Clover Hill Primary School

Mental & Written Calculation Policy

This document recommends an approach for developing progression in the conceptual and procedural aspects of calculation across Key Stages 1 & 2. It takes into account the mathematics programme of study and non statuary guidance for the National Curriculum 2014.

The document covers:

* Calculations that an be done wholly or partially by mental methods, based on fluency with number facts and understanding of place value and number operations and sometimes using horizontally presented number sentences or empty number lines to show steps in thinking.

* The use of expanded or informal written methods to support understanding of compact, formal written methods and

* Developing fluency in the use of formal written methods by the end of Key Stage 2.

Children should work towards being able to use, by the end of Key Stage 2:

* A range of strategies for mental calculations appropriate to the numbers involved.

* One formal written method (for each number operation) for calculations that cannot be done mentally.

Progression in mental calculation skills can be supported by:

* The ability to quickly recall a range of number facts and an understanding of how to use them to derive other related facts.

* Understanding how numbers and calculations can be represented by materials and images such

    as arrays, ten frames Numicon shapes.

An understanding of the number system (order and relative position of numbers, place value, etc.) the four number operations and the laws of arithmetic associated with them.

Understanding of how symbols are use to record calculations especially the equals sign. Care should be taken that the equals sign is used correctly

⇒ Eg. 42+35= might be calculated by partitioning the second number to add the tens followed by the units. This could be recorded as:

42+30=70

72+5 = 77

But not as 42+ 30= 72+5 =77 as this involves incorrect use of the first equal sign.

⇒ An understanding of how calculations can be represented on empty number lines. They will need to work with numbered tracks and lines first before they are confident to rely on empty lines alone.

⇒ To make good use of empty lines children need to be able to:

- Move forward and back confidently on the number line.

- Make jumps of different sizes.

- Recognise landmark numbers such as multiples of 10.

- Know and use number complements to 10 and how these relate to multiples of 10.

⇒   Partition and recombine numbers in appropriate ways eg 7+5 as 7 + 3 +2 or 28+9 as 28+10-1

Teachers should demonstrate the use of number sentences and number lines to model steps in calculations. Children should be encourage to record the steps in their mental calculations some of the time. Recording is useful when explaining methods to others and to show which strategy has been used. It is not necessary to always record, especially for those children who have efficient mental methods. Teachers should use their judgement about when recording is necessary.

Progression to fluency with a formal written method for each number operation can be made by:

⇒   The appropriate use of informal or expanded written methods that build on mental methods continue to highlight understanding of the number system and number operations.

⇒   Linking of these expanded methods to the formal written method when it is first introduced to highlight steps that may be concealed, and therefore not understood, in the procedural execution of the formal written method.

⇒   Appropriate levels of practice of formal written methods to develop fluency.

Children should continue to develop their mental calculation skills with larger numbers once written methods are introduced and should be given opportunities to identify which calculations might be done mentally, with reference to the **nature** rather than the **magnitude** of the numbers involved. They should use mental calculation skills to estimate the likely magnitude of the answer when performing a calculation using a formal method and hence identify answers that are unreasonable and indicate errors to execution of the method.

Teachers need to judge when children are ready to move from mental to written calculations. The following lists offer some guidance:

Addition and Subtraction

Can pupils:

- recall addition and subtraction facts to 20?

- understand place value and partition numbers?

- add three single digit numbers mentally?

- add or subtract any pair of two digit numbers mentally?

- explain their mental strategies orally and record them using horizontal number sentences or an empty number line?

Multiplication and Division

Can pupils:

- quickly recall multiplication and division facts for 2, 3, 4, 5 and 10 times tables?

- understand what happens when a number is multiplied by 0 or 1?

- understand 0 as a place holder?

- multiply two- and three-digit numbers mentally by 10 and 100?

- demonstrate understanding of the commutative, distributive and associative laws (though not necessarily know the names)?

- double and halve two-digit numbers mentally?

- explain mental strategies orally and with recording?

This document considers addition and subtraction together followed by multiplication and division. Links between number operations should be emphasised regularly. A year by year approach has been taken in line with the format of the National Curriculum 2014 programmes of study but teachers should have regard to other year group expectations when planning for different abilities.

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Reception

Mental & Written

Calculation Policy

In mathematics we aim for Reception children to;

- Develop a strong grounding in number so that they develop the necessary building blocks to excel mathematically.

- Count confidently.

- Develop a deep understanding of the numbers to 10, the relationships between them and the patterns within those numbers.

- Engage in practical opportunities to build and apply understanding of numbers to 10.

- Develop a secure base of knowledge and vocabulary from which mastery of mathematics is built.

