Horsford
C of E VA
Primary School

Mathematics Calculations Policy
2019-20

Nebula
where stars are born

This calculation policy has been produced to ensure consistency in the teaching of mathematics throughout the school. It gives an overview of the different strategies used in our school to teach the year group maths objectives as outlined in the 2014 Primary Mathematics Curriculum.

Our children should be able to problem solve effectively and select an efficient method of their choice that is appropriate to the task. This includes practical, mental and formal written methods. They are encouraged to decide upon the best way to try and solve a problem then use the appropriate method to do so.

As children progress at different rates, some children may need to use strategies from previous or future year groups.

Use of language is key to children understanding the operations they are using. Please see the vocabulary section within the Mathematics Progression and Skills Map to support each operation.

Overall aims by the end of KS2:

- Have a secure understanding and knowledge of number facts and be able to select and use any of the four operations appropriately.

- Use their knowledge to carry out calculations mentally and to apply appropriate strategies when calculating with multi-digit numbers.

- Make use of diagrams, informal notes and jottings to record their thought processes when there is more information than can be kept in their heads.

- Have a formal, efficient and reliable written method of calculation for each operation that children can apply with confidence when undertaking calculations that they cannot carry out mentally

- Fluency, reasoning and problem solving to be securely embedded into all aspects of mathematics

N.B. The term 'units' is used throughout the school as a place value column heading in preference to 'ones' or 'singles'.

Addition

Reception

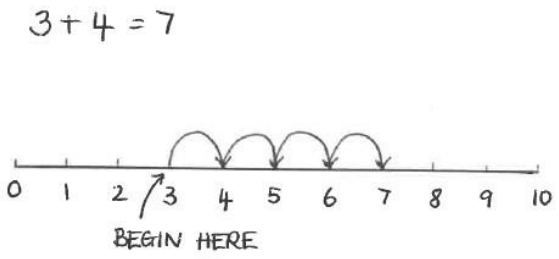
The focus at the beginning of the year is to use manipulatives to support children's understanding of addition, e.g. have 2 piles of objects and put them together to count how many **altogether**.

The children will then move on to **counting on** from a given number, with the support of a labelled number track by the end of the year.

Year 1

In Year 1 the children will continue to use practical equipment and labelled number lines to assist their **counting on**.

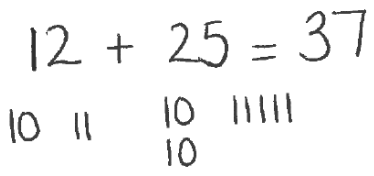
Labelled number line (counting on)



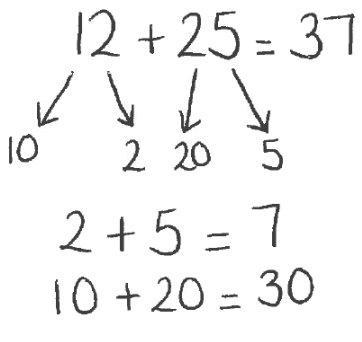
Year 2

At the beginning of Year 2 children will move from using a number line to **partitioning** 2 digit numbers using **exploding numbers** to visually represent the calculations.

Exploding numbers

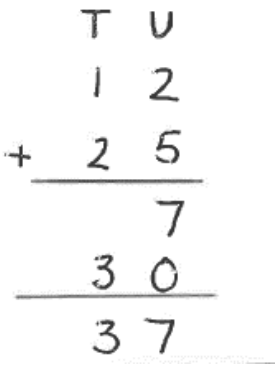


Partitioning



By the end of Year 2 the children may be introduced to **expanded column addition** (2 digit whole numbers), adding from the lowest place value column first (right).

Expanded column method

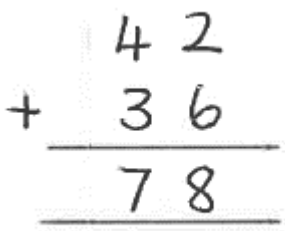


Years 3-6

Column addition method

The column method is introduced in Year 3 when a secure understanding of digit place value has been established. Initially in Year 3 it should be taught using numbers that do not require any '**carrying'** to the next column.

Compact column method (integers no carrying)

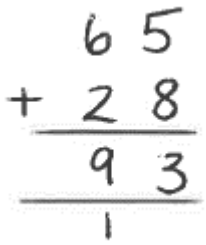


Concrete, practical resources (e.g. diennes) should be used to display the method visually and ensure the children's conceptual understanding.

