Maths

Addition and Subtraction Calculation Policy

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Teaching and Modelling Specific Vocabulary

Parts of Addition

2 + 3 = 5

Addend   Addend   Sum or Total

Parts of Subtraction

5 − 1 = 4

Minuend   Subtrahend   Difference

| Instead of using and saying….	Use and say….
Borrow/Carry *Carry the ones to the tens column*	**Regroup** *Regroup ten ones to make one ten*
Start with the biggest number (when subtracting)	*What is our starting number? What are we doing to it?*
Sum *Complete this sum: What is five and three?*	**Number sentence** *Complete this number sentence: What is the sum of five and three?* Sum means the total of two numbers added together
Units	**Ones**
Equals/Makes *5 + 3 equals 8*	**Is equal to…** *5 + 3 is equal to 8*

Additive Reasoning

Aggregation (+) and Partitioning (-)

- **Aggregation**- the combining together of numbers e.g. *I have 5 red flowers and 3 yellow flowers so I have 8 flowers in total*. The formal notation should be taught alongside: *5 add 3 is equal to 8.*
- Inverse of aggregation is **partitioning**. This is breaking a whole down into two or more parts. The subtraction symbol – can be used to represent partitioning.
- The + addition symbol is used to represent the combining of two parts to make a whole
- The = equals symbol shows equivalence between the whole and the sum of its parts
- The - subtraction symbol is used to represent the process of finding an unknown part. Try not to introduce it as solely 'take away' but rather finding the difference between values e.g. *I have 8 children in the classroom. 5 children are ready for PE. How many children are not?*
- Each addend represents a part which are combined to form the whole/sum. We can find the value of the whole by adding the parts.
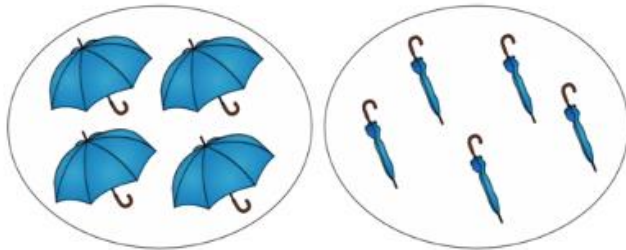
Aggregation structure example

*Four of the umbrellas are open and five are closed. If I gather the umbrellas together then there are nine.*
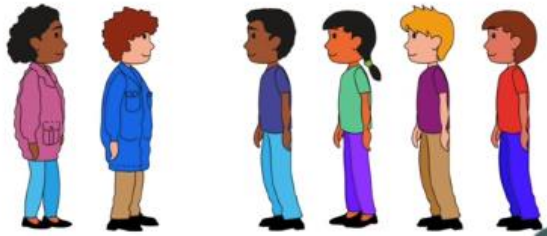
Partitioning structure example

We have six children. Two have coats on. Four don't have coats on. The amount has been split or partitioned.

Augmentation (+) and Reduction (-)

- Augmentation structure- increasing an amount. Use the + symbol
- Reduction structure- decreasing an amount. Use the - symbol
- Use the language structure of *First…Then… Now* to help pupils understand that there are three part
- If you have the information of two parts then you can work out the third missing part of information
- Children must be taught the connection between augmentation and reduction and that addition and subtraction are inverse operations
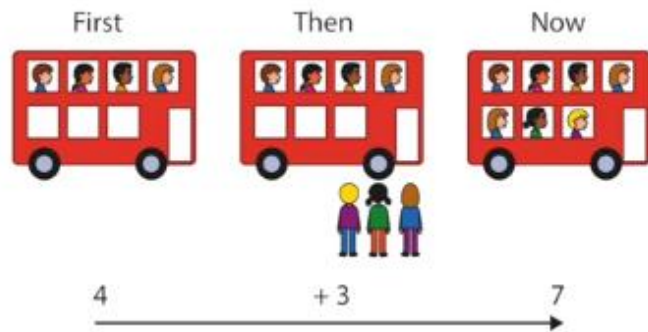
Augmentation structure – the amount has increased
First t*here are 4 children on a bus. Then 3 more children get on the bus. Now there are 7 children on the bus.*
The amount has increased.
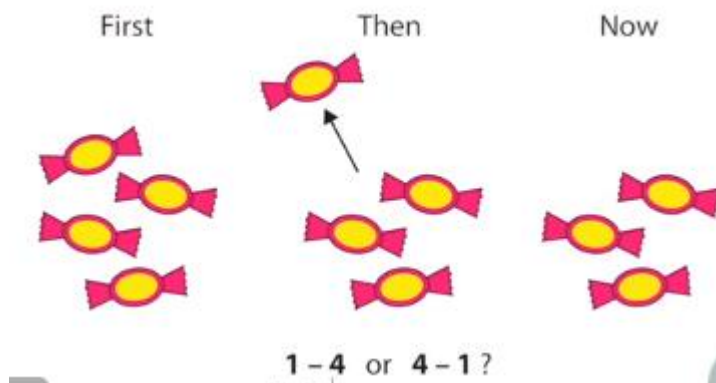
Reduction structure- the amount has decreased
First Tom had 4 sweets. Then Tom gave one sweet away. Now Tom has 3 sweets.

