Carlton Colville Primary School
Calculation Policy
October 2015
(Also see Mathematics Policy)

<u>Background to the policy</u>

This policy explains the progression in calculation methods and strategies (both mental and written) for all four number operations that are taught in our school. These are based on, and developed from, 'The National Curriculum Programmes of Study' in conjunction with the 'The Suffolk Empty Number Line Programme' and Chris Quigley 'Essentials', which provide the basis for our school's scheme of work..

It has been written to ensure consistency and progression throughout the school and reflects a whole school agreement.

Pupils in EYFS should work from the EYFS Statutory Framework (Mathematics) in conjunction with the phase progression outlined in 'Numbers and Patterns.' Following this, the main emphasis in the early stages of addition, subtraction, multiplication and division in this policy is on developing mental methods supported by the use of concrete manipulatives such as counting objects, Base 10, bead frames and strings, Numicon, place value counters and Cuisenaire rods along with iconic / pictorial representations such as jottings, bar modelling, 100 squares, structured and (eventually) empty number lines. This 'CPA' approach (concrete-pictorial-abstract) should carry on throughout the school, with the abstract never being presented without the concrete and pictorial having already been explored. Children should be able to move backwards and forwards between the three and the concrete should always be available for children who need it.

It should be remembered that the strategies in the Suffolk Empty Number Line Programme that are included in this policy are essentially an aid to developing procedural fluency through effective mental strategies whilst at the same time building conceptual understanding- i.e. importance being placed on the 'why' and not just the 'how'. This is also true of the more formal written methods that are taught. The development and use of written number lines should be viewed as a jotting to aid the mental process at this stage. As numbers get bigger and calculations more complex then there is a greater need to use the empty number line as more of a written method to support the mental process, along then with the development of other appropriate written methods. It must be remembered that In every written method there is an element of mental processing. Therefore written recording both helps children to clarify their thinking and supports and extends the development of more fluent and sophisticated mental strategies.

During their time at school children will be encouraged to see mathematics as both a written and spoken language. Teachers will support and guide children through the following important stages:

- developing the use of pictures and a mixture of words and symbols to represent numerical activities;
- using standard symbols and conventions;
- use of jottings to aid a mental strategy;
- use of pencil and paper procedures;

It is important that children do not abandon jottings and mental methods once pencil and paper procedures are introduced. Therefore children will always be encouraged to look at a calculation/problem and then decide which is the best method to choose – pictures, mental calculation with or without jottings/bar modelling or more formal written method. Our long-term aim is for children to be able to use and apply their skills and understanding by selecting an efficient method of their choice that is appropriate for a given task. They will do this by always asking themselves:

> **'Can I do this in my head?'**
> **'Can I do this in my head using drawings or jottings?'**
> **'Do I need to use a pencil and paper procedure?'**

<u>Using the policy</u>

The philosophy behind this policy is that children work from where they are at in their learning, rather than being constrained by year groups. The policy shows a progression across the objectives for the 4 operations of calculation. Through your AfL you will be able to identify the starting point and next steps for the children in your class. This is particularly relevant to children who are not yet ready for the designated 'year group' stage. As stated in the aims of the Mathematics Programme of Study, pupils who grasp concepts rapidly will be challenged through being offered rich and sophisticated problems before any acceleration through new content.

Note: Bullet points may be, but are not necessarily, progressive within each Year Group Stage.

Throughout all the stages it is vital that the children's understanding of the appropriate mathematical vocabulary and language is developed systematically and progressively. The 'Mathematical Vocabulary' booklet is a useful aid to this along with the NCETM Glossary and appropriate maths dictionaries.

Please note - abbreviations such as '1A' refer to Suffolk ENL Programme blocks.
- the abbreviation 'COAPR' means 'concrete objects and pictorial representations'.

__Addition__

Year 1

- Exploring numbers to 20 using COAPR including Bead Frame (1A).

- Partitioning single digit numbers in different ways and starting to learn number bonds for numbers up to 10(1B) and then 20.

- Understanding addition as combining groups and counting or jumping on (up to 10)(1C).

- Partitioning numbers to 10 and 20. Starting to learn doubles to at least 10 (1E).

- Addition problems to 20 using 'counting on' with BF support if necessary (1F).

- Counting on in 2's, 3's and 5's using COAPR including Bead Frames, Bead Strings and Structured Number Line (1H).

- Use 'Clever Counting' strategies (1D)

- Exploring numbers to 100 (1I) using COAPR including BS, SNL and 100 square.

- Solve one-step problems that involve addition using COAPR.

- Children need to understand the concept of equality before using the '=' sign. Calculations should be written either side of the equality sign so that the sign is not just interpreted as 'the answer'.

