Bickley Primary School
Written Calculation Policy

The aim of this policy is to set out the progression in the teaching of written addition, subtraction, multiplication and division calculation strategies. If you are unsure which strategies your child is familiar with, please speak to their class teacher.

Expectations
Listed below are the expectations in number and calculation for the end of each year group in Key Stages 1 and 2. A range of strategies are used to support your child in achieving these expectations by the end of the relevant year. Please note that these are the expectations for the **majority** of children. Some children will exceed these and some will not yet meet them.

Year 1

Number and place value

- count to and across 100, forwards and backwards, beginning with 0 or 1, or from any given number
- count, read and write numbers to 100 in numerals; count in multiples of twos, fives and tens
- given a number, identify one more and one less
- identify and represent numbers using objects and pictorial representations including the number line, and use the language of: equal to, more than, less than (fewer), most, least
- read and write numbers from 1 to 20 in numerals and words

Addition and subtraction

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

Multiplication and division

- solve one-step problems involving multiplication & division, by calculating the answer using concrete objects, pictorial representations & arrays with the support of the teacher

Year 2

Number and place value

- count in steps of 2, 3, and 5 from 0, and in tens from any number, forward and backward
- recognise the place value of each digit in a two-digit number (tens, ones)
- identify, represent and estimate numbers using different representations, including the number line
- compare and order numbers from 0 up to 100; use <, > and = signs
- read and write numbers to at least 100 in numerals and in words
- use place value and number facts to solve problems

Addition and subtraction

- 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

Multiplication and division

- recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers
- calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs
- show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot
- solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts.

Year 3

Number and place value

- count from 0 in multiples of 4, 8, 50 & 100; find 10 or 100 more or less than a given number
- recognise the place value of each digit in a three-digit number (hundreds, tens, ones)
- compare & order numbers up to 1 000
- identify, represent & estimate numbers using different representations
- read & write numbers up to 1 000 in numerals & in words
- solve number problems & practical problems involving these ideas

Addition and subtraction

- add & subtract numbers mentally, including:
  – a three-digit number & ones
  – a three-digit number & tens
  – a three-digit number & hundreds
- add & subtract numbers with up to three digits, using formal written methods of columnar addition & subtraction
- solve problems, including missing number problems, using number facts, place value, & more complex addition & subtraction

Multiplication and division

- recall & use multiplication & division facts for the 3, 4 & 8 multiplication tables
- write & calculate mathematical statements for multiplication & division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental & progressing to formal written methods
- solve problems, including missing number problems, involving x & ÷, including positive integer scaling problems & correspondence problems in which n objects are connected to m objects
- estimate the answer to a calculation & use inverse operations to check answers

Year 4

Number and place value

- count in multiples of 6, 7, 9, 25 & 1000
- find 1000 more or less than a given number
- count backwards through zero to include negative numbers
- recognise the place value of each digit in a four-digit number (thousands, hundreds, tens, & ones)
- order & compare numbers beyond 1000
- identify, represent & estimate numbers using different representations
- round any number to the nearest 10, 100 or 1000
- solve number & practical problems that involve all of the above & with increasingly large positive numbers
- read Roman numerals to 100 (I to C) & know that over time, the numeral system changed to include the concept of zero & place value

Addition and subtraction

- add & subtract numbers with up to 4 digits using the formal written methods of column addition & subtraction where appropriate
- solve addition & subtraction two-step problems in contexts, deciding which operations & methods to use & why

Multiplication and division

- recall multiplication & division facts for multiplication tables up to 12 ×12
- use place value, known & derived facts to multiply & divide mentally, including: multiplying by 0 & 1; dividing by 1; multiplying together three numbers
- recognise & use factor pairs & commutativity in mental calculations
- multiply two-digit & three-digit numbers by a one-digit number using formal written layout
- estimate & use inverse operations to check answers to a calculation
- solve problems involving multiplying & adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects

Year 5

Number and place value

- read, write, order & compare numbers to at least 1 000 000 & determine the value of each digit
- count forwards or backwards in steps of powers of 10 for any given number up to 1000 000
- interpret negative numbers in context, count forwards & backwards with positive & negative whole numbers, including through zero
- round any number up to 1 000 000 to the nearest 10, 100, 1 000, 10 000 & 100 000
- solve number problems and practical problems that involve all of the above
- read Roman numerals to 1 000 (M) & recognise years written in Roman numerals

