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# Teaching Calculations

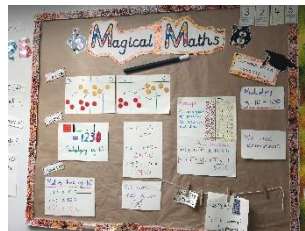


# Teaching Calculations at XXXXX Primary School

This document sets out the expectations for each year group in terms of calculations strategies which will be taught, explored and applied to a range of contexts.

## Concrete, Pictorial, Abstract

The children's understanding of these calculation strategies will be underpinned by a secure understanding of place value. At XXXXX we teach through a CPA (concrete, pictorial, abstract) approach. Understanding in all areas of maths will be developed by children using concrete resources and interpreting and using pictorial representations before moving onto solve abstract calculations. There are a range of place value and counting resources available for the children to use in each classroom. The CPA process/approach will be clearly exemplified on maths working walls for the current maths focus.



## Checking Children's Understanding

Teachers will be aware, not only of their year group's expectations but those the children have learnt previously. It is important that teachers check the children's understanding of the previous teaching before moving on, in order for the children to really master the mathematics curriculum. Where individuals or groups of children do not show a secure understanding of what has been taught previously, it will be necessary to track back, either through whole-class teaching or individual or group intervention (boost sessions).

## Mental Strategies

This document also contains essential information about the mental strategies that children will be taught. It is of vital importance that these are given high-priority during maths teaching and practised regularly, so that children have the skills which are required across all areas of maths.

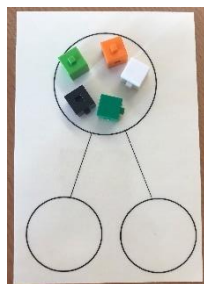
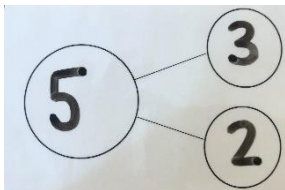
# ADDITION

## Year 1

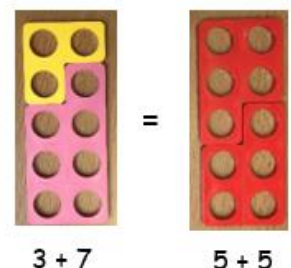
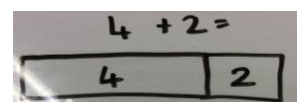
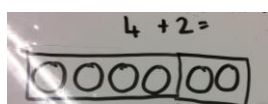
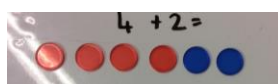
National Curriculum Objectives: Addition objectives from Addition and Subtraction Strand	Key Skills/ other linked NC Objectives (Place Value)	Key Vocabulary
<ul style="list-style-type: none"> <li>• Read, write and interpret mathematical symbols involving addition (+) and equals (=) signs.</li> <li>• Represent and use number bonds within 20.</li> <li>• Add one-digit and two-digit numbers to 20, including 0.</li> <li>• Solve one step problems that involve addition, using concrete objects and pictorial representations and missing number problems.</li> </ul>	<ul style="list-style-type: none"> <li>• Count forwards to and across 100, beginning with 0 or 1, or from any given number.</li> <li>• Count, read and write numbers to 100 in numerals.</li> <li>• Given a number, identify one more.</li> <li>• Identify and represent numbers using objects and pictorial representations including the number line.</li> <li>• Read and write numbers from 1-20 in numerals and words.</li> </ul>	<p>Addition, add, altogether, put together, sum, and, plus, total</p> <p>Equals, equal to, makes</p> <p>more than, less than, fewer, most, least</p>

### 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. They should explore number and the different ways the numbers can be partitioned (representing and using number bonds within 20).



- Read and write the addition (+) and equals (=) signs within number sentences. Specific learning should take place, through exploration of number, around the equals sign, ensuring children understand it's role within a number sentence and that it does not always just indicate where the answer goes.



