# Addition and Subtraction Calculation Policy at Newark Hill Academy 

## Addition - progression in written methods Y1 to Y6

There are two structures of addition: aggregation and augmentation.

Addition is commutative because the parts can be added in any order.

Combining two or more parts to make a whole is called aggregation.
Ben had 3 footballs and Zoe had 2 footballs. How many footballs are there altogether?


An addition context described by a first, then, now story is an example of augmentation. Harry had 3 footballs, then he was given 2 more. How many does he have now?

The sum of the parts is equal to the whole.

Both structures can be represented on a part/whole diagram.


# Year 1 <br> Addition and Subtraction 

## Objectives

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


## Key Skills

## Addition

- 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 12,5 and 10
- Solve simple 1-step problems involving addition, using objects, number lines and pictorial representations.


## Subtraction

- 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.
- $\quad$ Subtract with one-digit and two-digit numbers to 20, including zero.
- Solve one-step problems that involve addition and subtraction, using concrete objects (ie bead string, objects, cubes) and pictures, and missing number problems.
- Read and write numbers from 0 to 20 in numerals and words.


## Vocabulary

Addition
add, more, plus, and, put together, make, altogether, total, equal to, equals, double, most, count on, number line, addend, sum
Subtraction
equal to, take, take away, less, subtract, leaves, difference, how many more, how many fewer / less than, most, least, count back, how many left, how much less is_?

It is very important for pupils to be able to add and subtract within 10, fluently, by the end of year 1. This should be taught and practised until pupils move beyond counting forwards or backwards in ones, to more efficient strategies and eventually to automatic recall of these number facts. This is necessary before pupils move on to additive calculation with larger numbers.
The 66 addition facts within 10 are shown on the grid below. The number of addition facts to be learnt is reduced when commutativity is applied and pupils recognise that $3+2$, for example, is the same as $2+$ 3. Pupils must also have automatic recall of the corresponding subtraction facts, for example $5-3$ and 5-2.

| + | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | $0+0$ | $0+1$ | 0+2 | 0+3 | $0+4$ | 0+5 | 0+6 | 0+7 | 0+8 | 0+9 | 0+10 |
| 1 | $1+0$ | 1+1 | 1+2 | 1+3 | 1+4 | 1+5 | 1+6 | 1+7 | 1+8 | $1+9$ |  |
| 2 | $2+0$ | $2+1$ | $2+2$ | $2+3$ | $2+4$ | $2+5$ | $2+6$ | $2+7$ | $2+8$ |  |  |
| 3 | $3+0$ | $3+1$ | $3+2$ | $3+3$ | $3+4$ | $3+5$ | $3+6$ | $3+7$ |  |  |  |
| 4 | $4+0$ | 4+1 | $4+2$ | $4+3$ | $4+4$ | $4+5$ | $4+6$ |  |  |  |  |
| 5 | $5+0$ | $5+1$ | $5+2$ | $5+3$ | $5+4$ | $5+5$ |  |  |  |  |  |
| 6 | $6+0$ | 6+1 | $6+2$ | 6+3 | $6+4$ |  |  |  |  |  |  |
| 7 | $7+0$ | $7+1$ | $7+2$ | $7+3$ |  |  |  |  |  |  |  |
| 8 | $8+0$ | $8+1$ | $8+2$ |  |  |  |  |  |  |  |  |
| 9 | $9+$ | $9+$ |  |  |  |  |  |  |  |  |  |

## Strategies

## Example strategy 2:

## Language focus

"If I subtract 2 from an even number I get the previous even number, so 6 minus 2 is equal to 4 ."

$6-2=4$
Figure 9: tens frames with counters showing that subtracting 2 from an even number gives the previous even number

## Year 1 Addition

Immerse children in practical opportunities to develop understanding of addition and subtraction. Children will be introduced to the part, part, whole model.