    2 = 1+ 1
    2 + 3 = 4 + 1
    3 = 3
    2 + 2 + 2 = 4 + 2

- Solve 'Missing Number' problems (Missing numbers need to be placed in all possible places):

    3 + 4 = □   □ = 3 + 4
    3 + □ = 7   7 = □ + 4
    □ + 4 = 7   7 = 3 + □
    □ + ▽ = 7   7 = □ + ▽

Year 2

- Add any single digit number to any 2-digit multiple of 10 (2A) using COAPR (including BS and SNL).

- Know the addition facts for any single digit number (2A/B) and then numbers up to 20. Derive and use related facts up to 100.

- Addition of a 1-digit number to a 2-digit number up to 100 not crossing/crossing tens by adding on using number bonds knowledge and COAPR (including BS/SNL) (2B/2D).
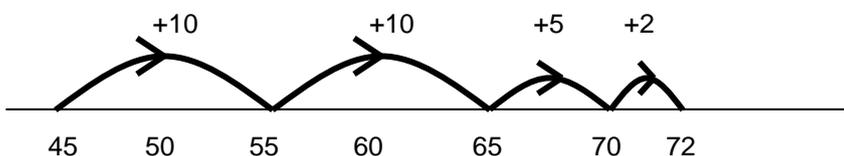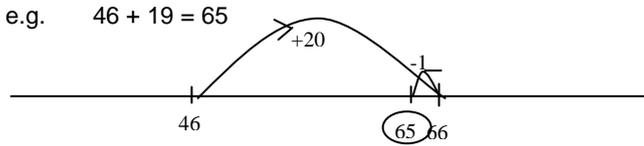
e.g. 27 + 8 = 35
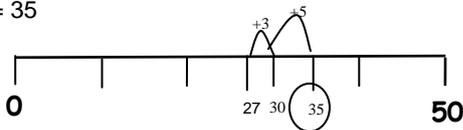
- Counting on in 10's from any 2-digit number using COAPR (2E).

- Addition of a 2-digit number to a 2-digit number up to 100 not crossing/crossing tens by adding on using number bonds knowledge and COAPR -J10 method (2D).

e.g.

J10   45 + 27 = 72

- Introduce Overjumping (O10) for +9 , +19 etc and +8, +18 etc with COAPR support as necessary (2E).

e.g.   46 + 19 = 65

- Consolidate J10 and O10 strategies (2F).

- Introduction to use of ENL as a PR to support mental process (2G).

- Begin to use partitioning as a written method of addition, supported by COAPR.

            e.g. 27+ 18 =
                20 + 10 = 30
                 7 + 8 = 15
          Then 30 + 15 = 45

- Continue developing the understanding of equality and 'missing number/operation' sentences.

- Adding three 1-digit numbers together.

- Understand and use the commutativity of addition.

- Solve problems with addition.

- Start to use the inverse operation to check answers.

Year 3

- Develop and consolidate use of COAPR (including ENLs) to support addition of a 2-digit number to a 2-digit number mentally (J10 and O10) (3B).

- Develop and consolidate use of COAPR (including ENLs) to support mental addition of a 3-digit number and ones, a 3-digit number and tens and a 3-digit number and hundreds.

- Begin to use compact ENL-style recording (e.g. arrow or number notation) (3E).
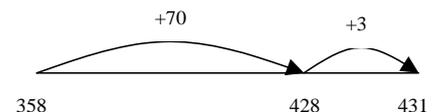
e.g. 27 + 25 = 52

Number notation for J10:   27 + 20 = 47   **Arrow notation for J10:**
                                 47 + 3 = 50
                                 50 +2 =52

- Make effective choices about the most appropriate strategy to use for a given problem (3C).

- Continue use of written ENL to support mental calculation, especially
  for larger numbers or more complex problems:

eg   **J10**   358 + 73 = 431

            O10   675 + 180 = 855

- Use of J10 and O10 if helpful) in an expanded format, especially for calculations involving larger numbers (up to 3 digit + 3 digit) or more than 2 numbers:

e.g .

Vertical expansion:
J10

```
        138
      + 125
138+100=238
238+20 = 258
258+5 =  263
```

> **NOTE-** Expanded methods are to be used mainly for demonstration, explanation and developing conceptual understanding rather than being learned as a procedural strategy. We aim to encourage a move onto the more compact methods as a procedural strategy.

T10

```
          138
        + 125
 138 + 2 = 140
 140 + 20  = 160
160 + 100= 260
  260 + 3 = 263
```

- Use of partitioning to add 2-digit +2-digit, 3-digit+ 2-digit and 3-digit + 3-digit numbers in an expanded horizontal and vertical format, showing that it makes no difference whether to add the tens or ones first, and so moving towards adding the ones first in order to make the transition to Stage 5 easier:

e.g.
Vertical expansion

```
   83
+  42
    5
  120
  125
```

- Refine to more compact column layout with 'carrying' (supported by COAPR):

```
  HTU
e.g.   587
      +475
      1062
       11
```

> **NOTE-** This is the core method for written column addition in our school.