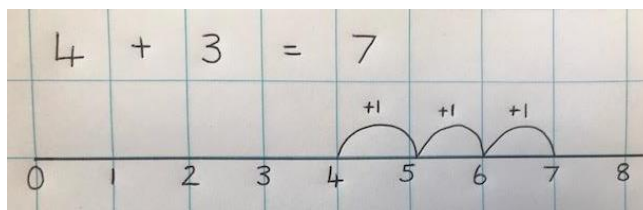
- Interpret addition number sentences and solve missing box problems, using concrete objects and number line addition to solve them:  $8 + 3 = \square$ ,  $\square = 15 + 4$  and  $14 = \square + 9$ .
- Where children are not yet secure in their Early Learning Goals, they should be given the opportunity to consolidate these foundations.

**Mental Methods**– The children should be taught to use the following mental strategies, and to use jottings to support their methods:

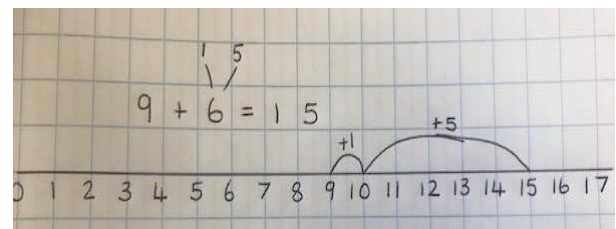
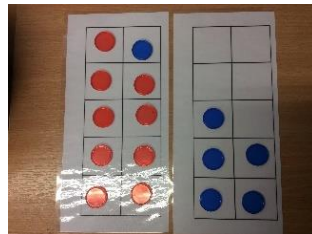
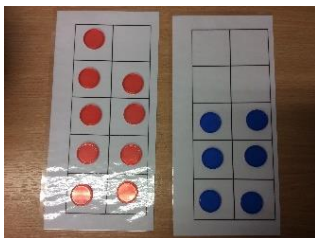
- Counting on in ones
- Re-ordering the numbers when adding e.g. put the larger number first
- Counting on and back in ones, twos and tens
- Looking for pairs of numbers that equal 10
- Partitioning small numbers to bridge tens e.g.  $8+3 = 8+2+1$
- Partitioning using known facts e.g. double and adjust  $5+6 = 5+5+1$
- Adding 9 to a number by adding 10 and then subtracting 1
- Recalling number bonds to 10 and 20 in several different forms (e.g.  $9+7 = 16$ ,  $16-7=9$  and  $7=16-9$ )

**Written Methods:** Building on the prior learning, and exploration of number outlined above, children should:

**Step 1** – Use numbered number lines to add, by counting on in ones. Children should be encouraged to start with the larger number.



**Step 2** – Once confident using a number line for addition, children should be taught to use their understanding of partitioning numbers and number bonds to bridge tens.



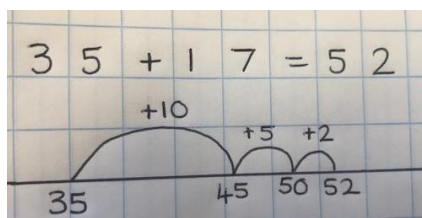
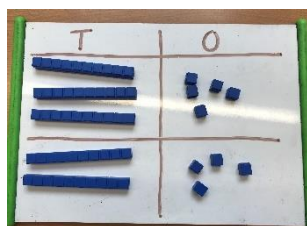
# ADDITION