Addition and subtraction

- add & subtract numbers mentally with increasingly large numbers
- add & subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition & subtraction)
- solve addition & subtraction multi-step problems in contexts, deciding which operations & methods to use & why
- solve addition & subtraction multi-step problems in contexts, deciding which operations & methods to use & why

Multiplication and division

- multiply & divide numbers mentally drawing upon known facts
- identify multiples & factors, including finding all factor pairs of a number, & common factors of two numbers
- know & use the vocabulary of prime numbers, prime factors & composite (non-prime) numbers
- establish whether a number up to 100 is prime & recall prime numbers up to 19
- multiply & divide whole numbers & those involving decimals by 10, 100 & 1000
- recognise & use square numbers & cube numbers, & the notation for squared (2) & cubed (3)
- multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers
- divide numbers up to 4 digits by a one-digit number using the formal written method of short division & interpret remainders appropriately for the context
- solve problems involving multiplication & division including using their knowledge of factors & multiples, squares & cubes
- solve problems involving multiplication & division, including scaling by simple fractions & problems involving simple rates
- use rounding to check answers to calculations & determine, in the context of a problem, levels of accuracy
- solve problems involving addition, subtraction, multiplication & division & a combination of these, including understanding the meaning of the equals sign

Year 6

Number and place value

- read, write, order and compare numbers up to 10 000 000 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
- solve number and practical problems that involve all of the above

Addition, subtraction, multiplication and division

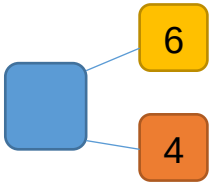
- multiply multi-digit numbers up to 4 digits by a two digit whole number using the formal written method of long multiplication
- divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context
- divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context
- perform mental calculations, including with mixed operations and large numbers
- identify common factors, common multiples and prime 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

Progression in Calculations

Children will begin to learn each calculation strategy using a practical (concrete) approach. This will include the use of cubes, counters, bead strings and other objects. They will then move to using pictorial representations, which could include using number lines (including 'empty' number lines with no numbers pre-drawn), pictures of objects, or drawing dots / marks to represent amounts. Children will then move to the abstract stage, which involves using numerals to represent amounts. The concrete and pictorial approaches can also include the use of written numerals to support the children's understanding.

This policy is specifically related to **written** calculation methods. If you require more information about concrete and pictorial methods, please refer to our entire calculation policy.

Addition

Objective and Strategies	Method
Combining two parts to make a whole: part-part whole model	 Use the part-part whole diagram as shown to move into the abstract. 10= 6 + 4
Starting at the bigger number and counting on	5 + 12 = 17 Place the larger number in your head (in this case, 12) and count on the smaller number (in this case, 5) to find your answer. This could include the use of fingers or counters for support.
Regrouping to make 10.	7 + 4= 11 Partition the smaller number to make the next 10 and then add the rest on. This means: partition the 4 into 3 and 1. Add the 3 to the 7, making 10. Then add the one to make 11.
Adding three single digits	Always look for bonds to 10 wherever possible. Combine the two numbers that make 10 and then add on what is left. 4 + 7 + 6 = 10 + 7 10 = 17

Adding 2 two-digit numbers

Partition numbers into 10s and ones
21 + 43 = ?
20 + 40 = 60 Add the tens first
1 + 3 = 4 Then add the ones
21 + 43 = 63 Lastly, add the tens and ones together to get the answer

Column method- no regrouping

If there is no regrouping, it means that the ones digits will not add to more than 10, the 10s will not add to more than 100 etc.

21 + 43 = 64

```
  21
+ 43
  64
```

Start with the ones first, then add the tens.
Add the 1 and 3 to make 4.
Add the 20 and 40 to make 60 (place a 6 to represent 6 lots of 10)
The answer is 64.

Column method- with regrouping

```
20  +  5
40  +  8
60  +  13  = 73
```

Add the ones first and put the answer underneath.
Then add the tens.
Combine both numbers to reach the total.

```
 536
+ 85
 621
 11
```

Add the ones first. If the answer is more than 10, place the ten in the tens column (represented by 1) and the ones in the ones column.
Continue moving from right to left along the columns, remembering to add any extra 10s or 100s as necessary.

