CALCULATION POLICY

MELLERS PRIMARY SCHOOL

July 2021

CALCULATION POLICY STATEMENT

Mathematics equips pupils with a uniquely powerful set of tools to understand and adapt to change the world. These tools include logical reasoning, problem-solving skills and the ability to think in abstract ways.

The ability to calculate is a fundamental skill not only for school but for the pupils to use throughout their adult lives. It is, therefore, essential that all pupils leave Key Stage Two being able to use the most efficient mental and written calculations strategies possible. This policy outlines the development of these skills through the use of concrete representations into the abstract representations needed to calculate with larger numbers.

At the heart of the policy, is the importance that the pupils have a deep understanding of number and calculations rather than the ability to follow a process.

AIMS

The mathematics teaching at Mellers Primary is aspirational as we aim to equip all pupils with the skills required to not only be successful during their time at school but also within the wider world. We use a mastery approach to the teaching of mathematics to ensure quality and consistency of teaching throughout the school. In the foundation stage and key stage one, we use resources from the 'Mastering Number' programme.
In line with the National Curriculum (revised 2104), we expect all pupils to:

- Become fluent in the fundamentals of mathematics
- Reason mathematically
- Solve increasingly sophisticated problems

We also expect that the majority of pupils' progress through the curriculum at broadly the same rate.

MENTAL STRATEGIES

It is important that pupils develop a secure understanding of how to solve problems involving all four operations mentally. The use of a mental strategy should always take precedent over that of a written method and pupils should be taught how to choose the correct strategy in their everyday lives. In order to achieve this there are a set of guidelines setting out the expectation at each year group.

Addition Stage One

Concrete

- Manipulate a range of real objects.


- Rearrange partition and recombine groups of real objects.
- Notice and compare size of groups.
- Objects for counting should be of the same type e.g. all bears, or all dinosaurs

Towards Written Calculation

- Adults model representations of pupils' ideas on paper
- Children's own jottings based on real objects

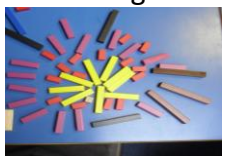
Expected Written Method

- Adults model conventional number representations
- Variety of maths symbols displayed in the environment.

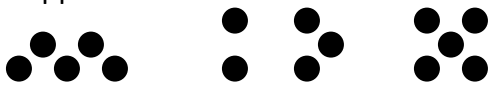
Addition Stage Two

Concrete

- Manipulate apparatus that represent real objects e.g. cubes, Base 10, Cuisenaire, bead strings



- Place objects in a line and on a number line.
- Estimate and check size of groups
- Rearrange, partition and recombine groups of objects and noticing what happens.



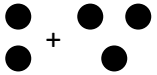
- Use pennies to calculate money
- Begin to **rename** objects e.g. 3 bananas and 4 apples is equal to 7 **pieces of fruit**

Towards Written Calculation

- Children's jottings reflect abstract representations of objects e.g. tallies, spots

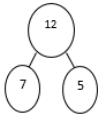
- Adults model abstract representations

2 + 3 = 5



= 5

- Use of part-part-whole model



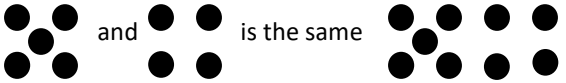
Expected Written Method

- Adults model horizontal recording of calculation and vocabulary

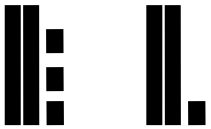
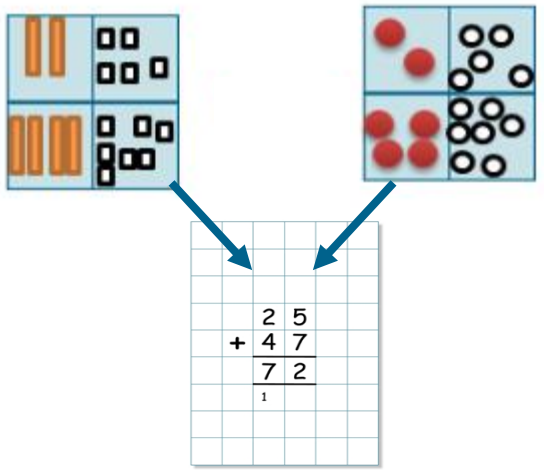
5 + 4 = 9