## Year 2

National Curriculum Objectives: Addition objectives from Addition and Subtraction Strand	Key Skills/ other linked NC Objectives (Place Value)	Key Vocabulary
<p>Solve problems with addition</p> <ul style="list-style-type: none"> <li>Using concrete objects and pictorial representations, including those involving numbers, quantities and measures.</li> <li>Apply their increasing knowledge of mental and written methods.</li> </ul> <p>Add numbers using concrete objects, pictorial representations and mentally:</p> <ul style="list-style-type: none"> <li>Add two-digit numbers and ones.</li> <li>Add two-digit numbers and tens.</li> <li>Add two, two-digit numbers.</li> <li>Add three one-digit numbers.</li> <li>Recall and use addition facts up to 20 fluently and derive and use related facts up to 100.</li> <li>Show that addition can be done in any order.</li> <li>Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing box number problems.</li> </ul>	<ul style="list-style-type: none"> <li>Count in steps of 2, 3 and 5 and count in tens from any number</li> <li>Understand the place value of 2-digit numbers (tens, ones)</li> <li>Compare and order numbers to 100 and use <math>&lt;</math>, <math>&gt;</math> and <math>=</math> signs.</li> <li>Read and write numbers to at least 100 in numerals and words.</li> <li>Identify, represent and estimate numbers using different representations, including the number line.</li> </ul>	<p>Addition, add, altogether, put together, sum, and, plus, total</p> <p>Equals, equal to, makes</p> <p>more than, less than, fewer, most, least, double</p> <p><i>N.B: Same vocabulary as Year 1, to be consolidated and extended in different contexts.</i></p>

### Children should:

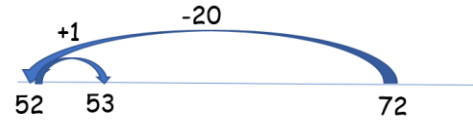
- Have access to a wide range of practical resources and equipment, counting materials, models and images and should be given the opportunity to use these to support their understanding of mental and written methods at all stages.



- Spend time learning and practising mental methods for addition, starting with questions which do not cross boundaries and progressing to those that do. This will include exploring number and different ways to partition number, to support addition strategies as well as adding the nearest multiple of 10 and adjusting (e.g. to add 9, 19 etc.), using near doubles and partitioning and recombining.

**Mental Methods:** The children should be taught to use the following mental strategies, and to use jottings to support their methods:

- Reordering numbers when adding
- Count on in tens or ones
- Using knowledge of pairs making 10 and place value
- Compensating: add 9, 19, 11 or 21
- Compensating: doubling and adjusting.
- Partitioning: Bridge through 10 when adding.
- Partition and combine multiples of tens and ones.
- Looking for number bonds/known facts when adding 3 one-digit numbers.

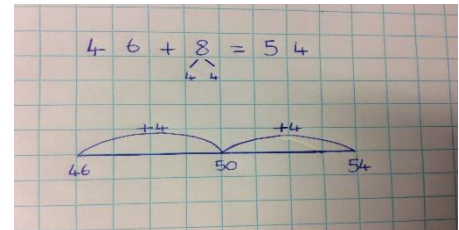


### Steps for Written Methods:

All steps to be supported by concrete and pictorial, with a focus on Year 2 children becoming confident in using a blank number line as a jotting for their mental method as well as a pictorial representation to prepare them for more formal written methods in the future.

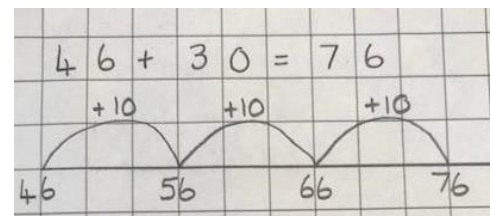
#### Step 1: Add two-digit numbers and ones

Children consolidate and extend their learning from year 1



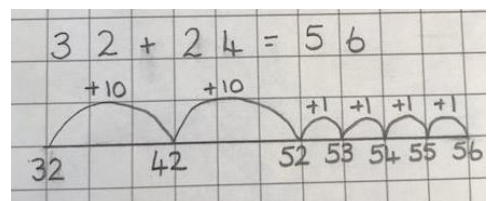
#### Step 2: Adding tens to a two-digit number

Children build on their previous learning and progress from adding one-digit numbers to adding multiples of 10.