Aggregation structure


-varying the position of the equals symbol (for example, 5-2 $3=$ and $35-2=$ )
-for addition, the addends can be written in either order and the sum remains the same (commutativity)

- Solve missing box problems, using concrete objects and number line addition to solve them
- Pupils must also learn to relate addition and subtraction contexts and equations to mathematical diagrams such as bar models, number lines, tens frames with counters, and partitioning diagrams.


Figure 30: number line and addition equation $(2+3=5)$


Language focus
"I know that double 3 is equal to 6 , so 4 plus 3 is equal to 7 ."

$3+3=6$
so

$4+3=7$

Figure 8: tens frames with counters showing derivation of a 'near-double' addition calculation

## Add one-digit and two-digit numbers to 20 including 0

Use numbered number lines to add, by counting on in ones. Encourage children to start with the larger number and count on.

## Year 1 Subtraction

## Subtract from numbers up to 20

Pupils should learn to compose and partition numbers within 10 before moving on to formal addition and subtraction. Start with expressions (no = sign) before moving onto equations that have an = sign.

Children use a variety of model to represent subtraction including part, part, whole as well as bar model.


Figure 32: cherry partitioning model and subtraction equation ( $7-3=4$ )


Figure 29: bar model and subtraction equation (7-2=5)


8-3

## Partitioning

Pupils must understand that, in partitioning situations, the subtraction symbol represents a splitting up or differentiating of the whole.

The problem "There are 6 children altogether. 2 children are wearing coats. How many are not wearing coats?" is represented by $6-24=$. Here, the subtraction symbol represents the separation of the 2 children wearing coats, and so, the number of children not wearing coats is exposed.

How many children are not wearing coats?


Figure 25: subtraction as partitioning

## Reduction

Pupils must also be able to write and interpret expressions and equations to represent reduction (decreasing a quantity by taking some away). Note that 'take away' should only be used to describe the subtraction operation in reduction contexts.


Figure 27: subtraction as reduction

## Difference



## Language focus

"If I subtract 2 from an even number I get the previous even number, so 6 minus 2 is equal to 4 ."

Children use number sense when solving problems.


Figure 9: tens frames with counters showing that subtracting 2 from an even number gives the previous even number

## Objectives

- solve problems with addition and subtraction:
- using concrete objects and pictorial representations, including those involving numbers, quantities and measures
- applying their increasing knowledge of mental and written methods
- recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100
- add and subtract numbers using concrete objects, pictorial representations, and mentally, including:
- a two-digit number and 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
- recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.


## Key Skills

Addition

- 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. $35+47$ ) and 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.
Subtraction
- 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.


## Vocabulary <br> Addition

add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, addition, column, tens boundary
Subtraction
equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer / less than, most, least, count back, how many left, how much less is_? difference, count on, strategy, partition, tens, units

## Year 2 Addition

## Add across 10

Pupils need to have a strategy for confidently and fluently carrying out calculations such as: 7+ $5=12$ For both addition across 10 , tens frames and partitioning diagrams can be used to support pupils as they learn about these strategies.

First, pupils should learn to add three one-digit numbers by making 10, for example,


Figure 5: tens frames with counters, and a partitioning diagram, showing $7+5=12$
$7+3+2=10+2$. They can then relate this to addition of two numbers across 10 , by partitioning one of the addends, for example $7+5=7+3+2$

## 1) Add within 100 ( 2 multiples of ten, ones to/from a two-digit number and multiples of ten to/from a twodigit number)

Tens frames, Dienes and partitioning diagrams can be used to support pupils as they learn how to relate these calculations to one-digit calculations. Throughout, pupils
 should use spoken language to demonstrate their reasoning.

Language focus "4 plus 3 is equal to 7 . So 4 tens and plus 3 tens is equal to 7 tens."

## 2) Add within 100 (any $\mathbf{2}$ two-digit numbers)

To add 2 two-digit numbers, pupils need to combine onedigit addition facts with their understanding of two-digit place value. Pupils should first learn to add 2 multiples of ten and 2 ones before moving on to the addition of 2 two-


Figure 11: Dienes and an equation to support adding 2 two-digit numbers

Language focus "First I partition both numbers. Then I add the tens.
Then I add the ones. Then I combine all of the tens and all of the ones."

