Amherst School

Calculations Policy

Introduction

This calculation policy has been devised to reflect the current teaching and learning of Mathematics at our school to meet the requirement of the National Curriculum and the Mastery approach of teaching Mathematics. It has been written to ensure a structured and systematic approach to teaching Maths to give consistency and smooth progression throughout the school and reflects a whole school agreement. It builds upon the content and methods already taught at Riverhead Infants School.

In this policy we recommend the route most children should be able to follow when developing their mathematical knowledge, skills and conceptual understanding to become successful mathematicians. However, teachers may need to introduce other methods for some children to investigate and explore. Every teacher MUST make sure that at the beginning of teaching new topics children are given the opportunity to show the methods they are currently using as this will inform future planning. The children will be taught each new stage when they are ready and their learning will be constantly supplemented by using manipulatives, pictorial representations and as many practical applications as possible to ensure conceptual understanding. The transition between the stages should not be hurried and our planning reflects the school's philosophy of teaching mathematical topics for longer and deeper to ensure pupils make connections, develop the ability to reason, see patterns and become unconsciously competent and confident mathematicians.

There is a considerable emphasis on teaching mental calculation strategies. During their time at Amherst School, children will be encouraged to see Mathematics as both a written and spoken language. The pre-requisite for fluent computational skills is dependent on accurate and rapid recall of basic number facts and times tables. It is important to recognise that the ability to calculate mentally is fundamental to a child becoming numerate. Considerable time will be spent each day as part of the Maths lesson to develop mental fluency and a strong sense of number. Mental methods will be taught systematically from Year 3 onwards. Each of the four operations build on the mental skills which provide the foundations for jottings and informal written methods of recording. Skills need to be taught, practised and constantly reviewed. These skills lead on to more formal written methods of calculation. However mental calculation is not at the exclusion of written recording and should be seen as complementary to and not as separate from it. In every written method there is an element of mental processing. Sharing written methods with the teacher encourages children to think about the mental strategies that underpin them and to develop new ideas. Therefore, written recording both helps children to clarify their thinking and supports and extends the development of more fluent and sophisticated mental strategies.

Aims

Children will:

- develop the mathematical knowledge, skills and understanding to be confident and competent mathematicians in real life and abstract contexts
- develop mental fluency in the fundamentals through the rapid recall of basic number facts and understanding of number relationships
- be able to select the most efficient calculation method (written/mental) to solve a problem, reason mathematically and use a range of written and mental skills
- be taught calculation methods that are appropriate to their current level of mathematical understanding
- have number sense and be able to estimate the size of an answer by using skills of approximation, to have a feeling for the correct size of the answer
- speak confidently about Mathematics using the correct mathematical language and be able to explain their methods of calculation to each other
- celebrate their mistakes and have the growth mind-set to view them as opportunities for learning
- solve problems by applying their mathematical understanding to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps.

Choosing a calculation method

Children will be taught and encouraged to use the following processes in deciding what approach they will take to solve a calculation to ensure they select the most appropriate method for the numbers involved. This they will do by asking themselves:

- Can I do this in my head using a mental strategy?
- What is the approximate answer? (estimation)
- Could I do jottings to keep track of the calculation?
- Can I use a picture or manipulatives to help me understand?
- Do I need to use a written method to solve the calculation?
- How can I check my answer is reasonable?

By the end of Year 6, children working at the Expected Level and above will be secure using a compact standard written method for each operation.

Providing a context for calculation:

For a child to develop procedural fluency and be able to select the most efficient written calculation method they will need to have experienced solving problems using concrete apparatus, then moving onto visual representations (pictorial) and finally onto abstract written methods. This will help them develop a deeper understanding of mathematics, making connections between themes in the subject. In lessons, teachers need to create a culture where mistakes are celebrated and viewed as opportunities to learn, children are encouraged to share their different strategies and explain their mathematical reasoning.

Intelligence Practice

Teaching exercises will encourage conceptual and procedural variation. Children are encouraged to identify things that are the same and different to help them make generalisations, e.g.: 2 X 3 =, 2 X 30=, 2 X 300=, 20 X 3=

Key Skills for Successful Fluency

Successful fluency will be established based on a secure understanding of place value and will include the following:

1. Remembering number facts and recalling them without hesitation
   e.g. number bonds to 10, doubles/halves to 20, importance of number 10 in place value
2. Using known facts to calculate unknown facts
   e.g. near doubles, multiples of 10, 24 + 10 = 34 therefore 24 + 9 = 33
3. Understanding and using inverse relationships to check answers
4. Estimating or approximating first to increase accuracy of calculations
5. Partitioning numbers to aid calculations
6. Understanding the equals symbol as a sign of equivalence and not as an instruction to work out the answer; this should be encouraged by moving the equals sign around within calculations
7. Understanding the value of a digit through place value
8. Bridging through 10 and using this along with partitioning to support mental calculations
   e.g. 9 + 6 = 9 + 1 + 5 = 15
9. Using jottings to assist calculations with larger numbers
   e.g. number lines, bar models, arrays, part-whole models
10. Solving word problems by identifying which operation to use and drawing on relevant strategies to explain reasoning
11. Learning tables in the order below; this will provide opportunities to make links between them e.g. 4 x table is double 2 x table.