9 = 4 + 5

- Adults model = as 'the same as'



- Represent manipulatives on a number line

Addition Stage Three		
<u>Concrete</u> ○ Use Cuisenaire and Base Ten to represent two digit numbers  ○ Use coins to calculate money	<u>Towards Written Calculation</u> ○ Use place value cards to partition two digit numbers.  ○ Represent Base Ten and Cuisenaire on paper 23 	<u>Expected Written Method</u> ○ Record calculations horizontally and 'read' using correct vocabulary 5 + 4 = 9 12 + 11 =23 ○ Children begin to add two digit numbers vertically with apparatus 

Addition Stage Four

Concrete

- Use Cuisenaire and Base Ten to represent two- and three-digit numbers

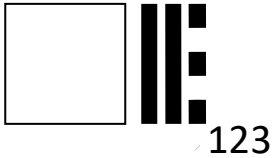
- Begin to introduce decimals and fractions using real objects

- Use coins and notes to calculate money

Towards Written Calculation

- Use place value cards to represent two- and three-digit numbers

- Represent Base Ten and Cuisenaire on paper



Expected Written Method

- Children begin to record by partitioning and recombining numbers

52 + 43 = 95
50 + 40 = 90
2 + 3 = 5
90 + 5 = 95

- Adults begin to model vertical addition without crossing ten

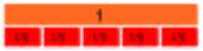
$$\begin{array}{r} 52 \\ +43 \\ \hline 95 \end{array}$$

Addition Stage Five

Concrete

- Use Base Ten and Cuisenaire to exchange once 10 is reached. Explain this as **renaming** 10 ones can also be called 1 ten.

- Use Cuisenaire and Base Ten to add fractions with the same denominator and decimals to one decimal place



- Use coins and notes when calculating money totals using decimal places

Towards Written Calculation

- Use place value cards to represent decimal numbers and money

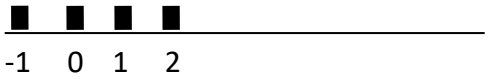
- Use coins to represent money
- Add fractions with the same denominator

Expected Written Method

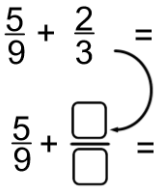
- Children use vertical addition to bridge 10

$$\begin{array}{r} 69 \\ +23 \\ {\scriptstyle 1} \\ \hline 92 \end{array}$$

- Children begin to use number lines to calculate using negative numbers



- Children use vertical addition to calculate amounts of money

Addition Stage Six		
<u>Concrete</u> ○ Use manipulatives to add fractions with a different denominator. Explain the process as **renaming** the denominator to make it common to both fractions. 1/4 + 2/3 = 3/12 + 8/12 =11/12 We can **rename** the denominator as 12	<u>Towards Written Calculation</u> ○ Add fractions with the same denominator mentally	<u>Expected Written Method</u> ○ Children are proficient in using vertical addition for whole numbers and decimals $\begin{array}{r} 12.53 \\ +19.28 \\ \scriptstyle 1 \quad 1 \\ \hline 31.81 \end{array}$ ○ Add fractions with by renaming one denominator  ○ Add fractions by renaming all denominators ○ Add mixed number and improper fractions

Subtraction Stage One

Concrete

- Manipulate a range of real objects.


- Rearrange partition and recombine groups of real objects.
- Notice and compare size of groups.
- Objects for counting should be of the same type e.g. all bears, or all dinosaurs

Towards Written Calculation

- Adults model representing ideas on paper
- Children's own jottings based on real objects

Expected Written Method

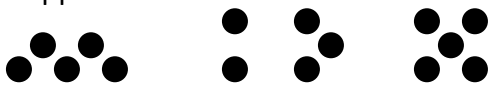
- Adults model conventional number representations
- Variety of maths symbols displayed in the environment.

