

Multiplication

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

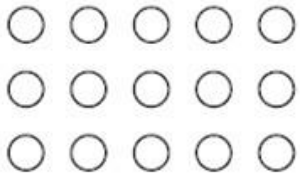
Use repeated addition on a number line:

- Starting from zero, make equal jumps up on a number line to work out multiplication facts and write multiplication statements using x and = signs.



4 X 5 = 20

Use arrays:



5 x 3 = 15

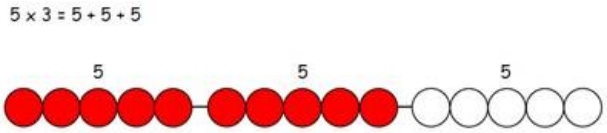
3 x 5 = 15

5 x 3 = 3 + 3 + 3 + 3 = **15**

3 x 5 = 5 + 5 + 5 = **15**

Use arrays to help teach children to understand the commutative law of multiplication, and give examples such as **3 x __ = 6**.

Use practical apparatus:



Use mental recall:

- Children should begin to **recall multiplication facts for 2, 5 and 10** times tables through practice in counting and understanding of the operation.

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.

Videos: 1) Teaching for understanding of multiplication facts **(youtube)**

2) Practical multiplication and the commutative law **(youtube)**

Multiplication

Year 3 Multiply 2-digits by a single digit number

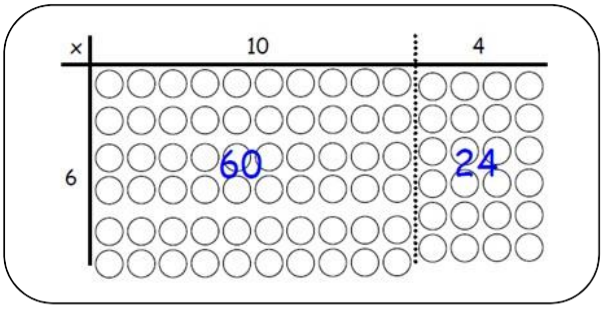
Introduce the grid method for multiplying 2-digit by single-digits:

Eg. 23 x 8 = 184

X	20	3
8	160	24

160 + 24 = 184

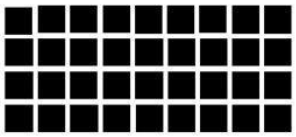
Link the layout of the grid to an array initially:



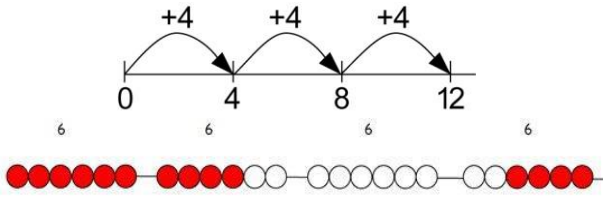
Introduce the grid method with children physically making an array to represent the calculation (e.g. make 8 lots of 23 with 10s and 1s place value counters), then translate this to grid method format (see video clip).

To do this, children must be able to:

- Partition numbers into tens and ones
- Multiply multiples of ten by a single digit (e.g. 20 x 4) using their knowledge of multiplication facts and place value
- Recall and work out multiplication facts in the **2, 3, 4, 5, 8 and 10** times tables.
- Work out multiplication facts not known by repeated addition or other taught mental strategies (e.g. by commutative law, working out near multiples and adjusting, using doubling etc.) Strategies to support this are: repeated addition using a number line, bead bars and arrays:



9 x 4 = 36



Key vocabulary: *groupsof,lotsof,times,array,altogether,multiply,count,multipliedby,repeated addition, column, row, commutative, sets of, equal groups, times, _ times, as big as, once, twice, three times…,*
partition, grid method, multiple, product, tens, ones, 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

Video: Teaching the grid method as an interim step (partitioning and counters to introduce grid)

Multiplication

Year 4 Multiply 2 and 3-digits by a single digit, using all multiplication tables up to 12 x 12

Developing the grid method:

Eg. 136 x 5 = 680

X	100	30	6
5	500	150	30

500
150
+ 30
680

Encourage column addition to add accurately.

If and when children are confident and accurate multiplying 2 and 3-digit numbers by a single digit this way, move on to mastery style questions to deeper their understanding.

Children should be able to:

- **Approximate before they calculate**, and make this a regular part of their calculating, going back to the approximation to check the reasonableness of their answer. e.g: **346 x 9** is approximately 350 x 10 = **3500**

  Record an approximation to check the final answer against
- Multiply multiples of ten and one hundred by a single-digit, using their multiplication table knowledge
- Recall all times tables **up to 12 x 12.**

Approximate,
Calculate,
Check it mate!