- Develop their spatial reasoning skills across all areas of mathematics including shape, space and measures.

- Develop positive attitudes and interests in mathematics.

- Look for patterns and relationships, to spot connections and to 'have a go'.

- Talk to adults and peers about what they notice and not be afraid to make mistakes.

We spend time each day fostering an interest in mathematics and weave mathematical concepts throughout many of our daily activities. We have developed our mathematics curriculum by using the BBC Numberblocks series alongside supporting resources produced by NCETM as its core, (see appendix 1). *Numberblocks* is a BBC television series aimed at introducing children to early number. The Numberblock characters combine with engaging storylines to gently introduce concepts of number to support early mathematical understanding. The NCETM supporting resources use each episode as a launch pad. These resources enable practitioners to confidently move on from an episode, helping children to bring the numbers and ideas to life in the world around them. They highlight and develop the key mathematical ideas that are embedded in the programmes. We ensure that we have high quality and open ended mathematics resources readily accessible in our indoor and outdoor environments to enable children to lead their own learning and to develop their mathematical knowledge. We also ensure we provide relevant and stimulating resources in our provision that will further support the aspects of mathematics that we are focussed on in any one week; this includes five and ten frames and whole part models. We encourage children to explore and work out mathematical problems using signs and strategies of their own choice including (where appropriate) standard numer-

It is our aim that by the end of Reception children achieve their Early Learning Goals for both strands of mathematics; number and numerical patterns. It is our aim for all children to have solid foundations instilled and to be fully equipped with the skills required to continue their mathematics education in Key Stage One, following the National Curriculum.

Number ELG

Children at the expected level of development will;

- Have a deep understanding of number to 10, including the composition of each number

- Subitise (recognise quantities without counting) up to 5

- Automatically recall (without reference to rhymes, counting or other aids) number bonds up to 5 (including subtraction facts) and some number bonds to 10, including double facts.

Numerical Patterns ELG

Children at the expected level of development will:

- Verbally count beyond 20, recognising the pattern of the counting system

- Compare quantities up to 10 in different contexts, recognising when one quantity is greater than, less than or the same as the other quantity

- Explore and represent patterns within numbers up to 10, including evens and odds, double facts and how quantities can be distributed equally.

Assessment is based primarily on our knowledge of children. This knowledge is gained predominantly from observation and interaction in a range of daily activities and events. Examples of what these observations may look like are below;

Jonathan counted out 10 raisins; he counted down as he ate them…10, 9, 8, 7, 6, 5, 4, 3, 2, 1.

Kate proudly showed a spider she had made. "Oh no! It's got 7 legs now. One must have fallen off. I'm going to glue another leg so that it's got 8 again."

Hatty and Emily were preparing a teddy bears picnic in the outdoor area. They agreed that they would ask the other children if they would like to come to their picnic. They counted 5 seats and Emily said that they had room for 3 more people.

Christopher sorted the carrots and apples for snack time. "We have 17 apples and 14 carrots. There are more apples."

Hannah made a tally chart of the children outside. She listed how many girls and how many boys were outside. "There are 5 girls and 4 boys, that's 9 altogether."

When counting the vegetarian lunches Thomas counted in 2s, "2, 4, 8, 10… 10 that's even because you can count in 2s".

When playing with the number sticks Jane put 6 and 4 together, "Look 6 and 4, that makes 10".

When playing snakes and ladders Molly and James took turns to roll the die and were both able to subitise and quickly call out the number that they had rolled.

When playing a game Hannah rolled the die, subitised then quickly doubled the number, "3…6".

Jack found 10 golden coins in the sand, he shared his coins between two treasure chests, "Five coins each!"

Ella placed 7 counters on a 10 frame, "7 is 5 and 2."

When exploring ways of making 8 using a whole part model, George placed 8 buttons in the whole then moved them down into the parts, "Look 5 and 3 make 8". He moved the buttons again, "4 and 4 makes 8".

What can parents and carers do to support their child's learning?

- Count everything! Add more or take some away and recount!

- Sing number rhymes; Five little ducks, 1, 2, 3, 4, 5 Once I caught a fish alive.

- Point out numbers on doors, buses, car number plates etc.

- Share things out and see if it is fair.

- Sort out different coloured sweets; are there more or less yellow ones?

- Cook – weigh/measure ingredients, set the timer etc.

- Play shops; count and play with real money - 1p and 2p coins to begin with.

- Notice important times; 7 o'clock - bedtime!

- Look for and talk about the maths in stories.

- Set the table; how many people for tea? Count out how many plates etc. are needed.

- Pouring and filling in the bath; how many cups will fill the jug?