Subtraction Stage Two

Concrete

- Manipulate apparatus that represent real objects e.g. cubes, Base 10, Cuisenaire, bead strings

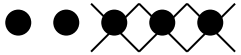
- Place objects in a line and on a number line.
- Estimate and check size of groups
- Begin to **rename** objects e.g. 3 bananas and 4 apples is equal to 7 **pieces of fruit**
- Rearrange partition and recombine groups of objects and noticing what happens.



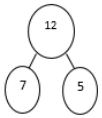
- Use pennies to calculate money

Towards Written Calculation

- Children's jottings to reflect abstract representations of objects e.g. tallies, spots
- Adults model abstract representations
- 5 - 3 = 2



- Use of part-part-whole model

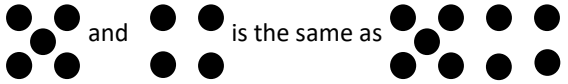


xpected Written Method

- Adults model horizontal recording of calculation and vocabulary

$$9 - 4 = 5$$
$$5 = 9 - 4$$

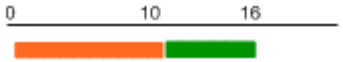
- Adults model = as 'the same as'



Subtraction Stage Three

Concrete

- Use Cuisenaire and Base Ten on a number line



- Use Cuisenaire and Base Ten to represent two digit numbers

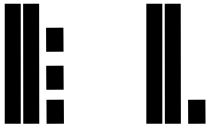
- Use coins to calculate money

Towards Written Calculation

- Use place value cards to partition two digit numbers.

- Represent Base Ten and Cuisenaire on paper

23



Expected Written Method

- Represent Multilink, Base Ten, Cuisenaire on a number line

- Record calculations horizontally and 'read' using correct vocabulary

9 – 5 = 4

23 – 11 = 12

- Children begin to subtract two digit numbers with apparatus

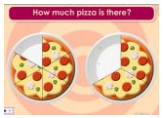
45 – 23 = 22

Subtraction Stage Four

Concrete

- Use Cuisenaire and Base Ten to represent two and three digit numbers

- Begin to introduce the subtraction of decimals and fractions using real objects

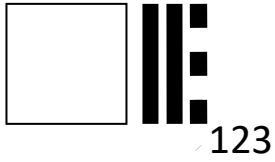


- Use coins and notes to calculate money

Towards Written Calculation

- Use place value cards to represent two and three digit numbers

- Represent Base Ten and Cuisenaire on paper

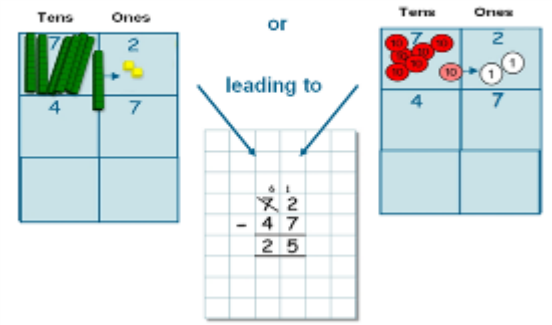


Expected Written Method

- Children begin to record by partitioning the second number

93 - 47 = 52
93 - 7 = 86
86 - 40 = 46

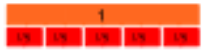
- Adults model vertical subtraction



Subtraction Stage Five

Concrete

- Use Base Ten and Cuisenaire to exchange once 10 is reached
- Use Cuisenaire and Base Ten to represent fractions and decimals to one decimal place



- Use coins and notes when calculating money totals

Towards Written Calculation

- Use place value cards to represent decimal numbers and money

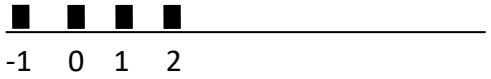
- Use coins to represent money

Expected Written Method

- Children use vertical addition to bridge 10

$$\begin{array}{r} {\scriptstyle 5\ 1} \\ \not{6}3 \\ -\ 29 \\ \hline 34 \end{array}$$

- Use number lines to calculate using negative numbers



Subtraction Stage Six

Concrete

- Use manipulatives to subtract fractions with a different denominator. Explain the process as **renaming** the denominator to make it common to both fractions.