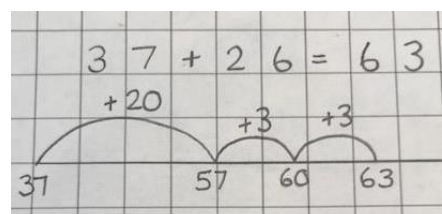
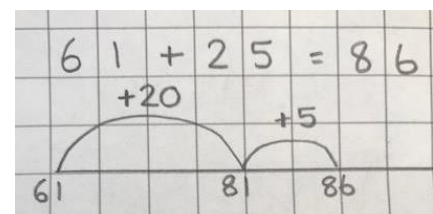
#### Step 3: Adding two, two-digit numbers

Once confident with the above, and using their ability to partition two-digit numbers into tens and ones, children add two two-digit numbers on a number line.



#### Step 4: Using number lines efficiently

When children are showing a secure understanding of the above steps, they should be taught to use number lines to calculate in the most efficient way. This will include partitioning numbers to bridge tens, as in the second example.



## Step 5: Partitioned Column Method (Year 2 if appropriate and Year 3)

Those children who are ready, **may** progress to a partitioned column method. Children to progress **only** when they have really **mastered** the **previous steps and have shown understanding through their mental methods.**

Children to work with examples which do not cross boundaries first and working left to right, before progressing (if they are ready) to those which do cross boundaries and working right to left)



$$36 + 25$$

$$50 + 11 = 61$$

$$30 + 6$$

$$20 + 5$$


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$$50 + 11 = 61$$

$$50 + 9 = 59$$

$$30 + 6$$

$$+ 20 + 5$$


---


$$60 + 1$$

$$10$$

$$32 + 27$$

$$30 + 2$$

$$20 + 7$$


---


$$50 + 9 = 59$$

$$36$$

$$+ 25$$


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$$11 \quad (6 + 5)$$

$$+ 50 \quad (30 + 20)$$


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$$61$$

$$\begin{array}{r} 32 \\ + 27 \\ \hline 59 \end{array}$$

$$\begin{array}{r} 36 \\ + 25 \\ \hline 61 \\ \hline 1 \end{array}$$

# ADDITION

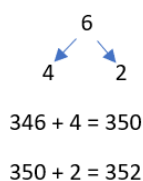
## Year 3

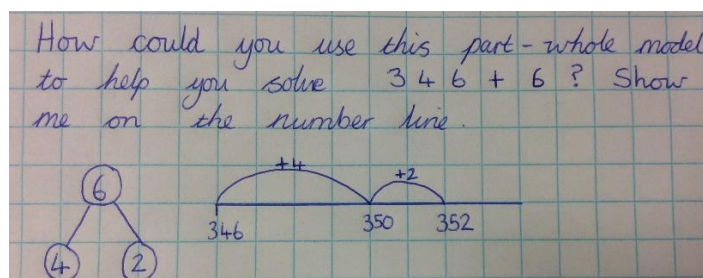
National Curriculum Objectives: Addition objectives from Addition and Subtraction Strand	Key Skills/ other linked NC Objectives (Place Value)	Key Vocabulary
<ul style="list-style-type: none"><li>• Add numbers mentally, including three-digit numbers and ones.</li><li>• Add numbers mentally, including three-digit numbers and tens.</li><li>• Add numbers mentally, including three-digit numbers and hundreds.</li><li>• Add numbers with up to 3 digits, using formal written method of columnar addition.</li><li>• Estimate the answer to a calculation and use inverse operations to check answers.</li><li>• Solve problems including missing number problems, using number facts, place value, and more complex addition.</li></ul>	<ul style="list-style-type: none"><li>• Find 10 or 100 more than a given number.</li><li>• Recognise the place value of each digit in a three-digit number.</li><li>• Identify, represent and estimate numbers using different representations.</li><li>• Read and write numbers up to 1000 in numerals in words.</li><li>• Compare and order numbers up to 1000.</li></ul>	<p><i>KS1 Vocab plus:</i></p> <p>Combined, more, column, carrying, expanded, compact</p>

### Children should:

- Have access to a wide range of practical resources and equipment, counting materials, models and images and should be given the opportunity to use these to support their understanding of mental and written methods at **all stages**.
- Spend time learning and practising mental methods for addition, starting with questions which do not cross boundaries and progressing to those that do. This will include exploring number and different ways to partition number, to support addition strategies as well as adding the nearest multiple of 10 and adjusting (e.g. to add 9, 99 etc.), using near doubles and partitioning and recombining.