The amount has decreased

Standard and Non-Standard Contexts

Standard examples are contexts where the language is aligned with the operation used to solve the problem, e.g.:

Standard: First I had 5 apples. Then I bought 3 more. How many apples do I have now?

The problem is that pupils will generally identify the word 'more' with addition, which would be correct in this example. However, in non-standard contexts, identifying key vocabulary would not help to solve a problem, e.g.:

Non-standard: First I had 5 apples. Then I bought some more. Now I have 8 apples. How many apples did I buy?

Because of the word 'more' and the pupil identifying this word with addition, pupils might incorrectly add 5 and 3 together. Using vocabulary which is aligned to the operation needed within a problem can be unhelpful for children and can lead to pupils selecting an incorrect operation.

Here you can see how 'more than' can mean a different unknown:

more than

How many <u>more than</u> 3 is 12?

12	
3	?

+?

3 ⌒ 12

What is 3 <u>more than</u> 12?

?	
12	3

+3

12 ⌒ ?

Pupils should be encouraged to consider the known and unknown values and the relations between them and also have plenty of practice with non-standard contexts so that they do not become over-reliant on 'key vocabulary' strategies. Use concrete objects so that pupils can see the relationship between the numbers, like the example below:

Before there were ten people on the bus. Then some people got off the bus. Now seven people are on the bus. How many people got off the bus?

Before, there were ten people were on the bus.

Then, some people got off the bus.

Now, seven people are on the bus.

Pupils should now be able to see that they need to work out the difference between the 'before' and the 'now'.

'I know the whole is 10 and I know the remaining part is 7. I don't know the part that was taken away. To find that part I could add on from 7 to make 10 or I could subtract 7 from 10'

$$10 - ? = 7 \qquad 10 - 7 = ?$$

The scaffolded language structure of 'first/before… then… now' can be gradually removed once pupils are confident and have been exposed to non-standard contexts.

| EYFS	
Early Learning Goals- Number	• Have a deep understanding of number to 10, including the composition of each number • Subitise (recognise quantities without counting) up to 5 • Automatically recall (without reference to rhymes, counting or other aids number bonds up to 5 (including subtraction facts) and some number bonds to 10, including double facts
Early Learning Goals- Numerical Patterns	• Verbally count beyond 20, recognising the pattern of the counting system • Compare quantities up to 10 in different contexts, recognising when one quantity is greater than, less than or the same as the other quantity • Explore and represent patterns within numbers up to 10, including evens and odds, double facts and how quantities can be distributed equally

| Year 1	
Year 1 Addition and Subtraction Vocabulary	Add, more, plus, make, sum (e.g. the sum of 5 and 4 is 9), total, altogether, inverse, equal, is the same as, equivalent to, difference between, minus, subtract, take away, how many more, how many less, how many fewer is, how much less is, forwards, backwards, count, ones, twos, fives, tens, total, most, least, fewest, greatest, tens, digit, double, half, halve, zero, one, two, three, four, five, six, seven, eight, nine, ten, eleven, twelve, thirteen, fourteen, fifteen, sixteen, seventeen, eighteen, nineteen, twenty…, parts, wholes, partition, number line
National Curriculum Year 1 Addition and Subtraction objectives	• Given a number, identify one more • Read, write and interpret mathematical statements involving addition (+), subtraction (-) and the equals (=) sign • Represent and use number bonds and related subtraction facts within 20 • Add and subtract one- digit and two-digit numbers within 20, including zero • Solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as 7 = ? – 9

Year 1 Addition

Identifying one more: Start with using concrete objects to identify one more. Progress onto a number track to count on, starting with the largest number and then children will progress onto a marked number line.
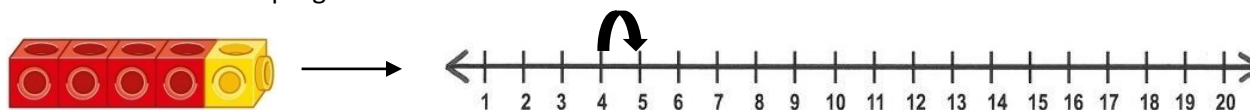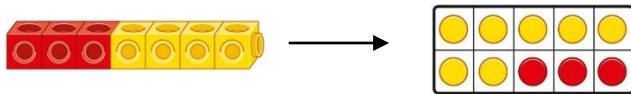