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Year 1

Mental & Written Calculation Policy

Addition and Subtraction

Children in Year 1 should:

- Use concrete objects and pictorial representations, including number lines, to support their solution of addition and subtraction problems.

- Represent and use number bonds and related subtraction facts within 20, memorising and reasoning with these bonds.

- Add and subtract one-digit and two-digit numbers to 20, including zero (and realise the effect of adding or subtracting zero to establish the relationship between these operations).

- Read, write and interpret mathematical statements involving addition (+), subtraction (-) and (=) signs in a range of formats e.g. $\triangle + 5 = 12$ or $7 = \lozenge - 9$.

Multiplication and Division

Children in Year 1 should:

- 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.

- Through grouping and sharing small quantities, pupils begin to understand: multiplication and division; doubling numbers and quantities; and finding simple fractions of numbers and quantities

- Pupils make connections between arrays, number patterns and counting in twos, fives and tens.
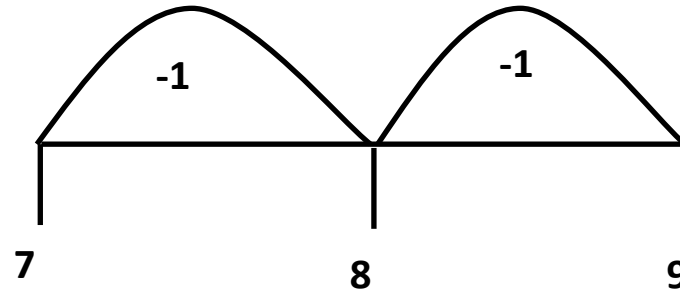
Year 1 Mental Addition and Subtraction Strategies

Counting on/back

8+3= 11

$+1$ $+1$ $+1$

8 9 10 11

9-2=7

-1 -1

7 8 9
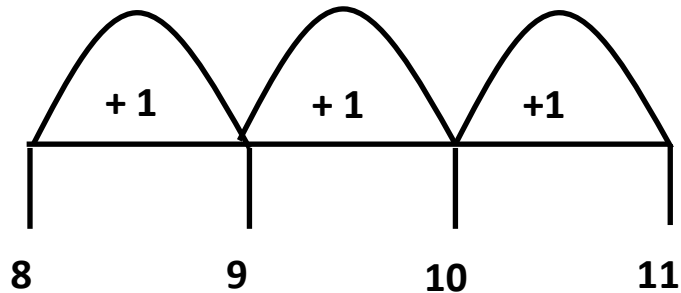
Reordering: Count on from larger number

3 + 8 = rewrite as 8 + 3 =

Find pairs that total 10

3+4+7 is the same as 3+7+4 is the same as 10+ 4

NB: Children are not expected to draw number lines. They are used for demonstration only.