Calculate 346 add 6=


$$\begin{array}{c} 6 \\ \swarrow \quad \searrow \\ 4 \quad 2 \end{array}$$
$$346 + 4 = 350$$
$$350 + 2 = 352$$





**Mental Methods:** The children should be taught to use the following mental strategies, and to use jottings to support their methods, where appropriate:

- Counting on in hundreds, tens and ones to find the total.
- Partitioning into hundreds, tens, and ones in different ways, then recombine ( $824 = 800 + 20 + 4$ ,  $824 = 700 + 110 + 14$ ).
- Reorder the numbers when adding.
- Bridge through a multiple of 10, then adjust.
- Use known facts and place value to add
- Use patterns of similar calculations
- Compensating: add or subtract 10, 20 or 100 and adjust.

### Steps for Written Methods:

#### Carrying in the ones column only

**Step 1:** To apply expanded column methods from Y2 when adding three-digit numbers. This may be new teaching for the children, depending on whether they were ready for this in Year 2. Therefore, they may need to track back.



$$\begin{array}{l} 437 = 400 + 30 + 7 \\ + 225 = 200 + 20 + 5 \\ \hline 600 + 50 + 12 = 662 \end{array}$$

**Step 2:** Introduce the expanded column method.



$$\begin{array}{r} 437 \\ + 225 \\ \hline 12 \quad (7+5) \\ 50 \quad (30+20) \\ 600 \quad (400+200) \\ \hline 662 \end{array}$$

Step 2 and Step 3 can be taught alongside each other to ensure the children understand the value of the numbers they are adding in the compact method.

Add the ones column first, in preparation for the compact method.

**Step 3:** Move to the compact column addition, first without carrying and then with.



$$\begin{array}{r} 437 \\ + 225 \\ \hline 662 \\ \hline 1 \end{array}$$

Add the ones first.

Carry numbers underneath the bottom line.

## Carrying in the tens column only

**Step 1:** To apply expanded column methods from Y2 when adding three-digit numbers. This may be new teaching for the children, depending on whether they were ready for this in Year 2. Therefore, they may need to track back.



$$\begin{array}{r} 237 \\ + 82 \\ \hline \end{array} = \begin{array}{l} 200 + 30 + 7 \\ \quad \quad \quad 80 + 2 \\ \hline 200 + 110 + 9 = 319 \end{array}$$

**Step 2:** Introduce the expanded column method.



$$\begin{array}{r} 237 \\ + 82 \\ \hline \quad \quad 9 \quad (7+2) \\ \quad 110 \quad (30+80) \\ \quad 200 \quad (200+0) \\ \hline 319 \end{array}$$

Step 2 and Step 3 can be taught alongside each other to ensure the children understand the value of the numbers they are adding in the compact method.

Add the ones column first, in preparation for the compact method.

**Step 3:** Move to the compact column addition, first without carrying and then with.



$$\begin{array}{r} 237 \\ + 82 \\ \hline 319 \\ 1 \end{array}$$

Add the ones first.  
Carry numbers underneath the bottom line.

Ensure correct use of vocabulary throughout. E.g. we are adding 3 tens and 8 tens (30 and 80) to make 11 tens or 110, as opposed to 3 and 8 equals 11.

## Carrying in the ones and the tens column

**Step 1:** To apply expanded column methods from Y2 when adding three-digit numbers. This may be new teaching for the children, depending on whether they were ready for this in Year 2. Therefore, they may need to track back.

$$\begin{array}{r} 238 \\ + 87 \\ \hline \end{array} = \begin{array}{r} 200 + 30 + 8 \\ + 80 + 7 \\ \hline 200 + 110 + 15 = 325 \end{array}$$

**Step 2:** Introduce the expanded column method.

$$\begin{array}{r} 238 \\ + 87 \\ \hline 110 \quad (8+7) \\ + 200 \quad (30+80) \\ \hline 325 \end{array}$$

Add the ones column first, in preparation for the compact method.