Part-whole relationships: Children should begin with sorting objects into parts and understand the relationship with the whole. Pupils can then progress onto using numbers to represent the part-whole model
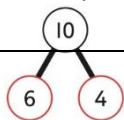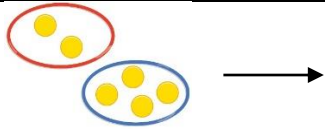
Number bonds: Break apart a group and put back together to find and form number bonds. Progress onto ten frames to represent key number bonds.

Adding by counting on (add one-digit and two-digit numbers to 20): Children use knowledge of counting to 20 to find a total by counting on using people or objects. Pupils can then use number lines or number tracks to support their counting on strategy.

8 on the bus

7

7 + 5 =
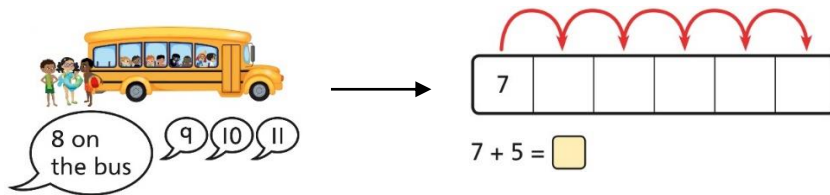
Bridging 10 using number bonds: Children use a bead string to complete a 10 and understand how this relates to the addition. They can then move onto using counters to complete a ten frame and understand how they can add using knowledge of number bonds to 10. Finally, pupils can use a part-whole model and a number line to support the calculation.
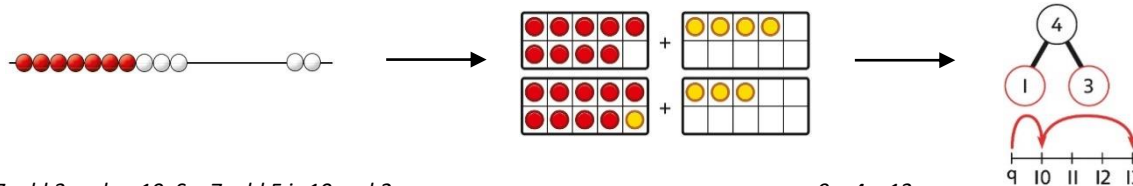
*7 add 3 makes 10. So, 7 add 5 is 10 and 2 more.*   *9 + 4 = 13*

Bar modelling: Children can be shown how to represent addition problems using the bar model so that they understand the relationship between the parts and the whole.

10

?	
6	4

Identifying one less: Start with using concrete objects to identify one less. Progress onto a number track to count back and then children will progress onto a marked number line. Use questioning such as: *What is our starting number? What are we going to do to it?*
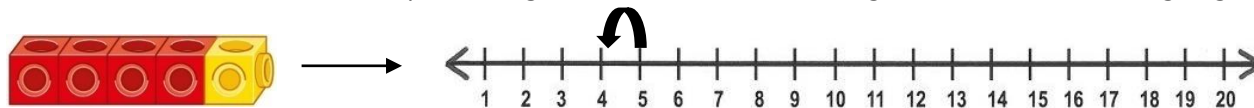
Children can use their fingers to count back alongside bead strings, number tracks and number lines.

Part-whole relationship: Begin with concrete resources to enable pupils to understand the relationship between the parts and the whole. Children can then use pictorial methods and finally use an abstract method to represent their understanding.