Year 3/4

Once children are secure with this initial concept, they can begin to be taught calculations which involve the sum of two digits being larger than nine, using the method of '**carrying'** to the next place value column.

Compact column method (integers with carrying)



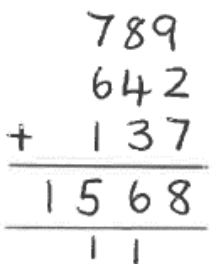
This method can then be used for the addition of multiple large numbers:

The concept of ten units becoming one ten in the next column or ten hundreds becoming one thousand should again be introduced visually using concrete, physical resources.

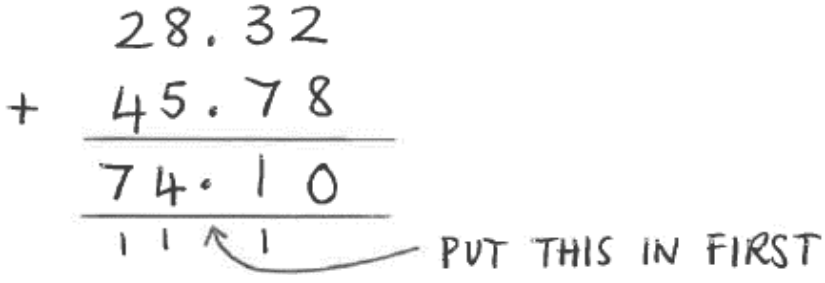
Year 5/6

The same method can be used to solve more complicated additions, such as adding multiple numbers or decimal numbers.

Column method (multiple integers with carrying)



Compact method (decimals)



It is essential that children understand the VALUE of all digits in the calculation, and how the method works.

They are simply adding each place value column in turn. The children should be able to clearly explain their working.

Subtraction

Reception

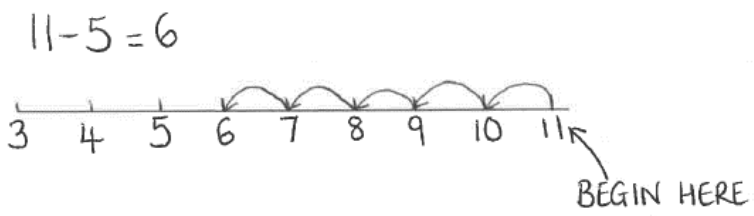
The focus at the beginning of the year is to use manipulatives to support children's understanding of subtraction, e.g. have 1 pile of objects and take some away to find out **how many are left**.

The children will then move on to **counting back** from a given number, with the support of a labelled number track by the end of the year.

Year 1

Children will use labelled number lines to **count back.**

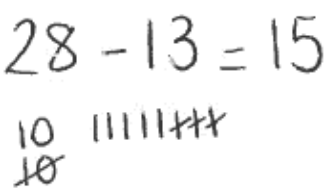
Labelled number line (counting back)



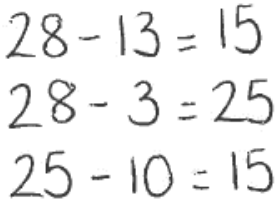
Year 2

Children will use partitioning of 2 digit numbers. They will partition the larger number and display the method visually by exploding it into tens and units to ensure the children's conceptual understanding. This will not involve '**exchanging'** initially, but by the end of the year exchanging should have been introduced and visually modelled.

Exploding numbers



Partitioning

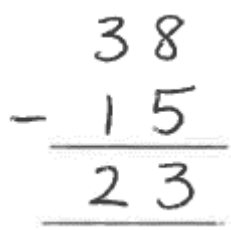


Years 3-6

Column Subtraction Method

This is introduced in Year 3 when a secure understanding of digit place value has been established. Initially in Year 3 it should be taught using numbers with a higher digit in each place value column to introduce the method simply.

Column method (no exchanging)



Concrete resources can be used to clearly demonstrate what is being represented by the calculation. It is important for the children to understand and articulate that the 6-3 = 3 is actually 60-30=30. Their understanding of digit value is crucial.

Decomposition

Once secure, children are then introduced to the concept of '**decomposition'**, whereby numbers can be '**exchanged'** across place value columns.