Step 2 and Step 3 can be taught alongside each other to ensure the children understand the value of the numbers they are adding in the compact method.

**Step 3:** Move to the compact column addition, first without carrying and then with.

$$\begin{array}{r} 238 \\ + 87 \\ \hline 325 \\ \phantom{0}1 \phantom{0} \end{array}$$

Add the ones first. Carry numbers underneath the bottom line.

# ADDITION

## Year 4

National Curriculum Objectives: Addition objectives from Addition and Subtraction Strand	Key Skills/ other linked NC Objectives (Place Value)	Key Vocabulary
<ul style="list-style-type: none"><li>• Add numbers with up to 4 digits using the formal methods of columnar addition where appropriate.</li><li>• Estimate and use the inverse operations to check answers to a calculation.</li><li>• Solve two-step addition problems in contexts, deciding which operations to use and why.</li></ul>	<ul style="list-style-type: none"><li>• Find 1,000 more than a given number.</li><li>• Recognise the place value of each digit in a four-digit number.</li><li>• Identify, represent and estimate numbers using different representations.</li><li>• Compare and order numbers beyond 1000.</li></ul>	<p><i>All previously taught vocabulary, plus:</i></p> <p>Inverse, operation, opposite, increase</p>

### Children should:

- Have access to a wide range of practical resources and equipment, counting materials, models and images and should be given the opportunity to use these to support their understanding of mental and written methods at all stages.
- Be given time to extend their previous work on adding multiples of 10 and 100 to adding 1000s too.
- Spend time learning and practising mental methods for addition. This will include exploring number and different ways to partition number, to support addition strategies as well as adding the nearest multiple of 10, 100 and 1000 and adjusting (e.g. to add 9, 49, 99, 999 etc), using near doubles and partitioning and recombining.

**Mental Methods:** The children should be taught to use the following mental strategies, and to use jottings to support their methods, where appropriate:

- Count in steps of thousands, hundreds, tens and ones.
- Reorder numbers in a calculation
- Add 3 or 4 small numbers
- Partition: adding the most significant digit first
- Compensating: doubling and adjusting
- Compensating: Adding the nearest multiple of 10 or 100 and then adjust
- Using knowledge of place value and related calculations e.g. working out  $150 + 140 = 290$  by using  $15 + 14 = 29$ .

## Written Methods:

Recap the children's understanding of Year 3 calculation strategy, moving to the compact column method adding the ones first and carrying numbers underneath the calculation.



$$\begin{array}{r} 3721 \\ + 498 \\ \hline 4219 \\ \text{1} \quad \text{1} \end{array}$$

Ensure correct use of vocabulary throughout. E.g. we are adding 7 hundreds and 4 hundreds, not 7 add 4 for example.

Teach children to apply their use of the column methods to decimal numbers.



$$\begin{array}{r} £ 24.32 \\ £ 12.84 \\ \hline £ 37.16 \\ \text{1} \end{array}$$

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.

Apply column method to money and measurement values.

# ADDITION

## Year 5

National Curriculum Objectives: Addition objectives from Addition and Subtraction Strand	Key Skills/ other linked NC Objectives (Place Value)	Key Vocabulary
<ul style="list-style-type: none"><li>• Add whole numbers with more than 4 digits, including using formal written methods (columnar addition).</li><li>• Add increasingly large numbers mentally.</li><li>• Solve addition multi-step problems in contexts, deciding which operations and methods to use and why.</li></ul>	<ul style="list-style-type: none"><li>• Read, write and compare numbers to at least 1,000,000 and determine the value of each digit.</li><li>• Count forwards in steps of powers of ten for any given number up to 1,000,000.</li></ul>	<p><i>All previously taught vocabulary, plus</i></p> <p>Tenths, hundredths, thousandths, decimal places, decimal point</p>

### Children should:

- Have access to a wide range of practical resources and equipment, counting materials, models and images and should be given the opportunity to use these to support their understanding of mental and written methods at all stages.
- Spend time learning and practising mental methods for addition. This will include exploring number and different ways to partition number, to support addition strategies as well as adding the nearest multiple of 10, 100 and 1000 and adjusting (e.g. to add 9, 49, 99, 999 etc.); using near doubles; partitioning and recombining; inverse and using number bonds.