Key vocabulary: *groupsof,lotsof,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 ones)

Multiplication

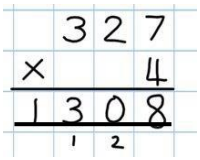
Year 5 Multiply up to 4-digits by 1 or 2 digits.

Introducing column multiplication

- Introduce by comparing a grid method calculation to a short multiplication method, to see how the steps are related, but notice how there are less steps involved in the column method (see video).
- Children need to be taught to approximate first, e.g. for **72 x 38, they will use rounding: 72 x 38** is approximately 70 x 40 = **2800**, and use the approximation to check the reasonableness of their answer against.

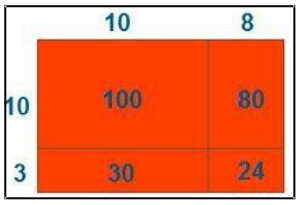
Short multiplication for multiplying by a single digit

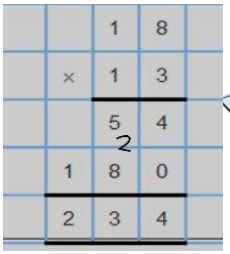
x	300	20	7
4	1200	80	28



Pupils could be asked to work out a given calculation using the grid, and then compare it to their column method. What are the similarities and differences? Unpick the steps and show how it reduces the steps.

Introduce long multiplication for multiplying by 2 digits





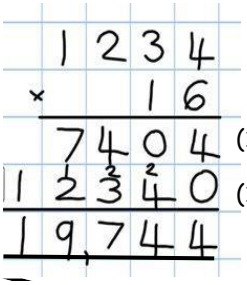
18 x 3 on the 1st row

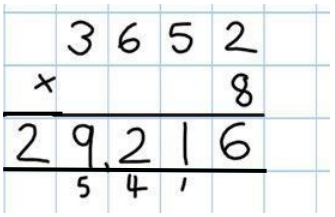
(8 x 3 = 24, exchanging the 2 for twenty, then „1 x 3).

18 x 10 on the 2nd row. Put a zero in ones first, then say 8 x 1, and 1 x 1.

The grid could be used to introduce long multiplication, as the relationship can be seen in the answers in each row.

Moving towards more complex numbers:





Approximate,

Calculate,

Check it mate!

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..., partition, grid method, total, multiple, product, inverse,* ***square, factor, integer, decimal, short/long multiplication, 'exchange'***

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.

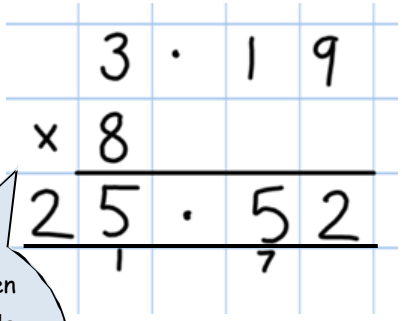
Videos: 1) Moving from grid method to a compact method

2) Reinforcing rapid times table recall:

3) Demonstration of long multiplication

Multiplication

Year 6 Short and long multiplication as in Y5, and multiply decimals with up to 2d.p by a single digit.



Line up the decimal points in the question and the answer.

Remind children that the single digit belongs in the ones column.

This works well for multiplying money (£.p) and other measures.

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**.

Approximate,
Calculate,
Check it mate!

Key vocabulary: *groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, 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 multiplication, 'exchange',* ***tenths, hundredths, decimal***

Key skills for multiplication at Y6:

- Recall multiplication facts for all times tables up to **12 x 12 (as Y4 and Y5)**
- 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 operations and methods
- Estimate answers using round and approximation and determine levels of accuracy
- Round any integer to a required degree of accuracy.

Videos:

1) Moving from grid method to a compact method (youtube)
2) Reinforcing rapid times table recall (youtube)
3) Demonstration of long multiplication (SLEP)

Division

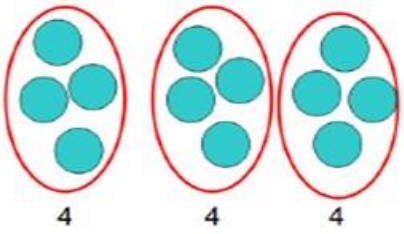
Year 1 Group and share small quantities

Use objects, diagrams and pictorial representations to solve problems involving **both grouping and sharing**.

How many groups of 4 can be made with 12 stars? = **3**

Grouping:

Sharing:



12 shared between 3 is 4

Example division problem in a familiar context:

There are 6 pupils on this table and there are 18 pieces of fruit to share between us. If we share them equally, how many will we each get?

Can they work it out and give a division statement… ?