- Extend these methods to decimals in the context of money (supported by COAPR):.

```
        HTU
e.g.    £6.72
       +£8.56
       £15.28
          1
```

- Solve problems including missing number problems, using number facts, place value and more complex addition.

- Teach importance of estimating and checking using the inverse operation.

- Addition of fractions with the same denominator within one whole.

Year 4

- Continue to use and refine effective mental strategies from ENL programme.

- Extend the core compact written method to add numbers with up to 4 digits and also more than 2 numbers (COAPR support as appropriate).

- Continue to add decimals using the contexts of money and measures.

- Addition using equivalent calculations: e.g. 538 + 170
$$= 508 + 200$$
$$= 708$$

- Further develop use of estimating and checking.

- Addition of fractions with the same denominator.

- Solve simple measure and money problems including fractions and decimals to 2 places.

Year 5

- Continue to use effective mental strategies as appropriate from previous stages with increasingly large numbers, based on ENL strategies.

- Use compact column addition to add whole numbers with more than 4 digits

- Further develop use of estimating and checking, determining levels of accuracy. This includes rounding to check answers.

- Solve multi-step addition problems in contexts.

- Solve problems involving numbers with up to 3 decimal places.

- Addition of fractions with the same denominator and multiples of the same number.

Year 6

- Further develop use of estimating and checking, determining levels of accuracy.

- Solve multi-step addition problems in different contexts.

- Addition of fractions with different denominators and mixed numbers, using the concept of equivalent fractions.

Further Challenge in Year 6

- Continue to use efficient written methods, applied to a range of numbers, both positive and negative.

- When pupils are ready, move them on to become more efficient when dealing with really large/really small numbers.

- Use mass, length, time, money and other measures when solving problems.

- Understand and use conventional notation for the priority of operations, including brackets, powers, roots and reciprocals.

<u>Subtraction</u>

<u>Year 1</u>

- Exploring numbers to 20 using Bead Frame and other COAPR (1A).

- Partitioning single digit numbers in different ways and starting to learn number bonds for numbers up to 10(1B).

- Understanding subtraction as taking away, and counting or jumping back (up to 10)(1D).

- Subtraction problems to 20 using 'counting back' with BF and other COAPR support (1F).

- Counting back in 2's, 3's and 5's using COAPR, including Structured Number Line (1H).

- Use 'Clever Counting' strategies (1D).

- Exploring numbers to 100 (1I) using COAPR including SNL and 100 square.

- Solve one-step problems that involve subtraction using COAPR.

- Children need to understand the concept of equality before using the '=' sign. Calculations should be written either side of the equality sign so that the sign is not just interpreted as 'the answer'

  5 = 6 - 1
  3 - 1 = 6 - 4
  8- 3 - 2 = 3

- Solve 'missing number' problems (missing numbers need to be placed in all possible places):

 | | |
  |---|---|
  | 7 - 3 = □ | □ = 7 - 3 |
  | 7 - □ = 4 | 4 = □ - 3 |
  | □ - 3 = 4 | 4 = 7 - □ |
  | □ - ∇ = 4 | 4 = □ - ∇ |

<u>Year 2</u>

- Subtract the ones from any 2-digit number to count back to the 2-digit .multiple of 10

- Know the number bonds for any single digit number (2A/B).

- Know the subtraction facts for any single digit number (2A/B) and then numbers up to 20. Derive and use related facts up to100.

- Subtract 1-digit numbers from any 2-digit number up to 100, including those that involve crossing a tens boundary using number bond knowledge and COAPR support (including BS/SNL (2C/D)).
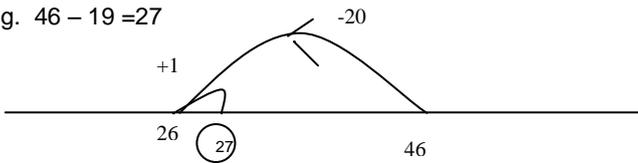
e.g. 15 – 6 = 9
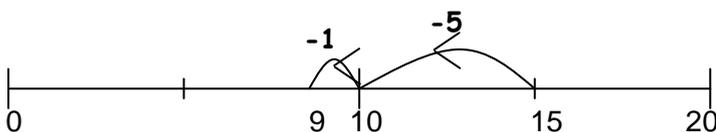
- Counting back in 10's from any 2-digit number using COAPR support (2E).