$$5 - 4 = \boxed{}$$
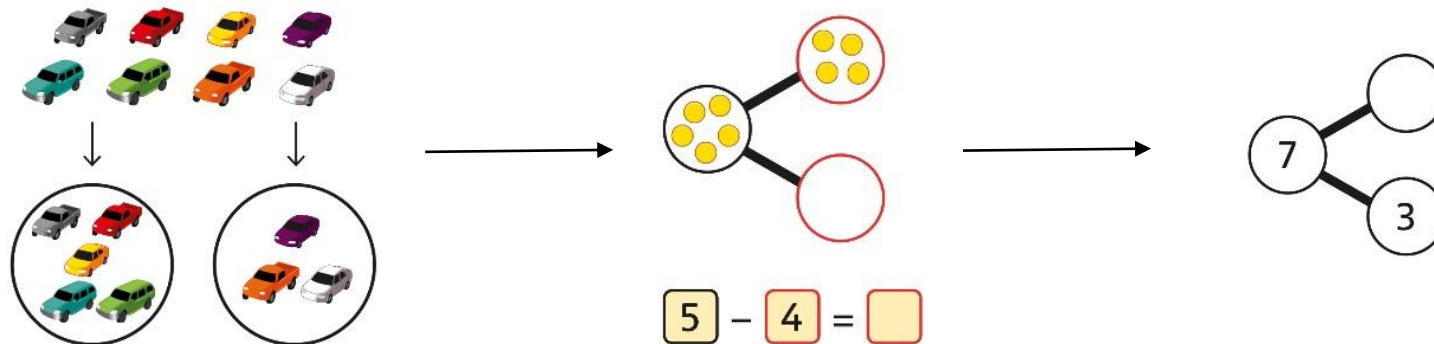
Finding the difference: Begin with lining two sets of objects up in a way in which children can see the difference between them. Children should understand 'find the difference' as subtraction
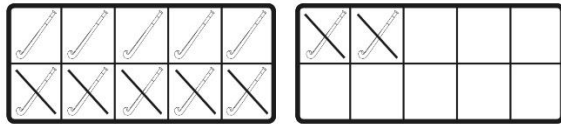
Images taken from Power Maths and NCETM
Policy created June 2021.

8 is 2 more than 6.

6 is 2 less than 8.

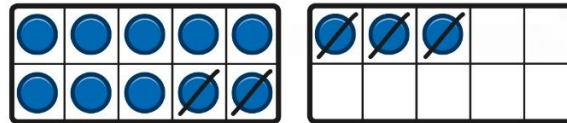*The difference between 8 and 6 is 2.*
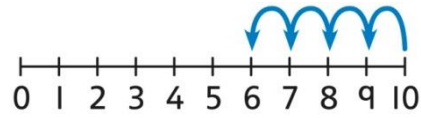
10 − 4 = 6

The difference between 10 and 6 is 4.

Subtraction bridging 10: Arrange objects into a 10 and some 1s, then decide on how to split the 7 into parts.

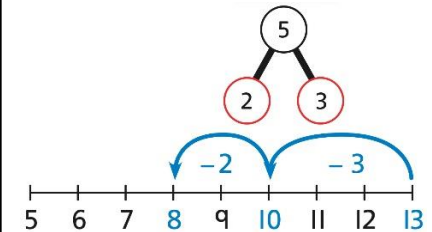*7 is 2 and 5, so I take away the 2 and then the 5.*

Represent the use of bonds using ten frames.

For 13 − 5, I take away 3 to make 10, then take away 2

Use a number line and a part-whole model to support the method.

13 − 5

Images taken from Power Maths and NCETM

Policy created June 2021.

Year 2	
Year 2 Addition and Subtraction Vocabulary	add, more, plus, make, sum (e.g. the sum of 5 and 4 is 9), total, altogether, inverse, equal, is the same as, equivalent to, difference between, minus, subtract, take away, how many more, how many less, how many fewer is, how much less is, forwards, backwards, count, ones, twos, fives, tens, total, most, least, fewest, greatest, tens, digit, double, half, halve, zero, one, two, three, four, five, six, seven, eight, nine, ten, eleven, twelve, thirteen, fourteen, fifteen, sixteen, seventeen, eighteen, nineteen, twenty… hundred, parts, wholes, bridging, partitioning, regroup

National curriculum Year 2 addition and subtraction objectives	• Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100
	• Add and subtract numbers using concrete objects, pictorial representations, and mentally, including:
	  A two-digit number and ones, a two-digit number and tens, two two-digit numbers, adding three one-digit numbers
	• Show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot
	• Solve problems with addition and subtraction:
	  Using concrete objects and pictorial representations, including those involving numbers, quantities and measures
	  Applying their increasing knowledge of mental and written methods
	• Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems

Year 2 Addition

Adding a two-digit number and ones/tens: Children can use a labelled number line and then progress onto an empty number line.
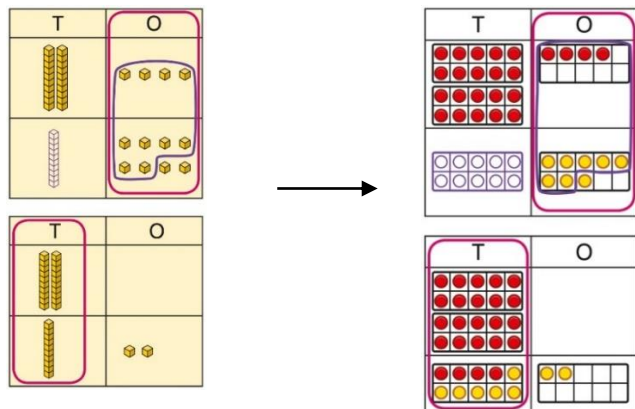