"18 shared between 6 people gives you 3 each."

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:

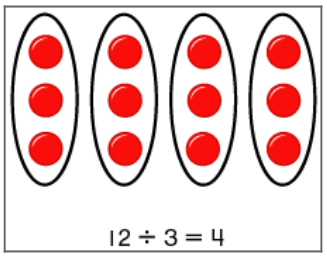
- Solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations arrays with the support of the teacher
- Through grouping and sharing small quantities, pupils begin to understand, division, and finding simple fractions of objects,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

Division

Year 2 Group and share, using the ÷ and = sign

Use objects, arrays, diagrams and pictorial representations, and grouping on a number line.

Arrays:

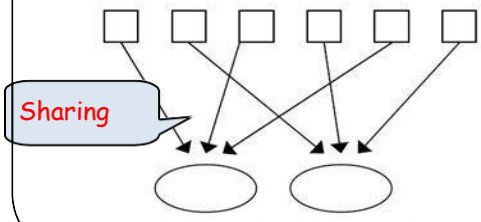


This represents **12 ÷ 3, posed as** how many groups of 3 are in 12?

Pupils should also show that the same array can represent **12 ÷ 4 =3** if grouped horizontally.

Know and understand sharing and grouping:

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



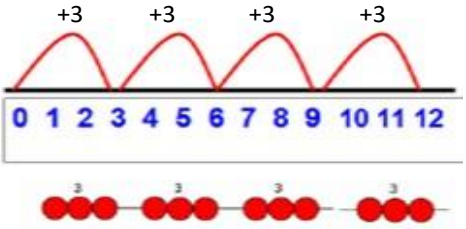
Grouping

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

Children should be taught to recognise whether problems require sharing or grouping.

Grouping using a number line:

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 like "A CD costs £3. How many CDs can I buy with £12?" **This is an important method to develop understanding of division as grouping.**



12 ÷ 3 = 4

Pose **12 ÷ 3** as "**How many groups of 3 are in 12?**"

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***

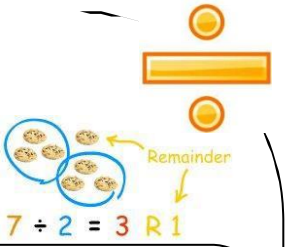
Key number skills needed for division at Y2:

- 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

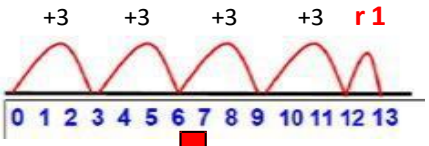
Year 3 Divide 2-digit numbers by a single digit

(where there may be a remainder in the final answer)



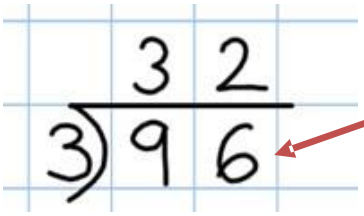
Grouping on a number line:

13 ÷ 3 = 4 r 1

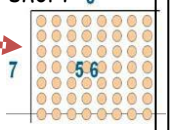


STEP 1: Children continue to work out unknown division facts by grouping on a number line from zero. They are also now taught the concept of **remainders,** as in the example. This should be introduced practically and with arrays, as well as being translated to a number line. Children should work towards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

Short division: Limit numbers to NO remainders in the answer OR carried (each digit must be a multiple of the divisor).



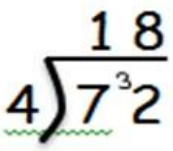
STEP 2: Once children are secure with division as grouping and demonstrate this using number lines, arrays etc., **short division** for larger 2-digit numbers should be introduced, initially with carefully selected examples requiring no calculating of remainders at all. Start by introducing the layout of short division by comparing it to an array.



Remind children of correct place value, that 96 is equal to 90 and 6, but in short division, pose:

- *How many 3's in 9? = 3, and record it above the* ***9 tens.***
- *How many 3's in 6? = 2, and record it above the* ***6 ones.***

Short division: Limit numbers to NO remainders in the final answer, but with remainders occurring within the calculation.



STEP 3: Once children demonstrate a full understanding of remainders, and also the short division method taught, they can be taught how to use the method when remainders occur within the calculation (e.g. 96÷4), and be taught to **exchange** the remainder onto the next digit. **If needed, children should use the number line to work out individual division facts that occur which they are not yet able to recall mentally.**

Step 3 Only taught when pupils can calculate **remainders.**

Real life contexts need to be used routinely to help pupils gain a full understanding, and the ability to recognise the place of division and how to apply it to problems.

