Uplands Primary School.

Written Calculation Policy.

Calculation Policy

Principles of Calculation at Uplands Primary School

This calculation policy has been produced to ensure consistency and progression in teaching throughout our school in line with the new National Curriculum (2014). The policy aims to identify the progression in each of the four operations that children will typically follow from **early years through to year 6.**

Each stage builds upon previous experience. We recognise that children will develop their mathematical skills at different rates and that it is important for them to develop conceptual understanding on a practical level before moving on to more formal written methods. They will develop calculation skills through a combination of practical, oral and mental activities using a range of appropriate resources to support their thinking.

Informal written recording will take place regularly and is an important part of learning and understanding. More formal written methods follow only when the child is able to use a wide range of mental calculation strategies and has secure conceptual understanding. The new curriculum suggests when more formal calculations should be taught **but the emphasis of our teaching will always to be to facilitate understanding and not simply to arrive at a correct answer.**

Calculation Policy

Principles of Calculation at Uplands Primary School

- Children should be encouraged to ask, "Can I do this in my head?" before attempting a calculation. If they can, then we will encourage them to use mental methods to calculate.
- Calculations should always be taught and applied in real life contexts.
- Models, images and concrete resources should be used to support conceptual understanding.
- Children must be given opportunities to reason about methods and understanding.
- Misconceptions and errors will be identified quickly and used as valuable learning points.
- Pupils will be taught to self-check using a range of strategies and apparatus.
- Children will be challenged at an appropriate level. For example, working with 2-step problems, using more than one operation at a time or working with more than two numbers at one time.
- Children will be taught and will become confident in recalling and figuring out multiplication facts.
- We aspire to develop confident individuals who love to challenge and discuss their learning.

The following document sets out the programme of study for key stage 1 and 2 for number & place value, addition & subtraction & multiplication & division the full programme of study is available on the government website https://www.gov.uk/government/publications/national-curriculum-in-england-mathematics-programmes-of-study/nationalcurriculum-in-england-mathematics-programmes-of-study

Early Years Foundation Stage – Year R

Mathematics in early years involves providing children with opportunities to develop and improve their skills in counting, understanding and using numbers, calculating simple addition and subtraction problems; and to describe shapes, spaces, and measures.

- Selects the correct numeral to represent 1 to 5, then 1 to 10 objects.
- Counts an irregular arrangement of up to ten objects.
- Estimates how many objects they can see and checks by counting them.
- Uses the language of 'more' and 'fewer' to compare two sets of objects.
- Finds the total number of items in two groups by counting all of them.
- Says the number that is one more than a given number.
- Finds one more or one less from a group of up to five objects, then ten objects.
- In practical activities and discussion, beginning to use the vocabulary involved in adding and subtracting.
- Records, using marks that they can interpret and explain.
- Begins to identify own mathematical problems based on own interests and fascinations.
- **Early Learning Goal**
- **Numbers**: Children count reliably with numbers from one to 20, place them in order and say which number is one more or one less than a given number. Using quantities and objects, they add and subtract two single-digit numbers and count on or back to find the answer.
- They solve problems, including doubling, halving and sharing.
- **Shape, space and measures**: children use everyday language to talk about size, weight, capacity, position, distance, time and money to compare quantities and objects and to solve problems. They recognise, create and describe patterns. They explore characteristics of everyday objects and shapes and use mathematical language to describe them.

Key stage 1 – years 1 and 2

The principal focus of mathematics teaching in key stage 1 is to ensure that pupils develop confidence and mental fluency with whole numbers, counting and place value. This should involve working with numerals, words and the four operations, including with practical resources [for example, concrete objects and measuring tools].

At this stage, pupils should develop their ability to recognise, describe, draw, compare and sort different shapes and use the related vocabulary. Teaching should also involve using a range of measures to describe and compare different quantities such as length, mass, capacity/volume, time and money.
By the end of year 2, pupils should know the number bonds to 20 and be precise in using and understanding place value. An emphasis on practice at this early stage will aid fluency.
Pupils should read and spell mathematical vocabulary, at a level consistent with their increasing word reading and spelling knowledge at key stage 1.

Year 1 programme of study for number & place value, addition & subtraction & multiplication & division

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

Year 2 programme of study for number & place value, addition & subtraction & multiplication & division

- 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.
- 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.
- 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.