- Subtraction of a 2-digit number from a 2-digit number up to 100 not crossing/crossing tens by counting back using number bonds knowledge and SNL support-J10 method (2E).

e.g. 72 – 35 = 37
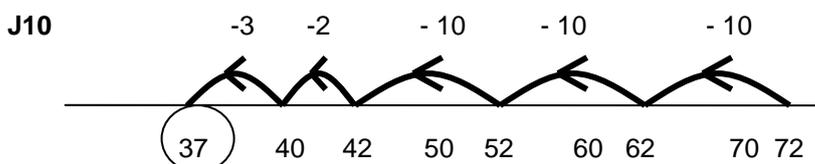
- Introduce Overjumping (O10) for -9, -19 etc and -8, -18 etc with COAPR support as necessary (2E).

e.g. 46 – 19 =27

- Consolidate J10 and O10 strategies (2F).

- introduction of Counting On (CO) for finding small differences not involving crossing a 10's boundary
  (e.g. 76-72) and Bridging (BRI) for finding a small difference crossing a 10's boundary (e.g. 83 – 78).(2F).

- Introduction to use of ENL to support mental process (2G).

- Continue developing the understanding of equality and 'missing number/operation' sentences.

- Solve problems with subtraction.

- Start to use the inverse operation to check answers.

Year 3

- Develop and consolidate use of COAPR (including ENL) to support subtraction of a 2-digit number from a 2-digit number mentally (J10, O10 CO and BRI) (3B) (see addition section for examples- reverse for subtraction).

- Use ENLs effectively to subtract 2-digit numbers from 3-digit numbers. (3D)

- Begin to use compact ENL-style recording (e.g. arrow or number notation) (3E).

- Make effective choices about the most appropriate strategy to use for a given problem (3C).

- Continue use of written ENL to support mental calculation.

- Use of J10 (and O10 if helpful) in an expanded horizontal and vertical format, especially for calculations involving larger, numbers (up to 3 digit + 3 digit) or more than 2 numbers:

e.g .

1. Vertical expansion   2. Horizontal expansion
J10

```
        238                238 - 125
       -125                238 - 100  =  138
238-100= 138               138 - 20 =    118
138-20 = 118               118 - 5 =     113
118-5 =   113
```

- Refine expanded column subtraction into compact column subtraction for 2-digit subtract 2-digit, 3-digit subtract 2-digit and 3-digit subtract 3-digit , using decomposition if any of the digits in the second row are less than the top row. Use the word 'Exchange' rather than 'borrow' (as this implies paying back): COAPR support.

e.g.

864-322=542

H	T	U
8	6	4
- 3	2	2
5	4	2

821-432=389

NOTE- This is the core method for written column subtraction in our school. Whilst it is the primary method taught alternatives that may be appropriate for some children can be found in the Appendix.

- Teach importance of estimating and checking (especially using inverse operation).

```
            H    T    U
            7    11
            8    2    ¹1
    -       4    3    2
    +       3    8    9
            8    2    1
            1    1
```

- Subtraction of fractions with the same denominator within one whole.

- Solve problems including missing number problems, using number facts, place value and more complex subtraction.

Year 4

- Continue to use and refine effective mental strategies from ENL programme. (CO and BRI to include 4 digit numbers).

- Continue use of ENL to support mental calculation, including decimals to 1 place.

- Extend use of compact column layout to include subtractions involving 4 digit numbers with COAPR support as appropriate.

- Solve two-step subtraction problems.

- Solve simple measure and money problems involving fractions and decimals to 2 places.

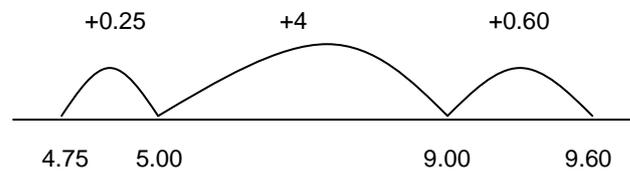- Subtraction of fractions with the same denominator.

Year 5

- Continue to use and refine effective mental strategies from ENL programme with increasingly large numbers. (CO and BRI to include 4 digit numbers).

- Continue use of ENL to support mental calculation, including decimals to 2 places, using contexts such as money.

e.g.

Counting On
$9.60 - 4.75 = 4.85$

```
        +0.25         +4          +0.60

   4.75    5.00              9.00      9.60
```

- Use column subtraction to subtract whole numbers with more than 4 digits.

- Solve multi-step subtraction problems in contexts.

- Subtract fractions with the same denominator and multiples of the same number.

- Use rounding to check answers to calculations, determining levels of accuracy.

Year 6

- Further develop use of estimating and checking, determining levels of accuracy.

- Solve multi-step subtraction problems in different contexts.

- Subtraction of fractions with different denominators and mixed numbers, using the concept of equivalent fractions.

Further Challenge in Year 6

- Continue to use efficient written methods, applied to a range of numbers, both positive and negative.