23 + 5
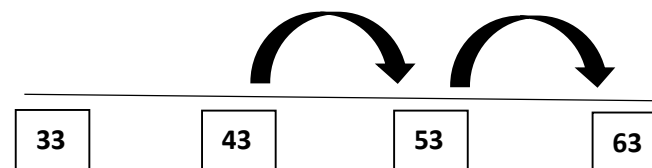
33 + 30 = 63
Use alongside a 100 square to show jumps of 10.

Images taken from Power Maths and NCETM
Policy created June 2021.

Adding a one-digit number to a two-digit number using regrouping: Begin with using dienes and progress onto ten frames or drawings.

24 + 8 = 32

Partitioning: Identify the starting number (56 + 37) then partition the smaller number (37 = 30 + 7) then count on. As children become more confident, larger jumps can be taken (e.g. jump of 30 rather than 3 x jumps of 10)

56   66   76   86 87 88 89 90 91 92 93

$$37 + 24 = 61$$

30   7   20   4

$30 + 20 = 50$

$7 + 4 = 11$

$50 + 11 = 61$

Adding two two-digit numbers: Use dienes to add the tens and ones separately then recombine. Pupils can progress onto using a part-whole model to support.

$32 +$ (11)

$11 = 10 + 1$
$32 + 10 = 42$
$42 + 1 = 43$

$32 + 11 = 43$

5 + 3 = 8. There are 8 ones

3 + 2 = 5. There are 5 tens

Year 2 Subtraction

Subtracting a single-digit bridging ten: Start with using ten frames and use known number bonds to aid the subtraction. Progress onto a number line.
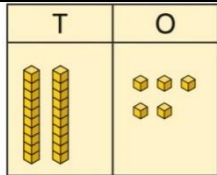
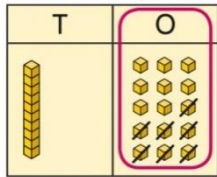*35 − 6*
I took away 5 counters, then 1 more

-4

16   17   18   19   20   21   22   23   24   25   26

$24 − 6 = ?$
$24 − 4 − 2 = ?$

Pupils should also be shown how tens and ones can be regrouped:

T	O
(2 tens rods)	(5 ones)

25 – 7.

7 ones cannot be subtracted currently so we must regroup one ten for ten ones.

T	O
(1 ten rod)	(15 ones, last 7 crossed out)

Subtracting a two-digit number: Children should be shown how to partition the number being subtracted into tens and ones and then to jump back on a number line:

64 - 41
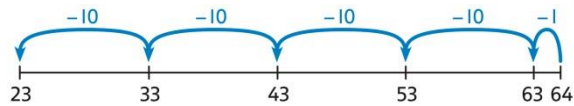
64 – 1 = 63

63 – 40 = 23

64 – 41 = 23

Once children are confident, more efficient jumps can be made (e.g. – 40 rather than – 10, -10, -10, -10)

| Year 3	
Year 3 Addition and Subtraction Vocabulary	add, more, plus, make, sum (e.g. the sum of 5 and 4 is 9), total, altogether, inverse, equal, is the same as, equivalent to, difference between, minus, subtract, take away, how many more, how many less, how many fewer is, how much less is, forwards, backwards, count, parts, wholes, column addition, regroup
National curriculum Year 3 addition and subtraction objectives	• Add and subtract mentally, including: a three-digit number and ones, a three-digit number and tens, a three-digit number and hundreds • Add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction • Estimate the answer to a calculation and use inverse operations to check answers • Solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction

Year 3 Addition

Children should be supported to identify when a mental method is appropriate.

Add numbers with up to three digits

Number line: Consolidate this method from Year 2. Use empty number lines with calculations that bridge 100.

