Calculation Policy

AIMS

At New Islington Free School we believe children should be taught calculation through a ‘mastery’ approach, being exposed to a variety of methods for calculation, applied to real life contexts. Beyond this children will have the depth of understanding to explain mathematical procedures effectively, showing greater depth of understanding. Children will also gain increased confidence in number and dealing with calculations. These procedures will be developed, extended and applied through their Primary learning journey resulting in proficient mathematicians by the end of Key stage Two.

Assessment for Learning

Teachers assess the children’s work in Mathematics by making informal and formal judgements as they observe them during lessons and assess progress through half-termly summative assessment. We have clear expectations of what the pupils will know, understand and be able to do at the end of each key stage. Assessment should offer the children the opportunity to reflect on their own progress and this will be shared biannually to parents.

Monitoring and Review

The Mathematics subject coordinator together with the Headteacher is responsible for monitoring the standards of children’s work and the quality of teaching of this subject. The subject coordinator supports colleagues in the teaching of Mathematics, by giving them information about current developments in the subject and by providing a strategic lead and direction for the subject in the school. The subject leader is also responsible for reporting to the Headteacher, evaluating strengths and weaknesses in the subject and indicating areas for further improvement.

<u>Progression in methods for ADDITION</u>

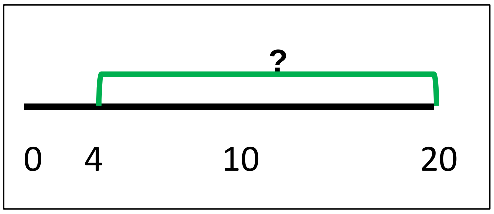
YEAR 1

- **Count on and back, to and from 30.**
- **Know number bonds to 20.**
- **Use a number line to add and subtract.**
- **Use objects and pictures to represent numbers up to 100.**
- **Recognise Place Value of 2-digit numbers.**
- **Solve one-step problems using manipulatives.**
- **Add and subtract 2-digit numbers.**

Number Lines

Children to initially count forwards and backwards in 'ones', using a pre-marked number line. Develop this to unmarked number lines to calculate number bonds to 20 and *'missing number problems'* involving addition.

e.g:-



4 + ? = 20

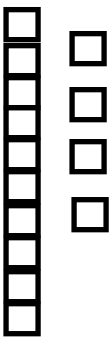
Hundred Squares

Children can also use Hundred Squares as a marked number line, helping them understand numbers up to 100.

Base Ten

Recognising Place Value is a key basic skill. Children will partition a 2-digit number into '**Ones'** and '**Tens'.**

e.g:-



Here we have **1** bar of Ten and **4** Ones = **14**

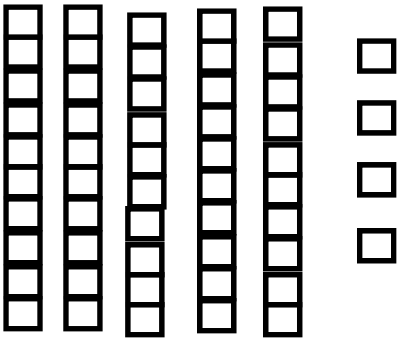
YEAR 2

- **Use a variety of manipulatives to represent numbers.**
- **Partition numbers up to 100.**
- **Use number facts, bonds and place value to solve problems.**
- **Calculate addition using manipulatives and mentally, including two 2-digit numbers and 3 single digit numbers.**
- **Begin to show calculations as written methods.**
- **Explain "Commutative" and "Inverse"**
- **Use 'Exchange' to show crossing the Tens barrier in addition.**

Base Ten

Base Ten can be used as in Year 1 to show partitioning of increasingly larger numbers.

e.g:-



Here we have 5 rods of Ten and 4 Ones = 54

Written Method

Once secure with addition using manipulatives, children should develop their understanding of partitioning and place value to record addition as a written algorithm *(Column Method)*

From the examples above we can show **24 + 54 =** __

2	**4**	
5	**4 +**	
	8	ONES
7	0 +	TENS
7	***8***	

2	**7**	
5	**8 +**	
1	5	ONES
7	0 +	TENS
8	***5***	

Children should recognise where there are more than 9 Ones and use the term ***'exchange'*****,** understanding this to mean '*swap ten ones, for a ten rod'.* Children should show this independently using the manipulatives to help secure their understanding of the next step in addition calculation.

YEAR 3

- **Know Place Value of 3-digit numbers and partition.**
- **Add and subtract using written algorithms, including column method.**
- **Use column method with improved efficiency.**

Place Value Cards

To show 3 digit numbers Base Ten can be used, using a Hundred Plate, followed by Tens Rods and Ones.

A more efficient manipulative would be Place Value Cards to show the partitioning, helping build a base for future Place Value knowledge.