Key Vocabulary: *share, share equally, one each, two each…,group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, numberline, left, leftover,* ***inverse, short division, exchange, 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 doubling, 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 formal 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.

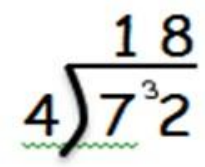
Division

Year 4 Divide up to 3-digit numbers by a single digit

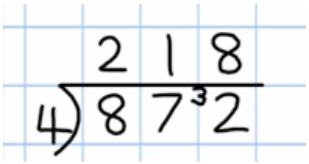
(without remainders initially)

Short division should only be taught once children have secured the skill of calculating "remainders".

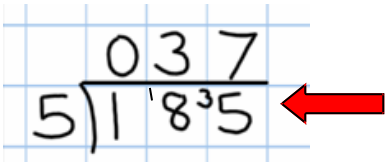
Continue to develop short division:



STEP 1: Pupils must be secure with the process of short division for dividing 2-digit numbers by a single digit (**those that do not result in a final remainder** —see steps in Y3), but must understand how to calculate remainders, using this to exchange remainders within the calculation process (see example).



STEP 2: 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 exceed this expectation may progress onto mastery style questions to deeper understanding.



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

Include money and measure contexts when confident.

Real life contexts need to be used routinely to help pupils gain a full understanding and the ability to recognise the place of division and how to apply it to problems.

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, 'exchange', remainder, multiple,* ***divisible by, factor***

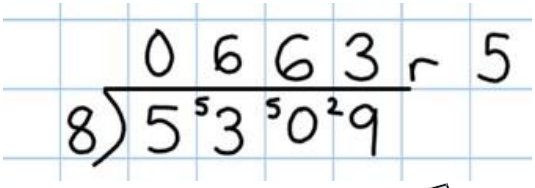
Key number skills needed for division at Y4:

- **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 up to 4 digits by a single digit, including those with remainders.

Short division, including remainder answers:



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.

The answer to 5309 ÷ 8 could be expressed as 663 and five eighths, 663 r 5, as a decimal, or rounded as appropriate to the problem involved.

See Y6 for how to continue the short division to give a decimal answer for children who are confident.

Include money and measure contexts.

Approximate,

Calculate,

Check it mate!

If children are confident and accurate:

Introduce **mastery** style question (real life context) to depper understanding.

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, 'exchange', remainder, multiple, divisible by, factor, inverse,* ***quotient, prime number, prime factors, composite number (non-prime)***

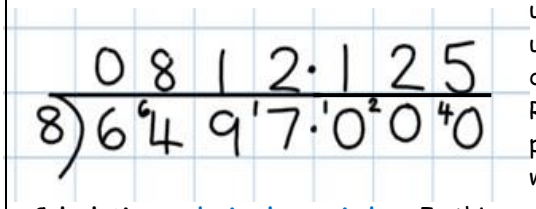
Key number skills needed for division at Y5:

- 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 interpret 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, including with remainders, as fractions, as decimals or by rounding (e.g. 98 ÷ 4 = 24 r 2 = 24 2/4 / = 24.5 ≈ 25)
- Solve problems involving combinations of all four operations, including understanding of the equals sign, and including division for scaling by different fractions and problems involving simple rates.

Division

Year 6 Divide at least 4 digits by both single-digit and 2-digit numbers (including decimal numbers and quantities)

Short division, for dividing by a single digit: e.g. 6497 ÷ 8



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.

Calculating a decimal remainder: In this example, rather than expressing the remainder as **r 1**, a decimal point is added after the ones because there is still a remainder, and the one remainder is carried onto zeros after the decimal point (to show there was no decimal value in the original number). Keep dividing to an appropriate degree of accuracy for the problem being solved. Pupils to be instructed to extend the division line as they add zeros.

Introduce long division by chunking for dividing by 2 digits.

Must be aligned in place value for subtracting.

```
      27
36 ) 972
   - 720      20x
     252
   - 252      7x
       0
```

Answer : 27

Find out "How many 36s are in 972?" by subtracting **chunks** of 36, until zero is reached (or until there is a remainder). Teach pupils to write a **'useful list'**, first at the side that will help them decide what chunks to use, e.g.:

'Useful' list: 1x = 36
10x = 360
100x = 3600

Introduce the method in a simple way by limiting the choice of chunks to "Can we use 10 lots? Can we use 100 lots?" As children become confident with the process, encourage more efficient chunks to get to the answer more quickly (e.g. 20x, 5x), and expand on their **'useful'** lists.

Where **remainders** occur, pupils should express them as fractions, decimals or use rounding, depending upon the problem.

Approximate,
Calculate,
Check it mate!

Key Vocabulary: *As previously, & 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 division, 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.