Pupils can then learn to be more efficient, by partitioning just one addend, for example:

$$
\begin{aligned}
45+23 & =45+20+3 \\
& =65+3
\end{aligned}
$$

## Pupils do not need to learn formal writ-

 ten methods for addition in Year 2, but column addition could be used as an alternative way to record two-digit calculations at this stage.For calculations such as $26+37$, pupils can begin to think about the 2 quantities arranged in columns under place-value headings of tens and ones.
They can use counters, dienes or draw dots for support .

| 10 s | 1 s |
| :--- | :---: |
| 000 | 00000 |
| 00 | 00000 |

$$
\left.\begin{array}{rl}
37+26 & =63 \\
30+20 & =50 \\
7+6 & =13 \\
50+13 & =63
\end{array}\right)
$$

Figure 21: adding 2 two-digit numbers using 10 s and 1 s columns

## Year 2 Subtraction

Pupils should practise additive calculation within 10 until they have automatic recall of the additive facts. Fluency in these facts is required for pupils to succeed with addition and subtraction across 10 (and for additive calculation with larger numbers). ( $66+/-$ Facts on Page 3)

## Subtract across 10

Use the 'subtracting through 10' strategy (partitioning the subtrahend) - part of the subtrahend is subtracted to reach 10 , then the rest of the subtrahend is subtracted from 10

## OR

the 'subtracting from 10' strategy (partitioning the minuend) - the subtrahend is subtracted from 10 , then the difference between the minuend and 10 is added.


Figure 6: using the 'subtracting through 10' strategy to calculate 15 minus 9


Finding the difference- pupils should recognise problems with difference and relate them to subtraction


There are 5 red cars and 3 blue cars. What is the difference between the number of red cars and blue cars?


Pupils should be able to recognise contextual problems involving finding a difference, phrased as 'find the difference', 'how many more' and 'how many fewer'. Pupils may solve these problems by relating them to either a missing addend equation or to subtraction, applying known facts and strategies.

## Estimate

Calculate
Check it!

1) Subtract within 100 ( 2 multiples of ten, ones to/from a two-digit number and multiples of ten to/from a two-digit number)


Tens frames, Dienes and partitioning diagrams can be used to support pupils as they learn how to relate these calculations to one-digit calculations. Language focus:
" 10 minus 3 is equal to 7 . So 30 minus 3 is equal to 27 ."

Figure 10: tens frames with counters, and number lines, to support subtracting ones from a multiple of 10
2) Add and subtract within 100 (any $\mathbf{2}$ two-digit numbers).

When pupils learn to subtract one two-digit number from another, the progression is similar to that for addition. Pupils can first learn to subtract a multiple of ten and some ones from a two-digit number, and then connect this to the subtraction of one two-digit number from another, for example:

There is an important difference compared to the addition strategy: pupils should not partition both two-digit numbers for subtraction as this can lead to errors, or calculations involving negative numbers, when bridging a multiple of 10 , for example:

| $63-17=46$ | $63-17=46$ |
| :---: | :---: |
| $63-10=53$ |  |
| $53-7=46$ |  |$\quad$| Figure $20:$ subtracting $\mathbf{1 7}$ from 63 by |
| :---: |
| subtracting the ones first |

# Addition and Subtraction 

## Objectives

- Add and subtract numbers mentally
- 3 digit number and 1 s
- 3 digit number and 10s
- 3 digit number and 100s
- Add and subtract numbers with up to 3 digits using formal written methods of columnar addition and subtraction.
- Estimate the answer to a calculation and use inverse operations to check the answers
- Solve problems including, missing number problems, using number facts, place value, and more complex addition and subtraction


## Key Skills

## Addition

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


## Subtraction

- 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


## Vocabulary

Addition
add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, plus, addition, column, tens boundary, hundreds boundary, increase, vertical, =carry', expanded, compact, addend, inverse,

## Subtraction

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

Developing mental fluency with addition and place value involving 3-digit numbers, then establish more formal methods. Use empty number lines, concrete equipment (Base 10, beadstrings etc.) to build confidence and fluency in mental addition skills.