  2/3 - 1/4 = 8/12 - 3/12 =5/12

  We can **rename** the denominator as 12

-

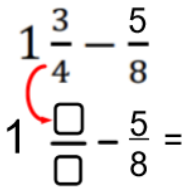
Towards Written Calculation

- Using place value cards to represent two and three digit numbers and money
- Representing money as decimals

Expected Written Method

- Children proficient in using vertical subtraction for whole numbers and decimals

$$\begin{array}{r} {\scriptstyle 1\ 1\ \ 4\ 1} \\ \not{2}2.\not{5}3 \\ -\ 19.28 \\ \hline 03.25 \end{array}$$

		○ Subtract fractions by renaming one denominator  ○ Subtract fractions by renaming both denominators

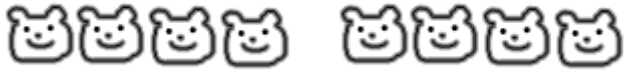
<table>
<tr><td colspan="3">Multiplication Stage One</td></tr>
<tr>
<td><u>Concrete</u>

○ Manipulate a range of real objects.
 
○ Rearrange, partition and recombine groups of real objects.

○ Sort and group sets of objects of the same kind e.g. all bears or all dinosaurs</td>
<td><u>Towards Written Calculation</u>

○ Adults model representing ideas on paper

○ Children's own jottings based on real objects

  </td>
<td><u>Expected Written Method</u>

○ Adults model conventional number representations

○ Variety of maths symbols displayed in the environment.</td>
</tr>
<tr><td colspan="3">Multiplication Stage Two</td></tr>
<tr>
<td><u>Concrete</u>

○ Introduce language and concepts of multiplication in real life contexts e.g. counting pairs of shoes, sweets in a bag, grouping objects.

○ Place objects in groups of the same number and calculating how many altogether

○ Count sets of coins e.g. 10 pence pieces</td>
<td><u>Towards Written Calculation</u>

○ Children count in multiples of 2, 5 and 10 and recognising why these patterns occur using Cuisenaire, 100 squares, number lines

○ Children's jottings to reflect abstract representations of objects e.g. tallies, spots

● ● ●
● ● ●
○ Adults model abstract representations

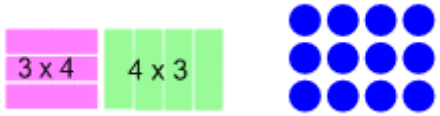
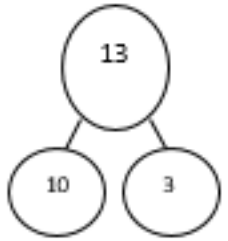
● ● ●
● ● ●
2 + 2 + 2 = 6 or 3 x 2 = 6</td>
<td><u>Expected Written Method</u>

○ Adults model horizontal recording of calculation and vocabulary related to repeated addition

3 + 3 + 3 + 3 + 3 = 15

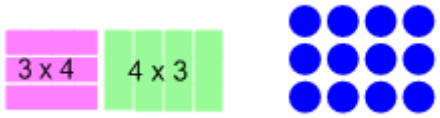
○ Adults model horizontal recording of calculation and vocabulary related to groups of and lots of

3 x 5 = 15
15 = 5 x 3</td>
</tr>
</table>

Multiplication Stage Three		
<u>Concrete</u> ○ Make arrays with different pieces of equipment e.g. cubes, peg boards, Cuisenaire  ○ Use of number line to find multiplication facts	<u>Towards Written Calculation</u> ○ Children count in multiples of all numbers to 10 and recognising why these patterns occur using Cuisenaire, 100 squares, number lines ○ Children begin to use abstract notation to answer problems e.g. drawing their own arrays. ○ Children begin to recall multiplication facts (2s, 3s, 5s, 10s)	<u>Expected Written Method</u> ○ Children record calculations horizontally and 'read' using correct vocabulary. 3 x 4 = 12 4 x 3 = 12 ○ Children understand that the operation is commutative ○ Children partition and recombine two-digit numbers in order to multiply  10 x 4 = 40 3 x 4 = 12 40 + 12 = 52