**Mental Methods:** The children should be taught to use the following mental strategies, and to use jottings to support their methods, where appropriate:

- Counting on in steps of 0.1, 1, 10, 100 or 1,000
- Reorder the numbers in a calculation
- Partitioning, adding the most significant digit first
- Compensating: Add a multiple of 10, 100 or 1,000 and adjust.
- Compensating: Double and adjust.
- Use knowledge of place value and related calculations e.g.  $6.3 + 4.8$  using  $63 + 48$

## Written Methods:

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

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



$$\begin{array}{r} £ 24.32 \\ £ 12.84 \\ \hline £ 37.16 \\ \phantom{£} 1 \end{array}$$

Numbers should exceed 4 digits.



$$\begin{array}{r} 23438 \\ + 2725 \\ \hline 26163 \\ \phantom{26163} 1 \phantom{00} \end{array}$$

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

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



$$\begin{array}{r} 19.01 \\ + 3.82 \\ + 0.60 \\ \hline 23.43 \\ \phantom{23.43} 1 \phantom{00} \end{array}$$

Empty decimal places could be filled with zero to show the place value of the column.

Ensure correct vocabulary is used throughout. E.g. 6 tenths and 7 tenths equals 13 tenths.

# ADDITION

## Year 6

National Curriculum Objectives: Addition objectives from Addition, subtraction, multiplication and division strand.	Key Skills/ other linked NC Objectives (Place Value)	Key Vocabulary
<ul style="list-style-type: none"><li>• Perform mental calculations, including with mixed operations and large numbers.</li><li>• Use their knowledge of the order of operations to carry out calculations involving the four operations.</li><li>• Solve addition multi-step problems in contexts, deciding which operations and methods to use and why.</li><li>• Solve problems involving four-operations.</li><li>• Use estimation to check answers to calculations.</li></ul>	<ul style="list-style-type: none"><li>• Read, write, order and compare numbers up to 10,000,000 and determine the value of each digit.</li></ul>	<i>Consolidate use of all previously taught vocabulary.</i>

### Children should:

- Have access to a wide range of practical resources and equipment, counting materials, models and images and should be given the opportunity to use these to support their understanding of mental and written methods at all stages.
- Spend time learning and practising mental methods for addition. This will include exploring number and different ways to partition number, to support addition strategies as well as adding the nearest multiple of 10, 100 and 1000 and adjusting (e.g. to add 9, 49, 99 999 etc.); using near doubles; partitioning and recombining; inverse and using number bonds.

**Mental Methods:** The children should be taught to use the following mental strategies, and to use jottings to support their methods, where appropriate.

- Consolidate all strategies from previous years
- Partition, adding the most significant digit first
- Compensating: adding a whole number, multiple of 10 or double and adjust.
- Use knowledge of place value and related calculations e.g.  $680 + 430$ ,  $6.8 + 4.3$ ,  $0.68 + 0.43$  can all be worked out using the related calculation  $68 + 43$ .



## Written Methods:

Written method of column addition should be used in a variety of contexts and with numbers of increasing size and complexity.

This should include addition several numbers with different numbers of decimal places (including in the context of measures and money).

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

Zeros should be added into empty decimal places to show there is no value to add.



$$\begin{array}{r} 23.361 \\ + 9.080 \\ \hline 52.300 \\ 84.741 \end{array}$$

Adding several numbers with more than four-digits.



$$\begin{array}{r} 82631 \\ + 3425 \\ \hline 213625 \\ 299681 \end{array}$$