## Fluently add within and across 10

Before pupils begin work on columnar addition, it is essential that pupils have automatic recall of addition and subtraction facts within and across 10.

## Scaling number facts by 10

Apply place-value knowledge to known additive facts (scaling facts by 10), for example: $8+6=14$ so $80+60=140$. Pupils can begin by using tens frames and counters as they did for calculation across 10, but now using 10-value counters

## Identifying core number facts:

 columnar addition

| 894 |
| :---: |
| 1 |

Figure 11: columnar addition of 465 and 429


Within-column calculations:

Complements to 100


Written Strategies

## Column Addition

Beginning with calculations that do not involve regrouping (no columns sum to 10 or more) pupils should:

- learn to lay out columnar calculations with like digits correctly aligned
- learn to work from right to left, adding the least significant digits first. Teachers should initially use place-value equipment, such as Dienes, to model the algorithms and help pupils make connections to what they already know about addition and subtraction.


Figure 20: columnar addition with no regrouping: calculation and Dienes representation

Pupils should use unitising language to describe within-column calculations.

## Language focus

" 3 ones plus 5 ones is equal to 8 ones." " 4 tens plus 2 tens is equal to 6 tens."
Pupils must also learn to carry out columnar addition calculations that involve regrouping. Dienes can be used to model the calculations, and to draw attention to this.

For calculations with more than 2 addends, pupils should add the digits within a column in the most efficient order.


Throughout, pupils should continue to recognise the inverse relationship between addition and subtraction. Pupils may represent calculations using partitioning diagrams or bar models, and should learn to check their answers using the inverse operation.

| 628 |  |
| :---: | :---: |
| 274 | 354 |

## Fluency of mental addition

The full set of addition calculations that pupils need for columnar addition are shown underneath. The number of facts to be learnt is reduced when commutativity is applied and pupils recognise that $7+5$, for example, is the same as $5+7$.

Automaticity in subtraction facts should also be developed through the application of the relationship between addition and subtraction, for example, pupils should recognise that if $7+5=12$ then $12-5=7$.

| $\mathbf{+}$ | $\mathbf{0}$ | $\mathbf{1}$ | $\mathbf{2}$ | $\mathbf{3}$ | $\mathbf{4}$ | $\mathbf{5}$ | $\mathbf{6}$ | $\mathbf{7}$ | $\mathbf{8}$ | $\mathbf{9}$ | $\mathbf{1 0}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathbf{0}$ | $0+0$ | $0+1$ | $0+2$ | $0+3$ | $0+4$ | $0+5$ | $0+6$ | $0+7$ | $0+8$ | $0+9$ | $0+10$ |
| $\mathbf{1}$ | $1+0$ | $1+1$ | $1+2$ | $1+3$ | $1+4$ | $1+5$ | $1+6$ | $1+7$ | $1+8$ | $1+9$ | $1+10$ |
| $\mathbf{2}$ | $2+0$ | $2+1$ | $2+2$ | $2+3$ | $2+4$ | $2+5$ | $2+6$ | $2+7$ | $2+8$ | $2+9$ | $2+10$ |
| $\mathbf{3}$ | $3+0$ | $3+1$ | $3+2$ | $3+3$ | $3+4$ | $3+5$ | $3+6$ | $3+7$ | $3+8$ | $3+9$ | $3+10$ |
| $\mathbf{4}$ | $4+0$ | $4+1$ | $4+2$ | $4+3$ | $4+4$ | $4+5$ | $4+6$ | $4+7$ | $4+8$ | $4+9$ | $4+10$ |
| $\mathbf{5}$ | $5+0$ | $5+1$ | $5+2$ | $5+3$ | $5+4$ | $5+5$ | $5+6$ | $5+7$ | $5+8$ | $5+9$ | $5+10$ |
| $\mathbf{6}$ | $6+0$ | $6+1$ | $6+2$ | $6+3$ | $6+4$ | $6+5$ | $6+6$ | $6+7$ | $6+8$ | $6+9$ | $6+10$ |
| $\mathbf{7}$ | $7+0$ | $7+1$ | $7+2$ | $7+3$ | $7+4$ | $7+5$ | $7+6$ | $7+7$ | $7+8$ | $7+9$ | $7+10$ |
| $\mathbf{8}$ | $8+0$ | $8+1$ | $8+2$ | $8+3$ | $8+4$ | $8+5$ | $8+6$ | $8+7$ | $8+8$ | $8+9$ | $8+10$ |
| $\mathbf{9}$ | $9+0$ | $9+1$ | $9+2$ | $9+3$ | $9+4$ | $9+5$ | $9+6$ | $9+7$ | $9+8$ | $9+9$ | $9+10$ |
| $\mathbf{1 0}$ | $10+0$ | $10+1$ | $10+2$ | $10+3$ | $10+4$ | $10+5$ | $10+6$ | $10+7$ | $10+8$ | $10+9$ | $10+10$ |