<table>
<tr><td colspan="3">Multiplication Stage Four</td></tr>
<tr>
<td><u>Concrete</u>

○ Making arrays with different pieces of equipment in order to answer multiplication questions e.g. cubes, peg boards, Cuisenaire

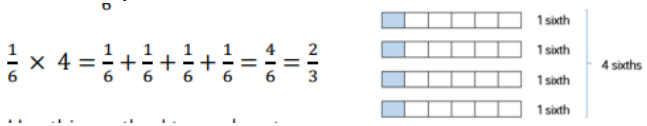
○</td>
<td><u>Towards Written Calculation</u>

○ Children proficient in recalling multiplication facts to 12 x 12

○ Children know the effect of multiplying by 0 and 1</td>
<td><u>Expected Written Method</u>

○ Use an expanded method for multiplication to multiply a two or three-digit number by a single digit

$\begin{array}{r} 30+8 \\ \times \quad 7 \\ \hline 210 \\ 56 \\ \hline 266 \end{array}$ $30\times 7=210$ $8\times 7=56$ $\begin{array}{r} 38 \\ \times \quad 7 \\ \hline 210 \\ 56 \\ \hline 266 \end{array}$</td>
</tr>
<tr><td colspan="3">Multiplication Stage Five</td></tr>
<tr>
<td></td>
<td>○ Understand multiplying by fractions as repeated addition

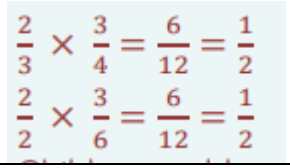
 

○ Understand the effect of multiplication on fractions using the word ‘of’

2/3 x 2 = two thirds of two</td>
<td>○ Children use an efficient written method to multiply (up to four) digit numbers by two-digit numbers.

○ Multiply fractions by integers

○ Multiply two fractions by multiplying the numerators and denominators and simplifying

  </td>
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<table>
<tr><td colspan="3">Division Stage One</td></tr>
<tr>
<td><u>Concrete</u>

○ Manipulate a range of real objects.
  

○ Rearrange, partition and recombine groups of real objects.

○ Sort and group sets of objects e.g. all bears or all dinosaurs</td>
<td><u>Towards Written Calculation</u>

○ Adults model representing ideas on paper

○ Children’s own jottings based on real objects

  </td>
<td><u>Expected Written Method</u>

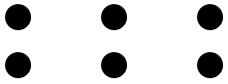
○ Adults model conventional number representations

○ Variety of maths symbols displayed in the environment.</td>
</tr>
<tr><td colspan="3">Division Stage Two</td></tr>
<tr>
<td><u>Concrete</u>

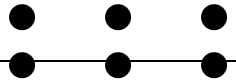
○ Introduce language and concepts of division in real life contexts e.g. pairing up socks, sharing sweets, grouping objects</td>
<td><u>Towards Written Calculation</u>

○ Children count in multiples of 2, 3, 5 and 10 and recognise why these patterns in counting occur using Cuisenaire, 100 squares, number lines

○ Children’s jottings to reflect abstract representations of objects e.g. tallies, spots