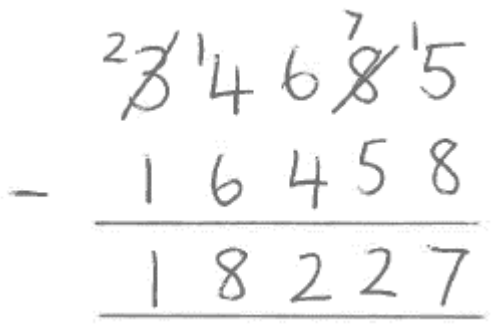
Column method (with exchanging)

In the above example, it is important they understand one 'ten' has been **exchanged** for ten 'units' because they have the same value. Concrete resources should be used to demonstrate to the children what has happened and WHY the method works.

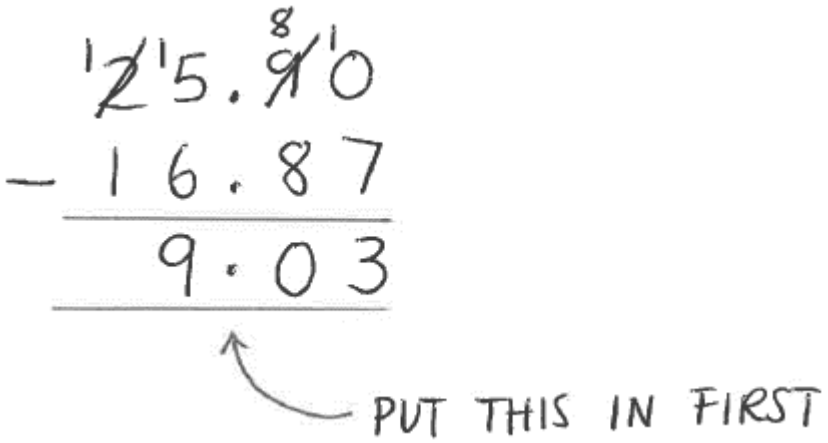
Year 5/6

The method is widened to include larger numbers and decimals.

Column method (with exchanging)



Column method (with decimals)



Multiplication

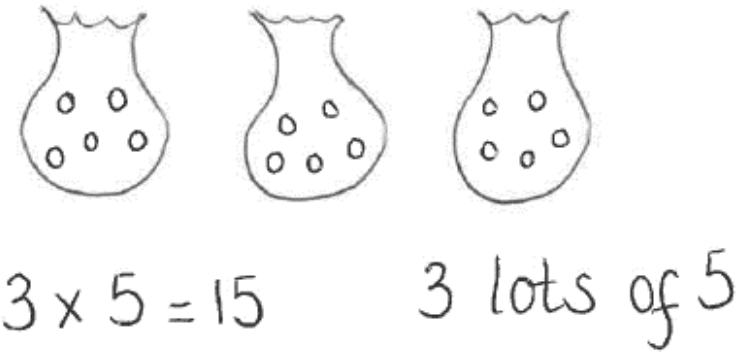
Reception

Children will be introduced to the concept of **doubling** using practical handling of objects.

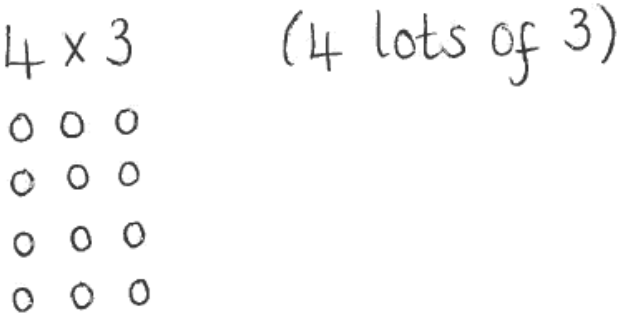
Year 1

Children will be supported to develop an understanding of multiplication using concrete objects and pictures.

Objects and pictures



Arrays



A secure understanding of times table facts is the basis for all multiplication methods used and therefore an essential requirement.

Year 2

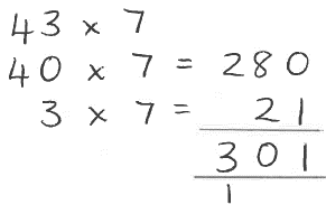
Children will continue to consolidate their understanding of multiplication using arrays and making links to repeated addition where they can use their times table facts.