Develop mental fluency with subtraction and place value involving 3-digit numbers, then establish more formal methods. Use empty number lines, concrete equipment (Base 10, beadstrings, Numicon, hundred squares etc.) to build confidence and fluency in mental subtraction skills.

Fluently subtract within and across 10
Before pupils begin work on columnar subtraction, it is essential that pupils have automatic recall of addition and subtraction facts within and across 10.

| Identifying core number facts: <br> columnar subtraction | Within-column calculations: |
| :---: | :--- |
| 61 | $9-6=3$ |
| -749 | $7-1=6$ |
| -286 | $6-8=6$ |

Figure 12: columnar subtraction of 286 from 749

## Scaling number facts by 10

$$
\begin{aligned}
14-6 & =8 \\
140-60 & =80
\end{aligned}
$$

During year 3, pupils develop automaticity in addition and subtraction facts within 20 .To be ready to progress to year 4, pupils must also be able to combine these facts with unitising in tens, including: • scaling known additive facts within 10, for example, 90-60 $=30$

## Calculate complements to 100

This important skill, because it is a prerequisite for calculating how much change is due when paying for an item.


## Written Strategies

## Column Subtraction

Beginning with calculations that do not involve exchanging (no columns have a minuend smaller than the subtrahend), pupils should:

- learn to lay out columnar calculations with like digits correctly aligned
- learn to work from right to left, adding or subtracting the least significant digits first Teachers should initially use place-value equipment, such as Dienes, to model the algorithms and help pupils make connections to what they already know about addition and subtraction.

Pupils must also learn to carry out columnar subtraction calculations that involve exchange. Exchange build on pupils' understanding that 10 ones is equivalent to 1 ten, and that 10 tens is equivalent to 1 hundred. Dienes can be used to model the calculations, and to draw attention to the regrouping/exchange.

Throughout, pupils should continue to recognise the inverse relationship between addition and subtraction. Pupils may represent calculations using partitioning diagrams or bar models, and should learn to check their answers using the inverse operation.


Figure 21: columnar subtraction with no exchange: calculation and Dienes representation

$$
\begin{array}{r}
5128 \\
-\quad 274 \\
\hline 354
\end{array}
$$

| 628 |  |
| :---: | :---: |
| 274 | 354 |
| addend | addend | | sum |  |
| :---: | :---: | :---: |
| difference | subtrahend |

## 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.


## Key Skills

## Addition

- 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.

Subtraction

- 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.