Lower key stage 2 – years 3 and 4

The principal focus of mathematics teaching in lower key stage 2 is to ensure that pupils become increasingly fluent with whole numbers and the four operations, including number facts and the concept of place value. This should ensure that pupils develop efficient written and mental methods and perform calculations accurately with increasingly large whole numbers.
At this stage, pupils should develop their ability to solve a range of problems, including with simple fractions and decimal place value. Teaching should also ensure that pupils draw with increasing accuracy and develop mathematical reasoning so they can analyse shapes and their properties, and confidently describe the relationships between them. It should ensure that they can use measuring instruments with accuracy and make connections between measure and number.
By the end of year 4, pupils should have memorised their multiplication tables up to and including the 12 multiplication table and show precision and fluency in their work.
Pupils should read and spell mathematical vocabulary correctly and confidently, using their growing word reading knowledge and their knowledge of spelling.

Year 3 programme of study for number & place value, addition & subtraction & multiplication & division

- count from 0 in multiples of 4, 8, 5, 10 and 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 and order numbers up to 1000
- identify, represent and estimate numbers using different representations
- read and write numbers up to 1000 in numerals and in words
- solve number problems and practical problems involving these ideas.
- add and subtract numbers mentally, including: a three-digit number and ones, a three-digit number and tens, a three-digit number and hundreds
- add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction
- estimate the answer to a calculation and use inverse operations to check answers
- solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction.
- recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables
- write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods

- solve problems, including missing number problems, involving multiplication and division, including positive integer scaling
- problems and correspondence problems in which n objects are connected to m objects.

Year 4 programme of study for number & place value, addition & subtraction & multiplication & division

- count in multiples of 6, 7, 9, 25 and 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, and ones)
- order and compare numbers beyond 1000
- identify, represent and estimate numbers using different representations
- round any number to the nearest 10, 100 or 1000
- solve number and practical problems that involve all of the above and with increasingly large positive numbers
- read Roman numerals to 100 (I to C) and know that over time, the numeral system changed to include the concept of zero and place value.• 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.
- recall multiplication and division facts for multiplication tables up to 12 × 12
- use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1;
- multiplying together three numbers
- recognise and use factor pairs and commutativity in mental calculations
- multiply two-digit and three-digit numbers by a one-digit number using formal written layout
- solve problems involving multiplying and 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.

Upper key stage 2 – years 5 and 6

The principal focus of mathematics teaching in upper key stage 2 is to ensure that pupils extend their understanding of the number system and place value to include larger integers. This should develop the connections that pupils make between multiplication and division with fractions, decimals, percentages and ratio.
At this stage, pupils should develop their ability to solve a wider range of problems, including increasingly complex properties of numbers and arithmetic, and problems demanding efficient written and mental methods of calculation. With this foundation in arithmetic, pupils are introduced to the language of algebra as a means for solving a variety of problems. Teaching in geometry and measures should consolidate and extend knowledge developed in number. Teaching should also ensure that pupils classify shapes with increasingly complex geometric properties and that they learn the vocabulary they need to describe them.
By the end of year 6, pupils should be fluent in written methods for all four operations, including long multiplication and division, and in working with fractions, decimals and percentages. Pupils should read, spell and pronounce mathematical vocabulary correctly.

Year 5 programme of study for number & place value, addition & subtraction & multiplication & division

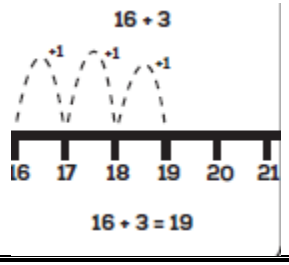
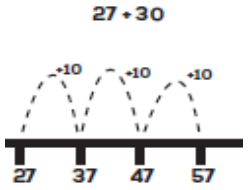
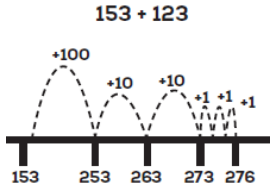
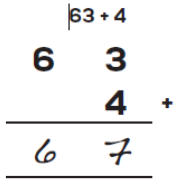
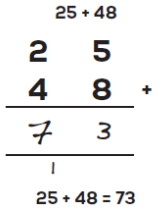
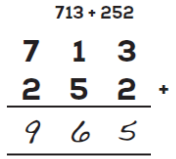
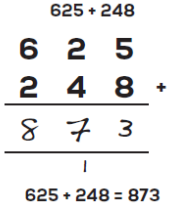
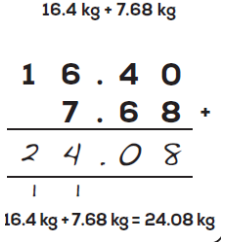
- read, write, order and compare numbers to at least 1 000 000 and determine the value of each digit
- count forwards or backwards in steps of powers of 10 for any given number up to 1 000 000
- interpret negative numbers in context, count forwards and backwards with positive and negative whole numbers, including through zero
- round any number up to 1 000 000 to the nearest 10, 100, 1000, 10 000 and 100 000
- solve number problems and practical problems that involve all of the above
- read Roman numerals to 1000 (M) and recognise years written in Roman numerals.
- 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.
- identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers
- know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers
- establish whether a number up to 100 is prime and recall prime numbers up to 19