- When pupils are ready, move them on to become more efficient when dealing with really large/really small numbers.

- Use mass, length, time, money and other measures when solving problems.

- Understand and use conventional notation for the priority of operations, including brackets, powers, roots and reciprocals.

__Multiplication__

Year 1

- Multiplication is related to doubling and counting groups of the same size.

-

Looking at columns	Looking at rows
2 + 2 + 2	3 + 3
3 groups of 2	2 groups of 3

- Counting using a variety of COAPR:

  Counting in 2s e.g. counting socks, shoes, animal's legs…
  Counting in 5s e.g. counting fingers, fingers in gloves, toes…
  Counting in 10s e.g. fingers, toes…

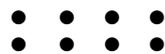- Using pictures / marks

  e.g. There are 3 sweets in one bag.
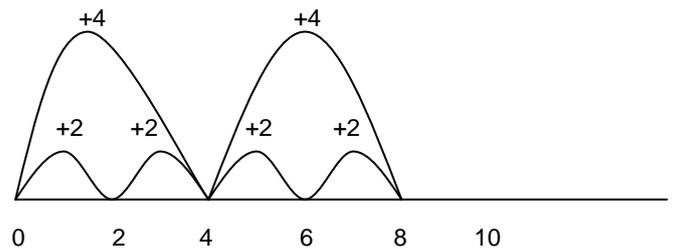   How many sweets are there in 5 bags?
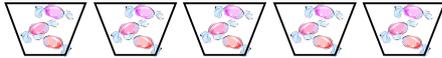
- Starting to understand doubling and begin to learn doubles of numbers up to double 10.

Year 2

- Use of arrays and repeated addition. Link to SNL
e.g.

  4 x 2 or 4 + 4

  2 x 4 or 2 + 2 + 2 + 2

- Use of x = signs and missing numbers

  e.g.   7 x 2 = □   □ = 2 x 7
          7 x □ = 14   14 = □ x 7
          □ x 2 = 14   14 = 2 x □
          □ x ∇ = 14   14 = □ x ∇

- Know by heart multiplication facts for 2, 5 and 10, up to 12x

- Learning doubles of numbers up to double 10 heart.

- Learning doubles of multiples of 5 up to double 25 by heart.
                    e.g. 2 x 15 = 30

- Start to use partitioning to double numbers up to double 50.
  Children need to be secure with partitioning numbers into 10s and 1s and partitioning in different ways: 6 = 5 + 1 so

  e.g. Double 6 is the same as double five add double one.

Double 15

$$10 \quad + \quad 5$$
$$\downarrow \qquad \downarrow$$
$$20 \quad + \quad 10 \ = \ 30$$
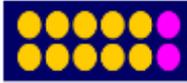
- Start to understand the relationship between multiplication and division.

Please note: Technically, to be mathematically accurate, '4 times 3' (eg) should be written as '3 x 4' i.e. ' 3 multiplied 4 times, as an operation sign states what is happening to the number it follows. However at this stage it is acceptable to write '4 times 3' as '4 x 3' and explain it as '4 lots of / groups of 3'. Children will learn the commutativity of x and so the order of writing becomes unimportant in practice.

Year 3

- Continue using a range of equations as in Stage 2 but with appropriate numbers.

- Continue to understand multiplication as repeated addition and continue to use COAPR (including arrays and ENL).

- Learn doubles of multiples of 5 up to double 50 by heart.

- Know by heart multiplication facts for 3, 4 and 8 up to 12x.

- Develop use of partitioning to double numbers up to double 100.

- Develop use of partitioning to double 3 digit numbers.

- Continue developing the understanding of equality and 'missing number/operation' sentences.

- Write and calculate mathematical statements for multiplication using the multiplication tables that they know, including 2-digit numbers times 1-digit numbers, using mental methods and progressing to written methods:

  Learn 'Grid Method' as a pencil and paper method for multiplication and develop as a mental visualisation using COAPR support such as place value counters.

  e.g. 23 x 7 is approximately 20 x 10 = 200

x	20	3	
7	140	21	= 161

Progressing (briefly) to expanded column layout:

```
      23
    X  7
      21
  + 140
    161
```

Progressing to more compact layout:

```
      23
    X  7
     161
      2
```

NOTE- This is the core method for written short multiplication in our school.

Year 4

- Know by heart multiplication facts for multiplication tables up to 12 x 12.

- Use place value, known and derived facts to multiply mentally, including multiplying 3 numbers together

- Further develop Grid Method and formal short multiplication method to include 2-digit times 1-digit, and 3-digit times 1-digit calculations using COAPR support such as place value counters.

e.g.
```
      342
   x    7
    2394
      2 1
```

- Understand the effect of multiplying by 10 and 100, including decimals to 3 places..

Year 5

- Extend Grid Method to include 4-digit times1-digit or 4-digit times 2-digit.