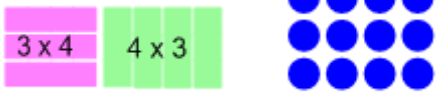
 

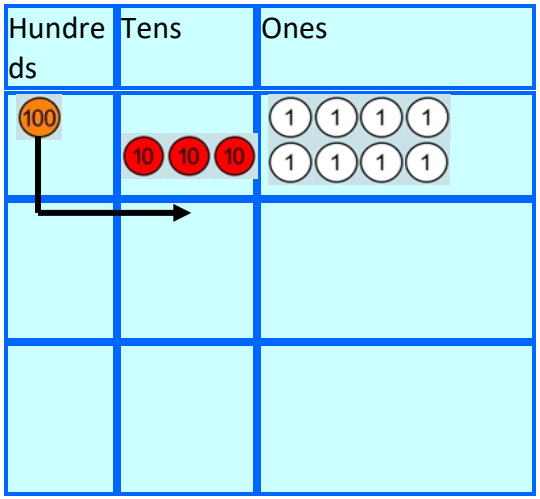
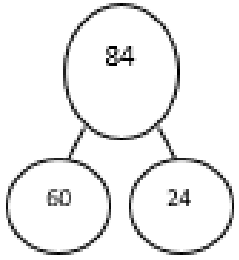
○ Adults model abstract representations

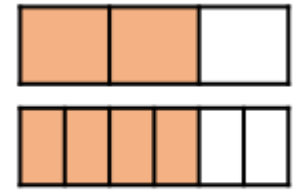
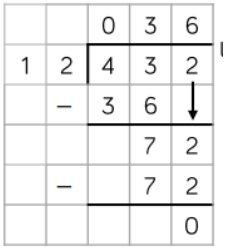
  </td>
<td><u>Expected Written Method</u>

○ Adults model horizontal recording of calculation and vocabulary related to groups of and lots of

15 ÷ 5 = 3
15 ÷ 3 = 5</td>
</tr>
</table>

Division Stage Three		
<u>Concrete</u> ○ Share and group using abstract apparatus e.g. cubes, Cuisenaire, bead strings e.g. how many 3's are in 9?  How many equal groups can you put 12 cubes into?  ○ Make arrays with different pieces of equipment to show relationship between multiplication and division e.g. cubes, peg boards, Cuisenaire  12 ÷ 4 = 3 12 ÷ 3 = 4	<u>Towards Written Calculation</u> ○ Children count in multiples of all numbers to 10 and recognise why these patterns occur using Cuisenaire, 100 squares, number lines ○ Children begin to use abstract notation to answer problems e.g. spots, tallies II II II II ○ Children begin to use their knowledge of multiplication facts to recall division facts to 12x12	<u>Expected Written Method</u> ○ Children record calculations horizontally and 'read' using correct vocabulary for numbers that can be divided exactly. 15 ÷ 5 = 3 15 ÷ 3 = 5 ○ Children record calculations horizontally and 'read' using correct vocabulary for division questions involving a remainder 16 ÷ 5 = 3 r1 16 ÷ 3 = 5 r1

Division Stage Four		
<u>Concrete</u> ○ Children explore exchange of counters for division  	<u>Towards Written Calculation</u> ○ Children proficient in using their knowledge of multiplication facts to recall division facts ○ Children partition numbers to divide e.g. 84 ÷ 6 =  60 ÷ 6 = 10 24 ÷ 6 = 4 10 + 4 = 14	<u>Expected Written Method</u> ○ Adults model using the short division method alongside the partitioning method **81 ÷ 3** **Partition 81 into 60 + 21** **60 ÷ 3 = 20** **21 ÷ 3 = 7** **20 + 7 = 27 so 81 ÷ 3 = 27** $\begin{array}{r} 27 \\ 3\overline{)81} \end{array}$ ○ Children should interpret remainders in different ways according to the context, as fractions, decimals or by rounding **e.g. 98 ÷ 4 = 24 r 2 = 24 ½ = 24.5**

Division Stage Five		
<u>Concrete</u>	<u>Towards Written Calculation</u> ○ Children proficient in recalling division facts ○ Children use bar models to divide fractions  	<u>Expected Written Method</u> ○ Children proficient in using the short division to divide whole numbers and numbers with up to 2 decimal places by a single digit ○ Children divide whole numbers by a two-digit number using long division  ○ Children divide fractions by an integer by multiplying the denominator by the divisor and simplifying