- 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
- multiply and divide numbers mentally drawing upon known facts
- divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders
- appropriately for the context
- multiply and divide whole numbers and those involving decimals by 10, 100 and 1000

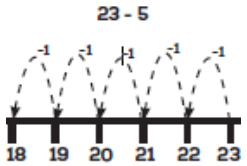
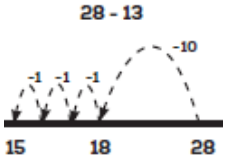
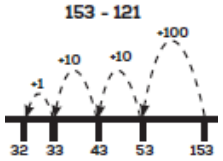
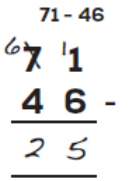
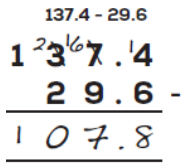
Year 6 programme of study for number & place value, addition & subtraction & multiplication & division

- 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.
- 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 Addition

I can use objects to answer addition sums.  3 + 2 = 5	I can use a bead string or dienes to add.  5 + 4 = 9  10 + 4 = 14	I can draw pictures to record a calculation.  3 2 3+2=5	I can use a structured number line to count on in ones.  16 + 3 = 19	I can use a blank number line to count on in tens.  27 + 30 = 57
I can use a blank number line to add hundreds, tens and units.  153 + 123 = 276	I can use partioning when adding tens and ones. 57+42 57 + 42 90 9 99 57+42=99	I can use column addition for tens and ones, no carrying.  63 + 4 = 67	I can use decimal amounts, no carrying. 5.6kg + 3.3kg 5.60 + 3.30 8.90 5.6kg + 3.3kg = 8.9kg	I can carry numbers to add using the compact method of tens and units addition  25 + 48 = 73
I can use partitioning when adding hundreds, tens and ones 287 45 200 120 12 332	I can carry numbers to add using the compact method of tens and units addition  713 + 252 = 965	I can carry numbers to add using the compact method of tens and units addition  625 + 248 = 873	I can add decimal amounts using the compact method.  16.4 kg + 7.68 kg = 24.08 kg	**Vocabulary:** add, addition, total, make, plus, more than, altogether, sum

Progression in Subtraction

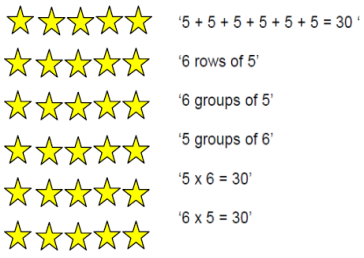
I can use objects to answer simple subtraction calculation.  5 - 2 = 3	I can use a bead string or dienes to illustrate subtraction.  9 - 4 = 5  14 - 4 = 10	I can draw pictures to record a calculation.  5 - 2 = 3	I can use a structured number line to count back when subtracting  23 - 5 = 18	I can use a blank number line to count back in tens and units  28 - 13 = 15
I can use a blank number line to subtract hundreds, tens and units.  153 - 121 = 32	I can use partioning when subtracting tens and ones. 78-23=55 7 8 - 2 3 5 0 5 5 5	I can use column subtraction for tens and ones, no carrying. 7 8 -2 3 5 5	I can subtract decimal amounts, no carrying. 5.6kg - 3.3kg 5.60 + 3.30 2.30 5.6kg - 3.3kg = 2.3kg	I can use the compact methods when subtracting tens and ones.  71 - 46 = 25
I can use partitioning when subtracting hundreds, tens and ones 287 145 100 40 2 142	I can use the compact method when subtracting hundreds, tens and ones 874 – 523 becomes 8 7 4 – 5 2 3 3 5 1 Answer: 351	I can use compact decomposition to solve subtraction calculations. 932 – 457 becomes 8 12 1 9 3 2 – 4 5 7 4 7 5 Answer: 475	I can use compact Decomposition to solve decimal subtractions  137.4 - 29.6 = 107.8	**Vocabulary:** take away, subtract, subtraction, less, minus, difference, decrease, leave, how many left

Progression in multiplication

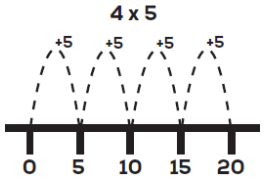
I can place objects into equal groups.

I understand multiplication as arrays.

6 x 5 = 30



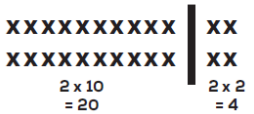
I understand multiplication as repeated addition on a number line.