- Extend short multiplication method to include 4-digit times 1-digit.

- Learn long multiplication method for numbers up to 4-digits times 2-digit numbers:

e.g.
```
        3 2
        154
     x   16
        924
     + 1540
        2464
          1
```

NOTE- This is the core method for written long multiplication that pupils will be given the opportunity to learn in our school. Whilst it is the primary method taught alternatives that may be appropriate for some children can be found in the Appendix. Some children may still prefer the grid method.

- Multiply numbers mentally, drawing on known facts.

- Multiply whole numbers, and those involving decimals, by 10, 100 and 1000.

- Multiply proper fractions and mixed numbers by whole numbers (COAPR support).

- Solve problems involving numbers up to 3 decimal places.

Year 6

- Perform mental calculations, including with mixed operations and large numbers.

- Teach mental strategy option for decimals of e.g. 2.4 x 3:   Multiply by 10 -   24 x 3 = 72. Eg (20 x 3) + (4 x 3)

    Divide by 10 again = 7.2

Extend grid method to other decimal calculations e.g. 34.2 x 7

x	30	4	0.2	
7	210	28	1.4	=239.4

- Multiply 1-digit numbers with up to 2 decimal places by whole numbers using strategy of x10/100 before multiplying then divide answer by 10 or 100 as appropriate.

- Use knowledge of the order of operations to carry out calculations and solve problems.

- Use estimation to check answers to problems, determining levels of accuracy.

- Multiply simple pairs of common fractions, writing the answer in its simplest form e.g. ¼ x ½ =1/8.

- Multiply multi-digit numbers up to 4-digits by a 2-digit number using long multiplication.

Further Challenge in Year 6

- Continue to use efficient written methods, applied to a range of numbers, both positive and negative.

- When pupils are ready, move them on to become more efficient when dealing with really large/really small numbers.

- Use mass, length, time, money and other measures when solving problems.

- Understand and use conventional notation for the priority of operations, including brackets, powers, roots and reciprocals.

Division

Year 1

Division as **sharing.**

Requires secure counting skills
Develops importance of one-to-one correspondence

Sharing – 6 sweets are shared between 2 people. How many do they have each?

Practical activities involving sharing, distributing cards when playing a game, putting objects onto plates, into cups, hoops etc.

Division as **grouping**

Sorting objects into 2s / 3s/ 4s etc

How many pairs of socks are there?

There are 12 crocus bulbs. Plant 3 in each pot. How many pots are there?

Jo has 12 Lego wheels. How many cars can she make?

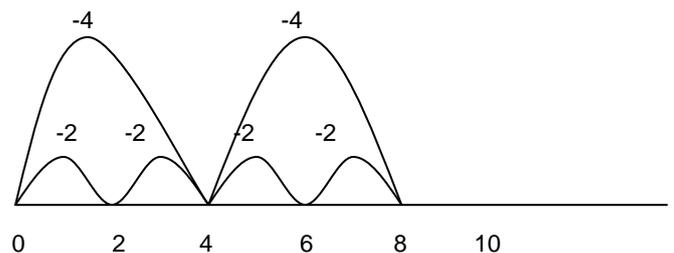- Starting to understand halving and begin to learn halves of numbers up to 20.

Year 2

Division as **grouping:**

Use of COAPR, including arrays and repeated subtraction. Link to SNL
e.g.

● ● ● ●   8 ÷2 or 8 ÷ 4
● ● ● ●

8- 2 - 2 - 2 – 2 = 0
8 – 4 – 4 =0

NB- Division as grouping is technically repeated subtraction, but also explain and demonstrate how this can be worked out with repeated addition.

- Further sorting of objects and practical examples of grouping e.g. in PE
  12 children get into teams of 4 to play a game. How many teams are there?

- Develop use of jottings and drawings to support this (counting on and counting back) :

  e.g.
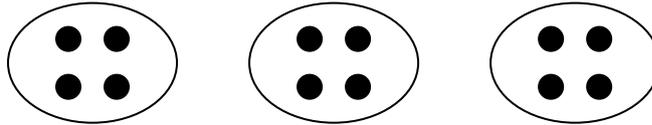
- In the context of money count forwards and backwards using 2p, 5p and 10p coins

Division as **sharing:**

- Sorting of objects and practical examples using COAPR.

- Develop use of jottings and drawings to support this, teaching systematic and careful 'sharing' (counting on and counting back).

- Understand division as the inverse of multiplication.

- Learn halves of numbers up to 20 by heart.

- Learning halves of multiples of 10 up to 50 by heart.

- Start to use partitioning to find half of even numbers up to 100.

- Learn division facts for the 2, 5 and 10 times tables (up to 12x).

- Use the fractions 1/3, ¼, 2/4, and ¾ to divide quantities and shapes.