Repeated addition

Year 3

Children use their knowledge of times table facts and place value to carry out simple multiplications using commutative properties (partitioning numbers).

Partitioning

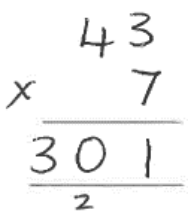


Arrays and concrete resources should be used in Year 3 to demonstrate visually the process of multiplication and to link it it conceptually to repeated addition.

Year 4

Children begin to multiply 2 digit numbers by a 1 digit number using short multiplication.

Column method (short multiplication)

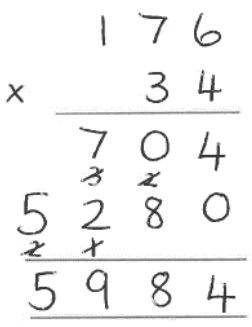


Children should understand why the small digit is placed in the next column: it represents 20 so has been placed in the tens column and added to the other tens in that column.

Year 5

Children move on to multiplying 3 and 4 digit numbers by a 2 digit number using column (long) multiplication. Children should cross out carried numbers to avoid confusion when adding answers.

Column method (long multiplication)

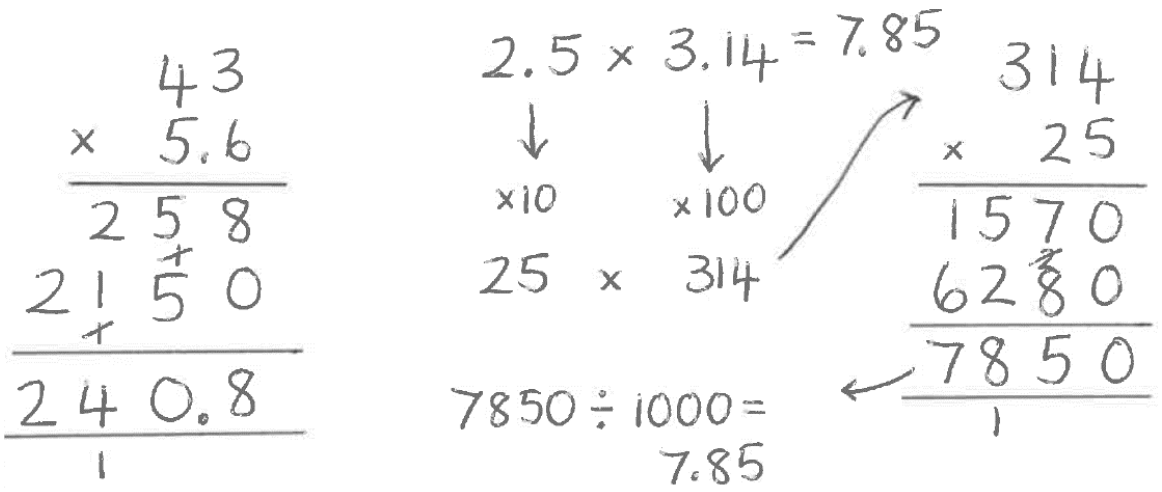


Children should understand that it is 176 x 4 and 176 x 30. The 3 is worth 30 therefore the answer will be ten times bigger so a zero is put into the units column as a place holder. Principles of column addition apply when calculating a final answer.

Year 6

Children will use their understanding of place value and multiplying/dividing by 10, 100 and 1000 to calculate multiplications involving decimals.

Column method (decimals)



'Multiplying out' the decimal in the question (x10 to make 43 x 56) then dividing the answer by 10 to put the decimal back in.

Division

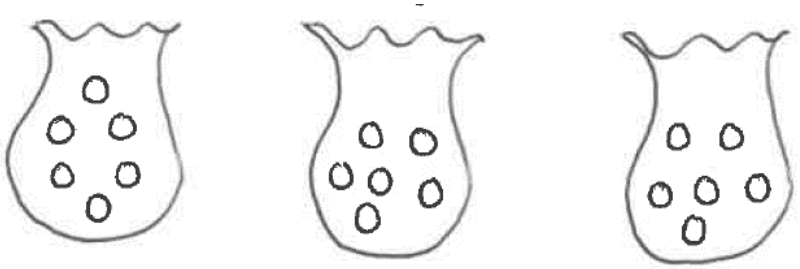
Reception

Children will be introduced to the concept of division as halving using concrete objects and drawings.