## Vocabulary

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

Subtraction
equal to, take, take away, less, minus, subtract, leaves, distance be-tween, how many more, how many fewer / less than, most, least, count back, how many left, how much less is_? difference, count on, strategy, partition, tens, units exchange, decrease, hundreds, value, digit, subtrahend, minuend, inverse, decimal places, decimal point, tenths, hundredths, thousandths

## Mental Strategies

Develop confidence at calculating mentally with larger numbers including decimal numbers using the full range of strategies

As well as being able to partition numbers in the 'standard' way (into individual place value units), pupils must also be able to partition numbers in 'non-standard' ways, and carry out related addition and subtraction calculations, for example:

Reason about the location of any four-digit number in the linear number system, including identifying the previous and next multiple of 1,000 and 100 , and rounding to the nearest of each.


Explore different methods of bridging the thousands boundary, including the numberline, bar model and part part whole model.

## Scaling number facts by 100



Apply place-value knowledge to known additive and multiplicative number facts (scaling facts by 100), for example:

$8+6=14$ so $800+600=1,400$
For calculations such as $800+600=1,400$, pupils can begin by using tens frames and counters as they did for calculation across 10 (Year 2) and across 100 (Year 3), but now using 100 -value counters.

$$
1,003+10=1,113
$$

$$
1,003+100
$$



## Written Strategies

## Column Addition

Use the calculation approaches learnt for 3 digit numbers (Year 3) to be applied when adding 4 digit numbers (including tenths and hundredths)

Children should pay attention to placing digits in the correct columns, making

|  | 6, 5 | 8 | 4 |  | 3 , | 3 | 6 | 2 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| + | 2,7 | 3 | 9 | + |  | 6 | 4 | 9 |
|  | 9, 3 | 2 | 3 |  | 4, | 0 | 1 | 1 |
|  | 11 | 1 |  |  | 1 | 1 | 1 |  | sure to start adding digits from the ones column. Concrete apparatus can be used to develop confidence. Once children are confident, children will be able to extend this method to 4 digit numbers.

Give children opportunities to solve missing number problems starting with no regrouping, then regrouping once, then regrouping more than once.

| 1,649 |
| ---: |
| 3,104 |
| $+\quad 516$ | | 1.36 |
| ---: |
| 1.68 |$+$| 1. |
| :--- |

Addition with no regrouping


Addition with regrouping once


Addition with regrouping more than once


## Year 4 Subtraction

## Mental Strategies

Develop mental fluency with subtraction using a range of strategies. Children are encouraged to think about the best method for the numbers involved- more details is provided in the spine materials 1.22 . Use empty number lines, concrete equipment (Base 10, beadstrings, Numicon, hundred squares etc.) to build confidence and fluency in mental subtraction
Bar model:

| 1,200 or 12 hundred |  |
| :---: | :---: |
| 500 | $?$ |
| 5 hundred | $?$ |

Bar model

| 1,500 |  |
| :---: | :---: |
| 1,000 | 500 |
| $?$ | 600 |

Part-part-whole models:


Further strategies for subtracting e.g. 1200-700=500

'Five hundred plus seven hundred is equal to twelve hundred.'
'We know there are ten hundreds in one thousand, so five hundred plus seven hundred is equal to one thousand two hundred.'

Number line - working backwards:


- 'We know there are tenhundreds in one thousand, so one thousand two hundred is equal to twelve hundred.'
- 'Twelve hundred minus five hundred is equal to seven hundred.'

Partitioning:



Same difference method


Number lines:


## Written Strategies

## Column Subtraction

Recap previous learning on subtracting three digit numbers ( Y 3 Spine 1.21), and how this can be applied to four digit numbers (including tenths and hundredths)

Children should pay attention to placing digits in the correct column so ensure they start by subtracting digits from the right. Encourage children to make their calculations clear to follow where exchanging (for example, exchanging one ten for ten ones) is necessary.