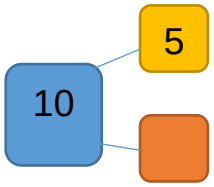
As the children move on, the same method can be used with decimals. It is important to make sure all the decimal points line up.

```
   £ 2 3 . 5 9
+  £   7 . 5 5
-------------
   £ 3 1 . 1 4
     1 1   1
```

```
  2 3 . 3 6 1
    9 . 0 8 0
  5 9 . 7 7 0
+ 1 . 3 0 0
-----------
  9 3 . 5 1 1
  2 1   2
```

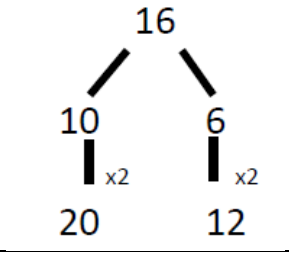
```
  72.8
+ 54.6
 127.4
 1 1
```

Subtraction

Objective and Strategies	Method
Taking away ones	18 - 3= 15 8 – 2 = 6 Children would start by using objects to represent the whole group then move some to a different place and count the number remaining.
Counting back	13 – 4 = 9 Put 13 in your head, count back 4. What number did you get to? Use your fingers to help.
Find the difference	Hannah has 23 sandwiches, Helen has 15 sandwiches. Find the difference between the number of sandwiches. This could be done by starting at 15 and counting on until you reach 23. How many did you add on? That is the difference. 23 – 15 = 8
Part- Part Whole Model	 Move to using numbers within the part whole model. eg 10 - 5 = 5
Make 10	16 – 8= 8 How many do we take off to reach the next 10? How many do we have left to take off? In this example, you would split the 8 into 6 and 2. Take the 6 away first to get to 10, then take away 2 to get to 8.

Column method without regrouping	47 – 24 = 23 40 and 7 - 20 and 4 20 and 3 = 23 This will lead to a clear written column subtraction. 47 -24 23
Column method with regrouping	836 – 254 = 582 Children will start their formal written method by partitioning the number into clear place value columns. Being able to understand this method relies heavily on a good understanding of the value of each digit. Children will use practial equipment to physically exchange counters before moving to the written stage. H T O ^{7}~~8~~ ^{1}3 6 -2 5 4 5 8 2 This will lead to an understanding of subtracting any number, including decimals. 5 12 1 2 ~~6~~ ~~3~~ . **0** - 2 6 . 5 2 3 6 . 5

Multiplication

Objective and Strategies	Method
Counting in multiples	Count in multiples of a number aloud. Write sequences with multiples of numbers. 2, 4, 6, 8, 10 5, 10, 15, 20, 25 , 30 Children could use fingers or objects to represent each multiple.
Doubling	 Partition a number into manageable parts and then double each part before recombining it back together. eg double 16 = 20 + 12 = 32.
Repeated addition	Write addition sentences to describe objects and pictures. 5 x 2 = 10 

Arrays- showing commutative multiplication	Use an array to write multiplication sentences and reinforce repeated addition. It is important for children to understand that the multiplication will have the same answer whichever way round it is carried out.  5 + 5 + 5 = 15 3 + 3 + 3 + 3 + 3 = 15 5 x 3 = 15 3 x 5 = 15

Grid Method

Start with multiplying by one digit numbers and showing the clear addition alongside the grid.

35 x 7 = 245

×	30	5
7	210	35

210 + 35 = 245

Moving forward, multiply a 2 digit number by a 2 digit number, showing the different rows within the grid method.

18 x 13 = 234

	10	8
10	100	80
3	30	24

100 + 80 + 30 + 24 = 234

This can be extended as necessary, to include more digits, as well as decimal numbers.

1342 x 18

X	1000	300	40	2
10	10000	3000	400	20
8	8000	2400	320	16

10,000 + 8000 + 3000 + 2400 + 400 + 320 + 20 + 16 = 24,156
These numbers may be added in sections and then combined.

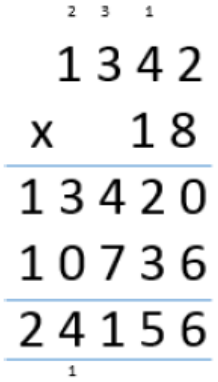
Column multiplication

Start with long multiplication, reminding the children about lining up their numbers clearly in columns.