- Use of ÷ = signs and missing numbers

  $6 ÷ 2 = \square$ $\square = 6 ÷ 2$
  $6 ÷ \square = 3$ $3 = 6 ÷ \square$
  $\square ÷ 2 = 3$ $3 = \square ÷ 2$
 $\square ÷ \nabla = 3$ $3 = \square ÷ \nabla$

Year 3

- Continue to develop grouping and sharing strategies with appropriate larger numbers e.g. 40 ÷ 8 = 5 by repeated subtraction of 8 on an ENL. Also use of repeated addition as an alternative to repeated subtraction.

- Learn division facts for the 3, 4 and 8 times tables (up to12x).

- Learning halves of multiples of 10 up to 100 by heart.

- Use partitioning to find half of 3-digit even numbers.

- Start to understand remainders in both sharing and grouping problems, practically, using COAPR including jottings/drawings.

- Continue developing the understanding of equality and 'missing number/operation' sentences.

- Use simple fractions to divide quantities.

Year 4

- Start using 'multiples of the divisor', which will lead to the compact 'Chunking' method:

e.g. $41 \div 4 = 10$ r 1
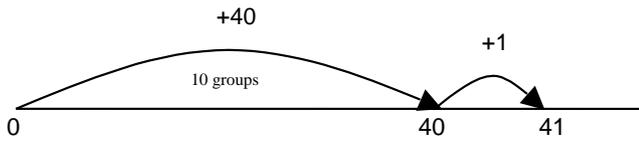
- Extend understanding of grouping for division column layout ('Chunking') first without a remainder, and then with a remainder:
e.g.
Without remainder:

$91 \div 7$
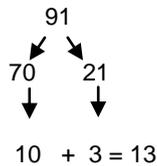
∗ Partition the dividend into multiples of the divisor:

$91 = 70 + 21$
$70 \div 7 = 10$
$21 \div 7 = 3$
So $91 \div 7 = 10 + 3 = 13$

OR

$$10 + 3 = 13$$

OR

$91 \div 7$

```
         91
       - 70   (10 x 7)
         21                  Answer = 13.
       - 21   (3 x 7)
          0
```

With remainder:
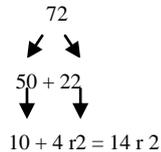
$72 \div 5$

$72 \div 5$ lies between $50 \div 5 = 10$ and $100 \div 5 = 20$

∗ Partition the dividend into multiples of the divisor:

$72 = 50 + 22$
$50 \div 5 = 10$
$22 \div 5 = 4r2 \rightarrow 10 + 4r2 = 14$ r 2

OR

$10 + 4$ r2 $= 14$ r 2

OR

```
          72
     -    50    (10 groups or 10 x 5 )
          22
     -    20     (4 groups or 4 x 5)
           2
```

Answer : 14 remainder 2

Note- It is perfectly acceptable to use addition to solve division questions using chunking, but pupils do need to understand that mathematically it is really subtraction that is happening.

- Begin to develop formal short division method ('bus stop') for numbers up to 2-digits divided by 1-digit (with COAPR support such as place value counters) where there are no remainders.

e.g.

$98 \div 7$ becomes

$$\begin{array}{c|cc} & 1 & 4 \\ \hline 7 & 9 & {}^2 8 \end{array}$$

Answer: 14

- Find the effect of dividing a 1 or 2-digit number by 10 and 100, identifying the value of the digits in the answer as ones, tenths and hundredths.

- Learn division facts for all times tables up to 12 x 12.

- Use partitioning to find half of four digit even numbers.

- Use increasingly complex fractions to divide quantities e.g. 2/7 or 4/9

Year 5

- Divide mentally, drawing on known facts.

- Begin to learn the tests of divisibility.

- Develop and refine the Chunking method.

  e.g. $256 \div 7$ lies between $210 \div 7 = 30$ and $280 \div 7 = 40$

  ∗ Partition the dividend into multiples of the divisor:

    $256 = 210 + 46$
    $210 \div 7 = 30$
    $46 \div 7 = 6r4 \rightarrow 30 + 6r4 = 36r4$

                    OR
    256   256
    ⤨⤩   - 210   (30 groups)
    210 + 46   46
    ↓   ↓   - 42   (6 groups)
    30 + 6r4   4

          Answer: 36 remainder 4

- Continue to develop formal short division method ('bus stop') for numbers up to 4-digits divided by 1-digit (with COAPR support such as place value counters and cuisenaire) interpreting remainders appropriately for the context.

e.g.