Give children opportunities to solve missing number problems starting with no exchanging, then exchanging once, then exchanging more than once.


$$
\begin{array}{r}
5.03 \\
-2.48
\end{array}
$$



## 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.


## Key Skills

## Addition

- Add numbers mentally with increasingly large numbers, using and practising a range of mental strategies ie. 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 1000000 to the nearest $10,100,1000,10000$ and 100000.
- Add numbers with more than 4 digits using formal written method of columnar addition.


## Subtraction

- 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 in-tegers through 0.
- Round any number up to 1 million to the nearest 10, 100, 1000, 10000 and 100000.


## Vocabulary

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

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

## Mental Strategies

Develop confidence at calculating mentally with larger numbers and decimal numbers. Using the full range of strategies, including practical equipment such as counters and dienes. Decimal numbers were introduced in Year 4 (Spine 1.23 and 1.24) however recap may be needed.

- Non-bridging

- Bridging

- Connected calculations

- Doubling

- Near 'whole-ten' or 'whole-hundred thousands'

- Partitioning
$284,000+37,000=284,000+16,000+21,000$


problems to


Using the same sum rule in balance helps with bonds to 100,000


I've subtracted 16 from 16.45, so I must add 16 to 30.25 to keep the sum the same.'




## Written Strategies

Pupils should recap from Year 4 extended columnar addition methods to 5 and 6 digit number (and up to 2 decimal places). Pupils must be able to add 2 or more numbers using columnar addition, including calculations whose addends have different numbers of digits. For calculations with more than 2 addends, pupils should add the digits within a column in the most efficient order. Start where there is no grouping necessary. Provide children with ample practice For the fourth example below, efficient choices could include:

- beginning by making 10 in the tenths column • making double-6 in the ones column

Empty decimal places can be filled with zero to show the place
With place-value headings

| Thousands |  |  | Ones |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathbf{1 0 0 s}$ | $\mathbf{1 0 s}$ | $\mathbf{1 s}$ | $\mathbf{1 0 0 s}$ | $\mathbf{1 0 s}$ | $\mathbf{1 s}$ |
| 3 | 6 | 5 | 0 | 0 | 0 |
| 2 | 1 | 4 | 0 | 0 | 0 |
| 5 | 7 | 9 | 0 | 0 | 0 |


6.3
$+\quad 81.70 \quad 1.49$
$+25 \cdot 6$

| 3 | 3.39 |
| :--- | :--- |
| 1 | 1 |

## Without place-value headings

Model how to add a thousands
separator comma to make it
easier to read the sum.

Develop mental fluency with subtraction using a range of strategies. Children are encouraged to think about the best method for the numbers involved.
Using Place Value
$4.58-0.08=4.5$
$6.26-0.2=6.06$
Partitioning and counting back
$3964-1051=$
$3964-1000=2964$
$2964-50=2914$
$2914-1=2913$ or
$5.72-2.01=$
$5.72-2=3.72$
$3.72-0.1=3.62$
Number Facts
Derived facts from number bonds to 10
and 100 , and $£, £ 10$ and $£ 100$
$2-0.45$ using $45+55=100$
$3-0.86$ using $86+14=100$
0.

Written Strategies

## Special Strategy

## Counting on

Children are taught to recognise when numbers are close together it is more efficient to count on and find the difference.
$£ 12.05-£ 9.59=£ 2.46$


Special Strategy Rounding and adjusting Near multiples of $10,100,1000$ or $£ 1$ 3.58-1.99 =


Subtract with at least 4-digit numbers including money, measures and decimals. Compact column method
Subtracting with larger integers. Children who are still not secure with number facts and place value will need to remain on the partitioned column method until they are ready for the compact method.


Subtracting with decimals, including mixtures of integers and decimals, aligning the decimal point. Ensure plenty of opportunities for subtracting money and measures. Model using a 'zero' in any empty decimal places to aid layout.

|  |  | $7^{61} \cdot 2$ | 6 |  | $2{ }^{1} 11 \cdot 8^{7} 10$ |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | 1 | 5.8 | 3 | - |  |  | - 2 |  |
|  | 3 | $1 \cdot 4$ | 3 |  | 1 |  | $2 \cdot 5$ |  |



## 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


## Key Skills

## Addition

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


## Subtraction

- 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.