67 + 56 = 123

```
        + 50                    + 6
   ⌒_____⌒    ⌒_____⌒
  67                    117          123
```
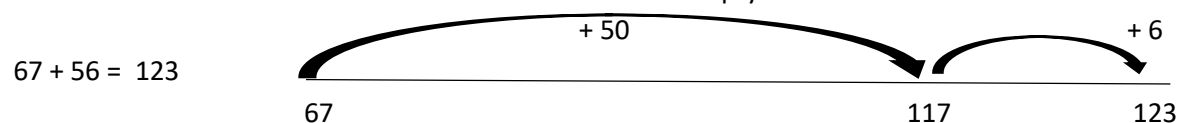
Progress onto addition of a three-digit and a two-digit number:

274 + 37 = 311

```
      + 30              + 7
  ⌒_____⌒     ⌒_____⌒
 274          304           311
```
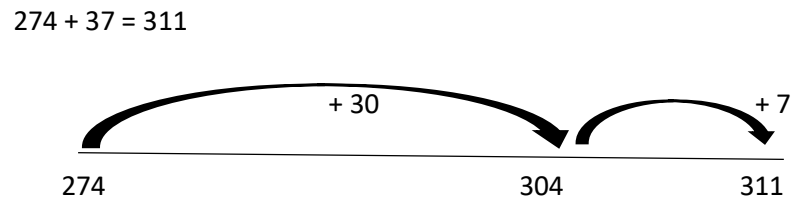
Partitioning: Continue with calculations that bridge

$$87 + 24 = 111$$

80   7   20   4

87 + 24 = 80
80 + 20 = 100
7 + 4 = 11
100 + 11 = 111

Expanded column method: Children can then progress onto this method before learning the formal written method. Pupils must have a secure understanding of partitioning in order to be successful with expanded column method. Pupils should also be taught how to correctly present and layout their work. If a pupil becomes confused at this stage then revert back to previous methods such as number lines and partitioning.

52 + 26 = 78

```
      50 + 2
  +   20 + 6
  _____
      70 + 8 = 78
```

52 + 26 = 78

```
      52
  +   26
  _____
      8 (2 + 6)
     70 (50 + 20)
  _____
     78
```

Formal written method

$$
\begin{array}{ccc}
\text{H} & \text{T} & \text{O} \\
2 & 7 & 5 \\
+ & 1 & 6 \\
\hline
& & 1 \\
\end{array}
\longrightarrow
\begin{array}{ccc}
\text{H} & \text{T} & \text{O} \\
2 & 7 & 5 \\
+ & 1 & 6 \\
\hline
9 & 1 \\
\end{array}
\longrightarrow
\begin{array}{ccc}
\text{H} & \text{T} & \text{O} \\
2 & 7 & 5 \\
+ & 1 & 6 \\
\hline
2 & 9 & 1 \\
\end{array}
$$

Add the ones: 5 ones and 6 ones is 11 ones. I will regroup 10 ones for 1 ten and show this under the line. Add the tens: 7 tens and 1 ten is 8 tens and I also need to add the regrouped ten so there are 9 tens. Add the hundreds: 2 hundred and 0 hundreds is 2 hundred.

Ensure that the language of regroup is used and that digits which have been regrouped are placed below the line. The concepts of place value must be reinforced using equipment and children must understand how the method relates to place value.

Year 3 Subtraction

Children should be supported to identify when a mental method is appropriate.

Subtracting a three-digit number and ones: Ensure that children understand why a regroup is necessary and understand how it has been regrouped. For some calculations it will be more efficient to complete mentally. Allow opportunities for discussion about which method would be more appropriate for particular number sentences. Here, 151-6 should be completed mental but for the purposes of understanding the regroup, it can be demonstrated using equipment.
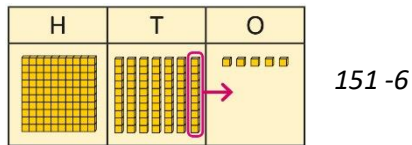
Regroup   151- 6
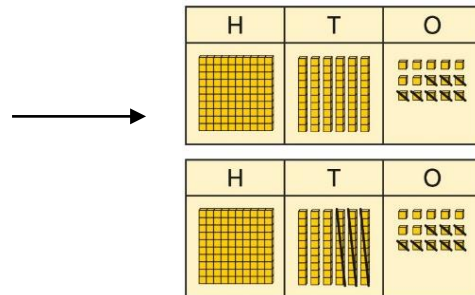

Mental strategy

$151 - 6 = ?$

$151 - 1 - 5 = 145$

H	T	O

151 -6

Subtracting a three-digit number and tens using regroup: Children should be able to use equipment to make regroups. Once they understand the concept, the numbers being subtracted can be made progressively harder.

175 - 38

H	T	O

H	T	O

I need to regroup 1 ten for 10 ones in order to subtract 8 ones from 175.