Here we have 2 Hundreds, 2 Tens and 2 Ones = **222**

Written Methods with improved efficiency

```
 2 7
 5 8 +
 ----
 1 5    ONES
 7 0 +  TENS
 ----
 8 5
```

To develop this example to 3 digit numbers, children should become increasingly confident in using the term ***'exchange'*** and show this in a written algorithm. This will improve the efficiency of the calculation.

```
 2 7 3
 5 8 1 +
 -----
     4    ONE
 1 5 0    TENS
 7 0 0    HUNDREDS
 -----
 8 5 4
```

Ch should recognise the **exchange**

From **15 TENS**, and exchange 10 of the TENS for **1 HUNDRED.**

```
 2 7 3
 5 8 1 +
 -----
 8 5 4
 -----
 1
```

The 'exchange' of HUNDREDS shown below the line.

YEAR 4, 5 and 6

The basic calculation and method remains the same, being applied to larger numbers and decimals as required.

Progression in methods for SUBTRACTION

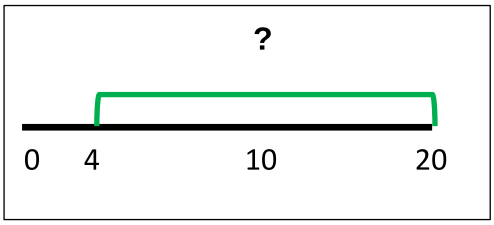
YEAR 1

- **Count on and back, to and from 30.**
- **Know number bonds to 20.**
- **Use a number line to add and subtract.**
- **Use objects and pictures to represent numbers up to 100.**
- **Recognise Place Value of 2-digit numbers.**
- **Solve one-step problems using manipulatives.**
- **Add and subtract 2-digit numbers.**

Number Lines

Number lines both marked and unmarked can be used to show subtraction in the same way as addition. Children can recognise counting left is counting backwards.

e.g:-



20 - ? = 4

Hundred Squares

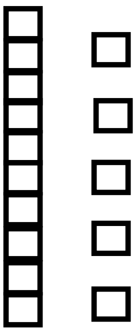
Hundred Squares can be used to show crossing the TENS barrier, a precursor to the bridging method considered in mental calculation further on.

21	22	23	24	25	26	27	28	29	**30**
31	32	33	34	35	36	37	38	39	**40**

37 – 9 = 28

Children can consider the number of jumps down to 30 then after 30. What do they notice?

Base Ten



Here we have **1** rod of Ten and **5** Ones = **15**

Children can take away an amount of cubes showing what is left as the answer. (*eg: 15 – 7 = ?)*

Through knowledge of partitioning, children should recognise the TEN and take the whole rod away as “1 TEN” rather than count individually.

YEAR 2

- **Use a variety of manipulatives to represent numbers.**
- **Partition numbers up to 100.**
- **Use number facts, bonds and place value to solve problems.**
- **Calculate subtraction using manipulatives and mentally, including two 2-digit numbers and 3 single digit numbers.**
- **Begin to show calculations as written methods.**
- **Explain "Commutative" and "Inverse"**
- **Use 'Exchange' to show crossing the Tens barrier in subtraction.**

All methods to be continued from Year 1 with the inclusion of **'exchange'** in subtraction.

Written Method

5 8
2 7 -

1 ONES
3 0 + TENS

3 1

Exchange 1 TEN

for 10 ONES

$\overset{4}{\not 5}\,{}^{1}4$
2 7 -

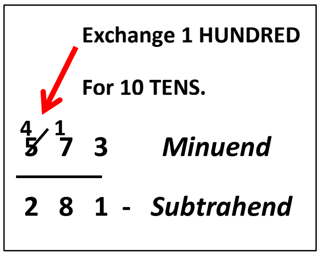
7 ONES
2 0 + TENS

2 7

YEAR 3

- **Know Place Value of 3-digit numbers and partition.**
- **Add and subtract using written algorithms, including column method.**
- **Use column method with improved efficiency.**

All methods to be continued with the added vocabulary of **‘minuend’** and **‘subtrahend’**



The ***Minuend*** should be recognised as the opening term in a subtraction calculation.

The ***Subtrahend*** should be recognised as the part being subtracted within the calculation.

YEAR 4, 5 and 6

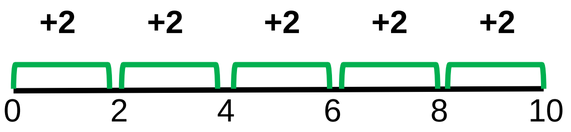
The basic calculation and method remains the same, being applied to numbers up to and including millions and decimals.

Progression in methods for MULTIPLICATION

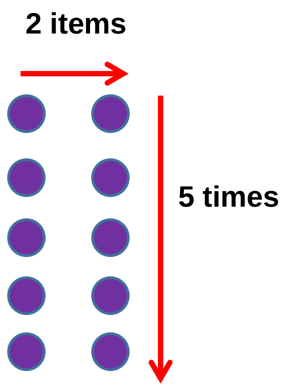
YEAR 1

- **Understand multiplication is the same as repeated addition.**
- **Solve One-Step multiplication problems using visual representations.**

Number Lines



Arrays



Arrays show children the idea of grouping. For example this could be 2 items 5 times or 5 items 2 times.