## Vocabulary

Addition
add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, plus, addition, column, tens boundary, hundreds boundary, increase, „carry",
expanded, compact, vertical, thousands, hundreds, digits, inverse, decimal places, decimal point, tenths, hundredths, thousandths
Subtraction
equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer / less than, most, least, count back, how many left, how much less is_? difference, count on, strategy, partition, tens, units exchange, decrease, hundreds, value, digit, inverse, tenths, hundredths, decimal point, decimal

## Mental Strategies

## Year 6 Addition

Develop confidence at calculating mentally with larger numbers and decimal numbers. Using the full range of strategies:

- Bridging through 60 when calculating with time
- Bridging through multiples of 1,10,100
$4.85+2.36=4.85+2$

$$
\begin{aligned}
& =6.85+0.15+0.21 \\
& =7.21
\end{aligned}
$$

## Counting on

Add two decimal numbers by adding the 1s, then the
$0 \cdot 1 \mathrm{~s} / 0 \cdot 01 \mathrm{~s} / 0.001 \mathrm{~s}$
e.g. $6 \cdot 314+3.006$ as $6.314+3$ (9.314) + $0 \cdot 006=9.32$
Add near multiples of 1
e.g. $6 \cdot 345+0.999$
e.g. $5.673+0.9$

## Jsing place value

Count in $0.1 \mathrm{~s}, 0.01 \mathrm{~s}, 0.001 \mathrm{~s}$ e.g. Know what 0.001 more than 6.725 is
Partitioning
e.g. $9 \cdot 54+3 \cdot 23$ as $9+3,0.5$ +0.2 and $0.04+0.03$, to give 12.77

## Rounding and adjusting

## Written Strategies

Add several numbers of increasing complexity including money, measures and decimals with different numbers of decimal places.
To support understanding children should physically make and carry out the calculation using base 10 or other apparatus then compare their practical version with the written form to develop conceptual understanding.

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
- Zeros could be used in any empty decimal places, to show there is no value to add.
- Cross out the "carries" when they have been added.

|  | 2 | 3 | 0 | 3 | 6 |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 1 |  |  |  |  |  |
|  |  | 9 | 0 | 0 | 8 |
| + | 5 | 9 | 0 | 7 | 7 |
|  |  | 1 | 0 | 3 | 0 |
|  | 9 | 3 | 0 | 5 | 1 |
|  | $z$ | 1 | $z$ |  | 1 |

Adding several numbers with more than 4 digits.


Develop mental fluency with subtraction using a wide range of strategies when calculating including decimal and increasingly larger numbers. Children are encouraged to think about the best method for the numbers involved.
Using Place Value
$7.782-0.08=7.702$
$16.263-0.2=12.063$

## Special Strategy

## Counting on

Partitioning and counting back
3964-1051=
$3964-1000=2964$
2964-50 = 2914
2914-1 = 2913 or
5.72-2.01 =
$5.72-2=3.72$
$3.72-0.1=3.62$
Children are taught to recognise when numbers are close together it is more efficient to count on and find the difference.
$1.2-0.87=0.33$


## Number Facts

Derived facts from number bonds to 10 and 100 , and $£, £ 10$ and $£ 100$
$0.1-0.075$ using $75+25=100$
$5-0.65$ using $65+35=100$ £100-£66.20 using 20p and 80 p $=£ 1$ and $£ 67+£ 33=£ 100$


Written Strategies

Special Strategy
Rounding and adjusting
Near multiples of $10,100,1000$ or $£ 1$
$12.831-0.99=11.841$


Subtract with increasingly large and more complex numbers and decimal values. Compact column method
Subtracting with more complex integers.

and measures, including deci-
Subtracting money mals with different numbers of decimal places. Empty decimal places can be filled with zero to show the place value in each column.