Subtracting a three-digit number and tens using a number line:

319 – 23

-3   -20

296		299		319

Subtracting using expanded column method: Start with subtracting two 2-digit numbers without a regroup needed.

```
45 – 23

      40 + 5
  -   20 + 3
      ──────
      20 + 2
```

```
457 – 226

      400 + 50 + 7
  -   200 + 20 + 6
      ────────────
      200 + 30 + 1
```

Progress onto expanded column method with regroup: Base 10/dienes should be used to consolidate understanding.

```
73 – 27

      70 + 3
  -   20 + 7
```

becomes ⟶

```
73 – 27

      60 + 13
  -   20 + 7
      ──────
      40 + 6    = 46
```

Subtracting using the formal written method: Once pupils are confident in the methods above and have a solid understanding of place value, they can begin to use the formal written method.

```
  H  T  O
  I  ⁶7̷ ¹5
-     3  8
  ─────────
  I  3  7
```

175 – 38 = 137   *In this example, it was only necessary to regroup in the tens column.*

Year 4	
Year 4 Addition and Subtraction Vocabulary	add, more, plus, make, sum (e.g. the sum of 5 and 4 is 9), total, altogether, inverse, equal, is the same as, equivalent to, difference between, minus, subtract, take away, how many more, how many less, how many fewer is, how much less is, forwards, backwards, count, parts, wholes, column addition, regroup, partition
National curriculum Year 4 addition and subtraction objectives	- Add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate - Estimate and use inverse operations to check answers to a calculation - Solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why

Year 4 Addition

If needed, recap the **expanded column method**. Ensure digits in columns are aligned in order to reinforce place value.

152 + 126 = 278

```
      152
  +   126
  ──────────
        8 (2 + 6)
       70 (50 + 20)
      200 (100 + 100)
  ──────────
      278
```

Introduce the addition of a 4-digit number and 4-digit number using the **formal written method:**

Ensure that the language of regroup is used and that digits which have been regrouped are placed below the line. The concepts of place value must be reinforced and children must understand how the method relates to place value. Use equipment alongside to demonstrate and encourage pupils to use too.
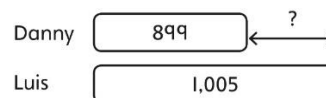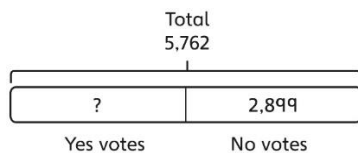
Year 4 Subtraction

Continue to teach with blank number lines and revisit the expanded column method if necessary. Continue the use of Base 10 and dienes to support conceptual understanding.

Regrouping across multiple columns should be modelled clearly to pupils first with equipment under a visualiser and then alongside the written method:

Bar models: Can be used to represent calculations where a part must be subtracted. They can also be used to help find the difference between numbers.

| Year 5				
Year 5 Addition and Subtraction Vocabulary	add, more, plus, make, sum (e.g. the sum of 5 and 4 is 9), total, altogether, inverse, equal, is the same as, equivalent to, difference between, minus, subtract, take away, how many more, how many less, how many fewer is, how much less is, forwards, backwards, count, parts, wholes, column addition, regroup, regroup			
National curriculum Year 5 addition and subtraction objectives	- Add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction) - Add and subtract numbers mentally with increasingly large numbers - Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy - Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why - Solve problems involving number up to three decimal places			
Year 5 Addition				

Ensure that concrete and pictorial representations are continued into UKS2 using counters and dienes alongside the **formal written method.**
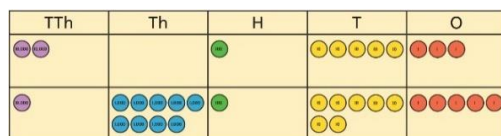
I need to regroup 10 tens for a 100.

Bar modelling: Bar models are effective in representing the addition of two or more numbers in the context of a problem.
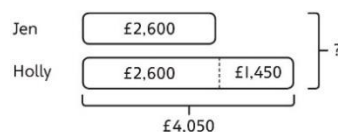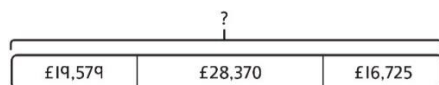
Formal written method

```
TTh Th  H   T   O
  2  3  4   0   5
+     7  8   9   2
─────────────────
  3  1  2   9   7
     |  |
```

Children should use rounding to check if their answers are reasonable (*e.g. 23,000 + 8,000*)

Calculation of decimals

Children should use the formal written method for the addition of decimal numbers, with a particular focus on the decimal point and the place value of each digit.


```
 O  · Tth Hth
 0  ·  9   2
+0  ·  3   3
─────────────
 1  ·  2   5
        |
```

It is particularly important to include calculations which have a different number of decimal places so that children learn how to align digits correctly in accordance with their place value:

3.4 + 0.65

```
 O  · Tth Hth
 3  ·  4   0
+0  ·  6   5
─────────────
    ·
```

Children will also use the formal written method to solve multi-step problems which involve the calculation of money (using decimal notation):
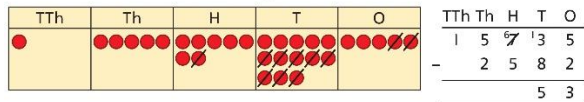
e.g. £107.53 + £98.05

Year 5 Subtraction

Continue to use place value equipment (base 10 and dienes) to show the regroup needed for particular calculations. Show alongside the formal written method so that the link is clear.
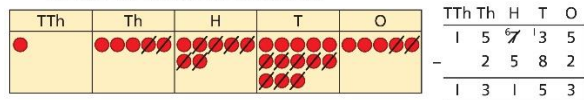
15,735 − 2,582 = 13,153
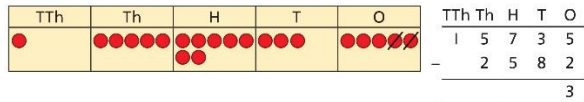
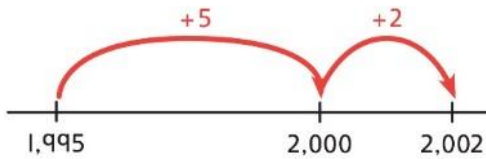Now subtract the 10s. Exchange 1 hundred for 10 tens.


Subtract the 100s, 1,000s and 10,000s.

Children should use efficient methods and may need to complete calculations mentally rather than using a formal written method:

2,002 − 1,995 = ?

Subtracting decimals: Use a place value grid to represent the stages of column subtraction, including regroups where required. Decimal calculation should ideally be used in the context of money and measures.
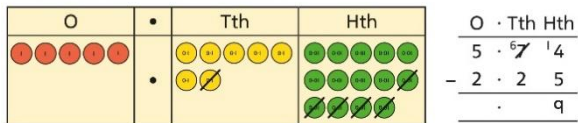
5·74 − 2·25 = ?
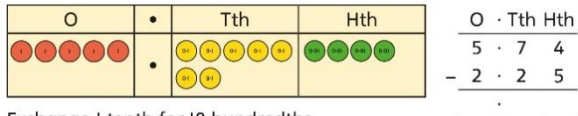
Exchange 1 tenth for 10 hundredths.

Now subtract the 5 hundredths.

Now subtract the 2 tenths, then the 2 ones.

Year 6	
Year 6 Addition and Subtraction Vocabulary	add, more, plus, make, sum (e.g. the sum of 5 and 4 is 9), total, altogether, inverse, equal, is the same as, equivalent to, difference between, minus, subtract, take away, how many more, how many less, how many fewer is, how much less is, forwards, backwards, count, parts, wholes, column addition, regroup, regroup
National curriculum Year 6 addition and subtraction objectives	• Perform mental calculations, including with mixed operations and large numbers • Use their knowledge of the order of operations to carry out calculations involving the four operations • Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why • Solve problems involving addition, subtraction, multiplication and division • Use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy

Year 6 Addition

Efficiency: Use the **formal written method** where mental methods are not efficient. Recognise common errors with column addition.

32,145 + 4,302 = ?

```
TTh Th  H   T   O        TTh Th  H   T   O
 3   2  I   4   5          3   2  I   4   5
+    4  3   0   2        + 4   3  0   2
 3   6  4   4   7          7   5  I   6   5
```

Which method has been completed accurately?
What mistake has been made?

Formal methods are also used for decimal additions where mental methods are not efficient.

```
 H   T   O · Tth Hth
 I   4   0 · 0   9
+    4   9 · 8   9
 I   8   9 · 9   8
             I
```

Order of operations: Understand the correct order of operations in calculations without brackets. Understand how brackets affect the order of operations in a calculation.
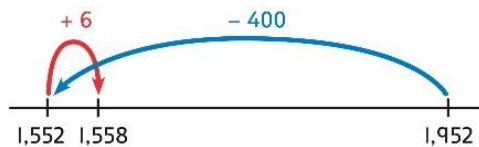
4 + 6 × 16   *(4 + 6) × 16*
4 +   96   = 100   *10   × 16 = 160*

Continue to use concrete resources (e.g. counters, dienes) and pictorial representations (part-whole model, bar model) in Year 6 to ensure that children maintain a solid understanding of all concepts- particularly place value and regrouping.

Year 6 Subtraction

Choosing efficient methods: Compare and select methods. Use column subtraction when mental methods are not efficient. Use two different methods for one calculation as a checking strategy.

1,952 – 394 = 1,558