Year 1 Mental Addition and Subtraction Strategies

Partition into 5 and a bit

5 + 8 becomes 5+5+3 becomes 10 + 3 = 13

7 + 8 becomes 5+2+5+3 is the same as 5+5+2+3 becomes 10+5

Use near doubles

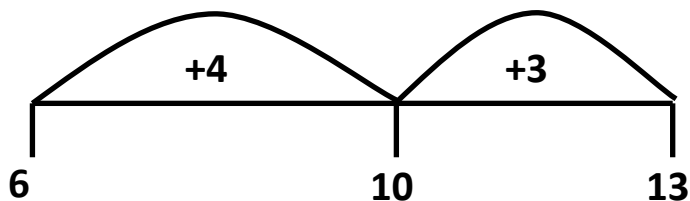5+6 becomes 5+5+1 becomes 10+1= 11

Begin to bridge through 10

6+7 = ?	13-7= ?
6+4 = 10	13-3= 10
10+3 = 13	10-4= 6

Year 1 Mental Addition and Subtraction Strategies

+10

- 1

6   **15**   **16**
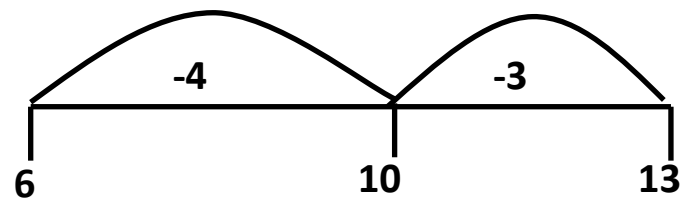
Add or Subtract 9

6+9=

6+ 10 = 16

16 -1 = 15

+ 1

- 10
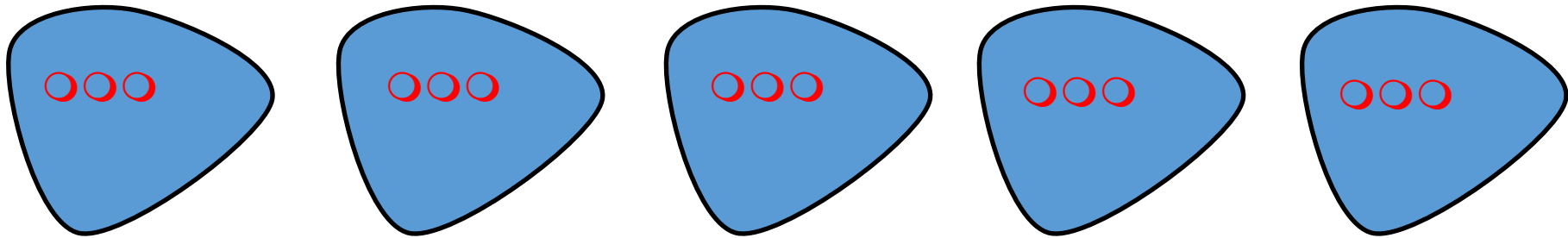
7   **8**

17
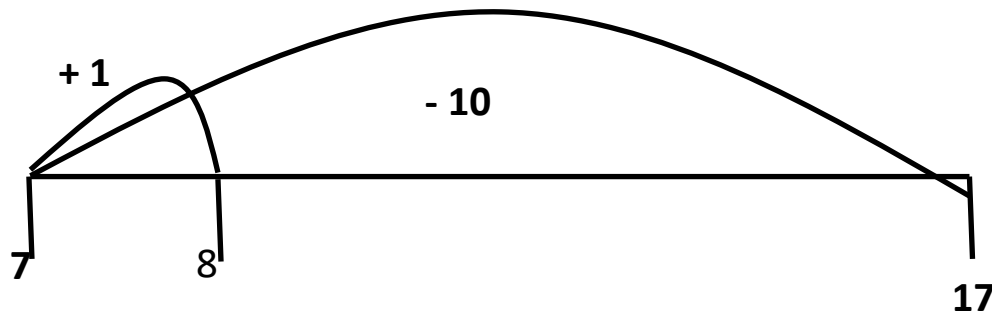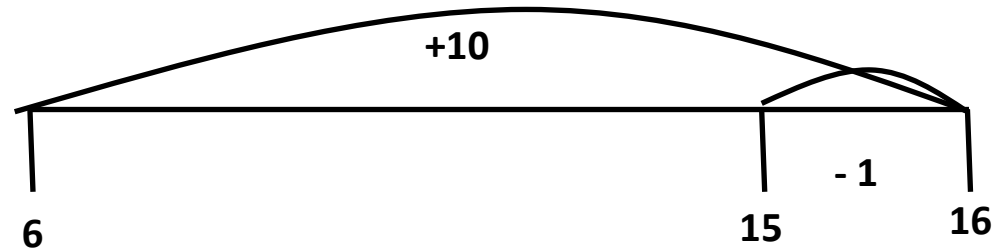
17-9=

17-10=7

7+1 = 8

Year 1 Multiplication and Division

Multiplication

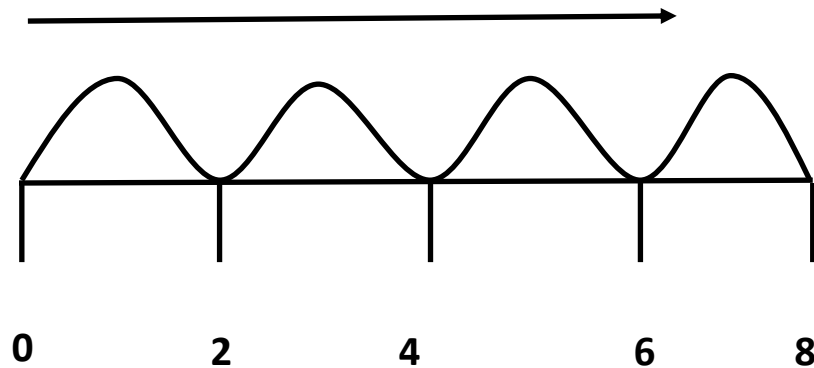There are 3 sweets in one bag. How many sweets are there in 5 bags?

Arrays

2 groups of 4 or 4 groups of 2

Jump forward in 2s on a number line

0   2   4   6   8

Year 1 Multiplication and Division

Division

12 children get into teams of 4 to play a game. How many teams are there?

Arrays

Put into groups of two

OOOO   OOOO

OOOO   OOOO

Jump backwards in 5s on a number line

0   5   10   15   20