$98 \div 7$ becomes

$$\begin{array}{c|cc} & 1 & 4 \\ \hline 7 & 9 & {}^2 8 \end{array}$$

Answer: 14

$432 \div 5$ becomes

$$\begin{array}{c|ccc} & 8 & 6 & r\,2 \\ \hline 5 & 4 & {}^3 3 & 2 \end{array}$$

Answer: 86 remainder 2

- Divide whole numbers and those involving decimals by 10, 100 or 1000.

Year 6

- Perform mental calculations, including with mixed operations and large numbers.

- Develop and refine the use of formal short division to include 3-digit divided by 2-digit and 4-digit divided by 2-digit.

- e.g.

$496 \div 11$ becomes

```
        4   5  r1
           5
1  1 | 4  9  6
```

| Note: As calculations become more complicated it may help initially to write out the relevant times table. |

Answer: $45\frac{1}{11}$

- As appropriate develop the use of long division for up to 4-digit divided by 2-digit, interpreting remainders appropriately for the context.

  e.g.

$432 \div 15$ becomes

```
            2   8
    1   5 | 4   3   2
            3   0   0    15×20
            ---------
            1   3   2
            1   2   0    15×8
            ---------
                1   2
```

| Note: As calculations become more complicated it may help initially to write out the relevant times table. |

$\frac{\cancel{12}}{\cancel{15}} = \frac{4}{5}$

Answer: $28\frac{4}{5}$

NOTE- Although pupils should be given the opportunity to experience long division, the emphasis should be on the short division method if the teacher considers this more appropriate for pupils.
This is the core method for long division in our school. Whilst it is the primary method taught alternatives that may be appropriate for some children can be found in the Appendix.

- Use estimation to check answers to calculations, determining levels of accuracy.

- Divide proper fractions by whole numbers e.g. $\frac{1}{3} \div 2 = \frac{1}{6}$

- Divide numbers by 10, 100 or 1000 where the answers are up to three decimal places.

- Use written division methods where the answer has up to two decimal places.

Further Challenge in Year 6
- Continue to use efficient written methods, applied to a range of numbers, both positive and negative.

- When pupils are ready, move them on to become more efficient when dealing with really large/really small numbers.

- Use mass, length, time, money and other measures when solving problems.

- Understand and use conventional notation for the priority of operations, including brackets, powers, roots and reciprocals.

This policy will be reviewed every two years or sooner if necessary.

Date: October 2015

To be reviewed October 2017

Appendix 1- alternative formal written methods

Subtraction

874 – 523 becomes	932 – 457 becomes

```
          8  7  4
       −  5  2  3
       _____
          3  5  1

        Answer: 351
```

```
        8   12  1
        9   3   2
     −  4   5   7
     _____
        4   7   5

      Answer: 475
```

Long Multiplication

24 × 16 becomes

```
          2
       2  4
    ×  1  6
    _____
       2  4  0
       1  4  4
    _____
       3  8  4

   Answer: 384
```

124 × 26 becomes

```
       1    2
    1  2  4
    ×     2  6
    _____
    2  4  8  0
       7  4  4
    _____
    3  2  2  4
    1    1

   Answer: 3224
```

Long Division

432 ÷ 15 becomes

```
              2  8  r 12
    1  5 | 4  3  2
           3  0  0
           _____
           1  3  2
           1  2  0
           _____
              1  2
```

Note: It may initially help to show the chunks taken with this method

Answer: 28 remainder 12

432 ÷ 15 becomes

```
              2  8 · 8
    1  5 | 4  3  2 · 0
           3  0
           _____
           1  3  2
           1  2  0
           _____
              1  2  0
              1  2  0
              _____
                    0
```

Answer: 28·8

Appendix 2- Core number facts/skills/understanding to prioritise in each Year Group

Year 1

- Count to 100 and back to 0.
- Recall of addition and subtraction facts for 2,3,4,5 and 10.

Year 2

- Recall of addition and subtraction facts for 6,7,8 and 9.
- Recall of addition and subtraction facts for rest of numbers up to 20.
- Recall of multiplication and division facts for 2, 5 and 10 x tables (up to 12x).
- Thorough understanding of place value up to 100.

Year 3

- Maintain recall of addition and subtraction facts for numbers up to 20.
- Recall of multiplication and division facts for 3, 4 and 8 x tables (up to 12x).
- Thorough understanding of place value up to 1000 and to one decimal place.

Year 4

- Recall of multiplication and division facts for all times tables (up to 12x).
- Thorough understanding of place value up to 10000 and to two decimal places.

Year 5

- Maintain recall of multiplication and division facts for all times tables (up to 12x).
- Thorough understanding of place value up to 100000 and to three decimal places.

Year 6

- Maintain recall of multiplication and division facts for all times tables (up to 12x).
- Thorough understanding of place value up to 1000000 and to three decimal places.

NOTE – **It is also a priority to continually develop confidence and competence in mental agility throughout the school, with regular practice and opportunities to apply knowledge and understanding.**