4 x 5 = 20

I can partition tens and ones with an array

12 x 2



12 x 2 = 24

I can partition tens and ones without arrays.

13 x 5 = 65 (Partition 13 into 10 + 3)

10 x 5 = 50
3 x 5 = 15

50 + 15 = 65

I can use the grid method to solve multiplication problems 13x8=104

X	10	3
8	80	24

80+24=104

I can use the grid method to solve multiplication problems.

23 x 13 = (20 + 3) x (10 + 3) = 299

X	20	3
10	200	30
3	60	9

Add the partial products (200 + 30) + (60 + 9) = 299

I can use the grid method to solve more complex problems.

127 x 6 = 762

x	100	20	7
6	600	120	42

600 + 120 + 42 = 762 (add the partial products)

I can use a short method with carrying.

$$\begin{array}{r} 13 \\ \times\ 8 \\ \hline 104 \\ {\scriptstyle 2\ \ \ \ } \end{array}$$

13x8=104

I can use a short method without carrying.

231 x 3

$$\begin{array}{r} 231 \\ \times\ 3 \\ \hline 693 \end{array}$$

231 x 3 = 693

I can use a short method with carrying

342 x 7

$$\begin{array}{r} 342 \\ \times\ 7 \\ \hline 2394 \\ {\scriptstyle 2\ 1\ \ \ } \end{array}$$

342 x 7 = 2394

56 x 27 = 1512

$$\begin{array}{r} 56 \\ \times\ 27 \\ \hline 392 \\ +\ 1120 \\ \hline 1512 \\ {\scriptstyle 1\ \ \ \ } \end{array}$$

(7x56)
(20x56)

I can use the compact method of multiplication

I can use the grid method to multiply a decimal by a 2-digit number.

53·2 x 24 = 1276·8

x	50	3	0·2	
20	1000	60	4	1064·0
4	200	12	0·8	212·8
				1276·8

I can use the compact method of multiplication.

$$\begin{array}{r} 53{\cdot}2 \\ \times\ 24{\cdot}0 \\ \hline 212{\cdot}8 \\ 1064{\cdot}0 \\ \hline 1276{\cdot}8 \end{array}$$

(53·2 x 4)
(53·2 x 20)

Vocabulary:

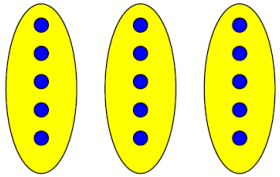
lots of, groups of, times, multiply, multiplication, multiplied by, multiple of, product, repeated addition, array

Progression in division

I can share items into equal groups

8 shared between 2 is 4

I can group objects to understand division



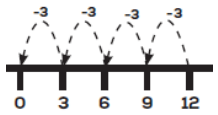
15 ÷ 5 = 3
15 ÷ 3 = 5

I can use arrays to understand division

15 ÷ 5 = 3
15 ÷ 3= 5

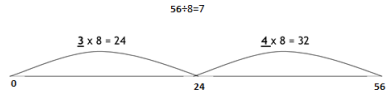
I understand division as repeated subtraction

12 ÷ 3



12 ÷ 3 = 4

I can divide a number by using chunking on a number line.



I can use divide a number using the compact method

24 ÷ 3 = 8

This can also be recorded as…

$$3\overline{)\,24}\quad 8$$

I can use partitioning to divide

65 ÷ 5 = 13

65 = 50 + 15

50 ÷ 5 = 10
15 ÷ 5 = 3
10 + 3 = 13

I can divide a number using the compact method

98 ÷ 7

$$7\overline{)\,9^{2}8}\quad 1\,4$$

98 ÷ 7 = 14

I can use the compact method with remainders

432 ÷ 5

$$5\overline{)\,4^{4}3^{3}2}\quad 0\,8\,6\ r2$$

432 ÷ 5 = 86 r 2

I can use the compact method using fractions

496 ÷ 11

$$11\overline{)\,4^{4}9^{5}6}\quad 0\,4\,5\ r1$$

496 ÷ 11 = $45\frac{1}{11}$

I can use long division to divide, no remainders

144÷ 16 = 9

$$16\overline{)\,144}\quad 9$$

- 64 (4 x 16)
80
- 64 (4 x 16)
16
- 16 (1 x 16)
0

I can use long division to divide, including remainders

432 ÷ 15 = 28 r12

$$15\overline{)\,432}\quad 28\ r12$$

300 (20 x 15)
132
120 (8 x 15)
12 (remainder)

Vocabulary:

divide, division, divided by, share, sharing, equal, equally, how many, remainder, factor, chunking