If it helps, children can write out what they are solving next to their answer.

```
  32
x 24
   8   (4 x 2)
 120   (4 x 30)
  40   (20 x 2)
 600   (20 x 30)
 768
```

This moves to the more compact method.



In this example, 1342 has been multiplied by 10 first (13,420) and then by 8 (10,736).
This would also work if you multiplied by the 8 first, and then the 10.
You reach the answer by adding them together: 13420 + 10736 = 24,156

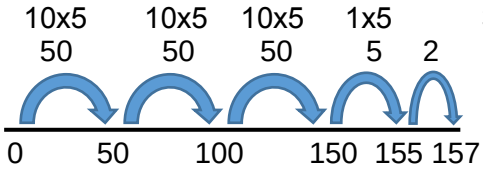
Division

Objective and Strategies	Method
Sharing objects into groups	Share 9 buns between three people. Children could use any countable items to carry out this calculation. Eventually, they will use their times tables knowledge to solve this calculation (i.e. knowing that 3 x 3 = 9). 9 ÷ 3 = 3
Division as grouping	28 ÷ 7 = 4 Divide 28 into 7 groups. How many are in each group? Again, children can start with objects and physically move them into groups. They could also draw marks to represent the objects. Eventually, as with the example above, they will use their times tables knowledge to carry out this calculation (ie 7 x 4 = 28).
Division within arrays	Find the inverse of multiplication and division sentences by creating four linking number sentences. 7 x 4 = 28 4 x 7 = 28 28 ÷ 7 = 4 28 ÷ 4 = 7
Division with a remainder	Complete written divisions and show the remainder using r. 

Chunking on an empty number line

Chunking is a method of division where children use number facts that they are familiar with in order to reach their answer. This example is drawn on an empty number line, where only the numbers needed for that calculation are drawn on. The child would count on in 'chunks' of 5s until they get to the required number.

157 ÷ 5



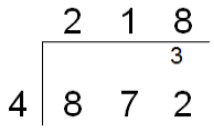
31 'lots of' 5 and 2 left over = 31 r 2.

Short division

Begin with divisions that divide equally with no remainder.

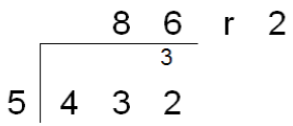
872 ÷ 4 = 218

How many 4s in 8? 2. Place above the 8.
How many 4s in 7? 1 with 3 left over. Place 1 above the 7 and the 3 next to the 2 to make 32.
How many 4s in 32? 8. Place above the 32.



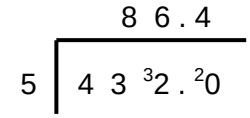
Move onto divisions with a remainder.

432 ÷ 5 = 86 r 2



How many 5s in 4? None, so move to the next digit.
How many 5s in 43? 8 with 3 left over. Place 8 above the 3 and 3 next to the 2 to make 32.
How many 5s in 32? 6 with 2 left over. Place 6 above the 2 and write 'remainder 2' as r 2.

Finally move into decimal places to divide the total accurately.
432.0 ÷ 5 = 86.4



How many 5s in 4? None, so move to the next digit.
How many 5s in 43? 8 with 3 left over. Place 8 above the 3 and 3 next to the 2 to make 32.
How many 5s in 32? 6 with 2 left over. Place 6 above the 2 and write 2 next to the 0 to make 20.
How many 5s in 20? 4. Place 4 above the 0.

Long division	Long division is when we divide by a two digit number. 3765 ÷ 15 $\begin{array}{r} 0\,2\,5\,1 \\ 15\overline{)3\;7^{7}6^{1}5} \end{array}$ This question is 3765 divided by 15, which means 'how many lots of 15 are there in 3765?' We do this in the following order: How many 15s are there in 3? 0, so move to the next digit. How many 15s are there in 37? 2 with 7 left over. How many 15s are there in 76? 5 with 1 left over, which leaves you with 'how many 15s are there in 15? 1. As you can see from the highlighted numbers, the answer is 251. Children may wish to write a list of multiples of 15 next to where they are working out the answer in order to support their calculation.