Year 1

Children will develop their understanding of division using practical physical activities to develop conceptual understanding.

Objects and pictures (sharing)



$18 \div 3 = 6$

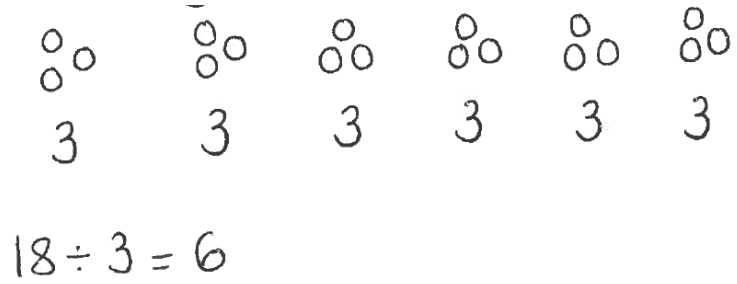
Objects and pictures (grouping)

$18 \div 3 = 6$

Year 2

Division will be represented as grouping objects and then counting in multiples using their times table facts.

Grouping

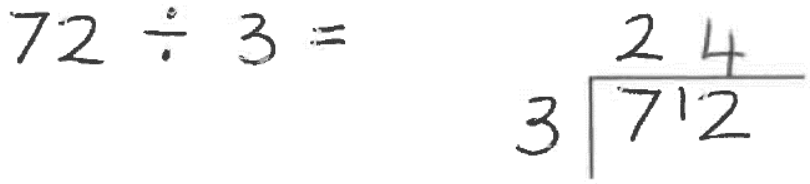


Year 3/4

Short division (bus stop)

Children use their knowledge of times table facts and place value to carry out simple division using commutative properties (partitioning numbers)

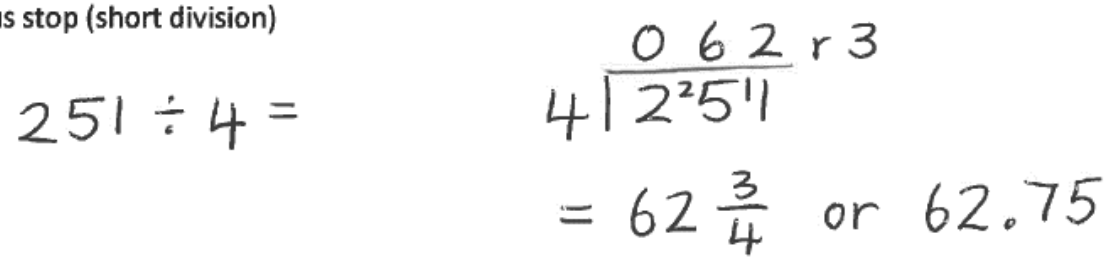
Bus stop (short division – pictorially and partitioned)



Year 5

Children will be introduced to interpreting remainders as a fraction or as a decimal.

Bus stop (short division)



Bus stop (short division – with decimals)

$2873 \div 4 =$

$$4 \overline{)\,2^{2}8\ 7^{3}3.1^{2}0} \quad 0\,7\,1\,8.2\,5$$

$= 718.25$ or $718\frac{3}{4}$.

Year 6

Children will need to be able to divide by a 2 digit number.

Jotting down tables, estimates and multiplications in a right-hand column are all techniques that can be used to assist in dividing by larger numbers in circumstances where the children do not know the times tables.

If children are very secure in using multiplication facts and being able to adapt their knowledge, then they can extend this strategy to increase efficiency.

Bus stop (using jottings for dividing by 2 digit numbers)

$586 \div 34$

$$34 \overline{)\,5^{5}8^{24}6} \quad 017r8$$

$$\begin{array}{r} 58 \\ -\,34 \\ \hline 24 \end{array}$$

$$\begin{array}{r} 2\,{}^{3}\cancel{1}^{1}6 \\ -\,238 \\ \hline 008 \end{array}$$

$1 \times 34 = 34$
$2 \times 34 = 68$
$3 \times 34 = 102$
$4 \times 34 = 136$
$5 \times 34 = 170$
$6 \times 34 = 204$
$7 \times 34 = 238$
$8 \times 34 = 272$