2 x 5 = 10 OR 5 x 2 = 10

YEAR 2

- **Solve multiplication problems using arrays or repeated addition in context.**
- **Explain "<u>commutative</u>" in terms of multiplication.**
- **Explain "<u>inverse</u>" of multiplication as division.**

Year 2 follows the same strategies above with increasing multiplication fact knowledge of 2, 5, 10, 3 and 6 multiplication tables.

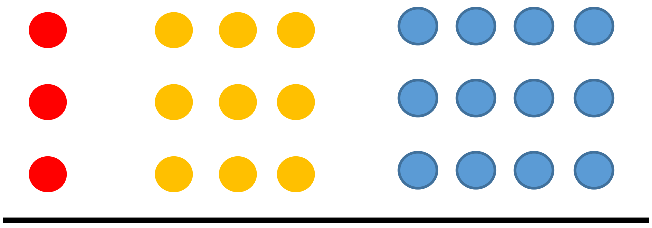
YEAR 3

- **Calculate 2-digit x single digit and 3-digit x single digit problems using visual representations and written method.**
- **Develop efficient written method.**

Place Value Counters

Counters can show larger numbers with greater efficiency. Children must recognise each single counter represents a different amount, Hundreds, Tens or Ones.

e.g:- **134 x 3 =**



3 Hundreds 9 Tens 12 Ones = 300 + 90 + 12 = **402**

This is a strong precursor to the inefficient, Grid Method.

e.g:-

X	100	30	4
3	300	90	12

300 + 90 + 12 = **402**

Written Method

This should now be developed into a written algorithm. Children must still consider *'exchange'* where appropriate.

```
 1 3 4
     3 X
 -----
   1 2
   9 0
 3 0 0 +
 -----
 4 0 2
  1
```

```
 1 3 4
     3 X
 -----
 4 0 2
 -----
 1 1
```

Both these examples show the exchange below the answer line as in addition. NOTE: the extra exchange shown in the contracted method as opposed to the expanded method.

YEAR 4, 5 and 6

Methods remain the same and should be fully embedded. For Year 6 where long multiplication is required, it is suggested to calculate 2 algorithms for Tens and Ones, then add the totals together.

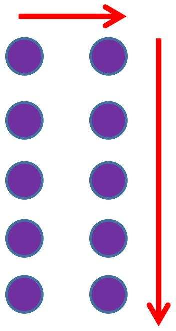
<u>Progress in methods for Division</u>

<u>YEAR 1</u>

- **Solve One-Step division problems using visual representations.**

All multiplication methods can be applied. For number lines, the concept of repeated subtraction should be secured through a similar process.

e.g:-



This array can be divided into 5 equal groups of 2 OR

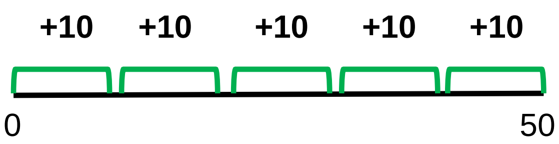
2 equal groups of 5.

<u>YEAR 2</u>

- **Solve division problems using arrays or repeated subtraction in context.**
- **Explain how division cannot be "<u>commutative</u>".**
- **Explain "<u>inverse</u>" of division as multiplication.**

All methods from Year 1 are applicable in Year 2 and should be applied to larger numbers.

Number Lines



Children begin to understand 'chunking' using a number line if the multiplication fact is not known.

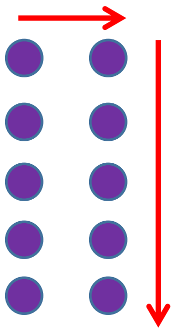
50 ÷ 5 = 10 The child has used knowledge of counting in 10's to calculate how many jumps it takes to reach 50. Children should recognise that this can also be expressed as 50 ÷ 10 = 5.

However, it is not commutative as the equation still begins with 50, *i.e- 10 ÷ 50 does NOT = 5.*

YEAR 3

- **Know which term is the '<u>divisor</u>' in division.**

Arrays



This array can show 10 ÷ 5 = 2 OR 10 ÷ 2 = 5. The second term in each of these statements is the '<u>divisor</u>'.

The following written method can be used to show this:-

2 over 5 ⟌ 10   **5** over 2 ⟌ 10

Divisors

YEAR 4, 5, 6

Continue to use and apply these methods with varying numbers, including decimals.

Extra consideration for 'Long Division' in Year 6, where the earlier concept of chunking and repeated subtraction are considered.

```
         1   2   7
      ______________
   23 | 2   9   2   1
      - 2   3
      -------
          5/6  1 2
        -   4  6
          -------
          1   6   1
```

The first 2-digit number is 29. There is 1 group of 23, 6 remainder.

Place the next digit alongside the remainder.

There are 2 groups of 23 with 16 remainder.

Place the next digit alongside the remainder.

There are 7 groups of 23 exactly.

When dealing with remainders, these should be expressed as, whole number remainders (e.g: r 4), fractions of the divisor (eg 4/23) or rounded to the nearest whole number (group) dependent on the context.