X10	X5	X2	X4	X8	X3	X6	X9	X11	X7	X12

12. Multiplying and dividing by 10, 100, 1000
13. Understanding 0 as a place holder
14. Knowing the result of multiplying a number by 0 and 1
15. Using mathematical vocabulary accurately and appropriately
    e.g. if partitioning 68 + 47, should be read “sixty add forty” not “six add four” for the ten’s column

The above list is not exhaustive but is a guide for the teacher to judge when a child is ready to move from informal to formal methods of calculation. If a child has gaps in this list then the teaching of these should be a focus of mathematical intervention groups.

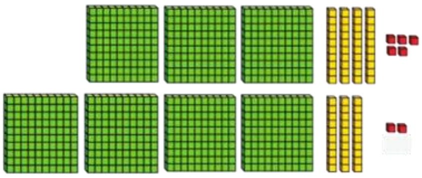
Progression of Skills for the Four Operations

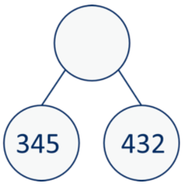
The Write Rose Scheme of Learning will be used as a basis for planning but adapted as appropriate for each class. For each stage outlined below, a selection of concrete and visual representations will be used to support understanding and progression.

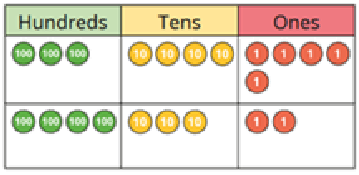
Addition

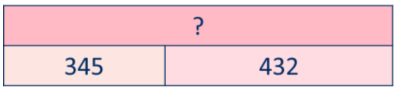
Stage 1: Concrete and Visual Representations

Examples:

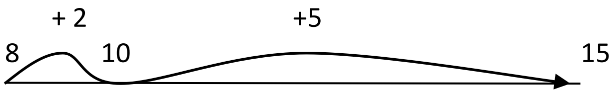




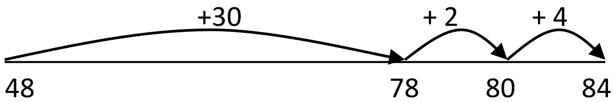




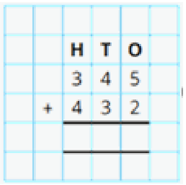
8 + 7 = 15
(Bridging 10)



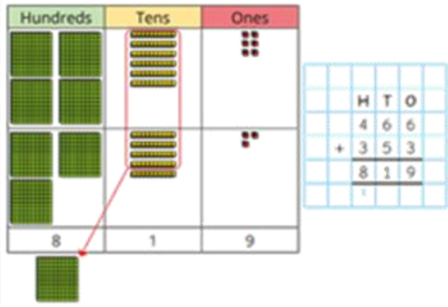
48 + 36 = 84



Stage 2: Column Addition without exchanging

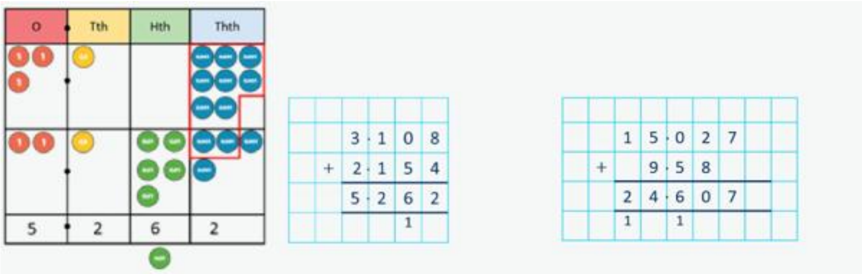


Stage 3: Column Addition with exchanging

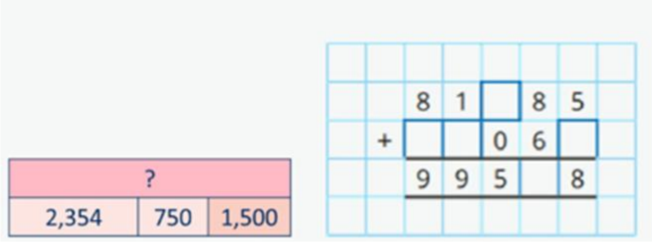


Stage 4: Column Addition with larger numbers and decimals

Decimal points should be correctly placed on the line between the ones and tenths columns.
Numbers with a different number of digits should be lined up correctly in place value columns.

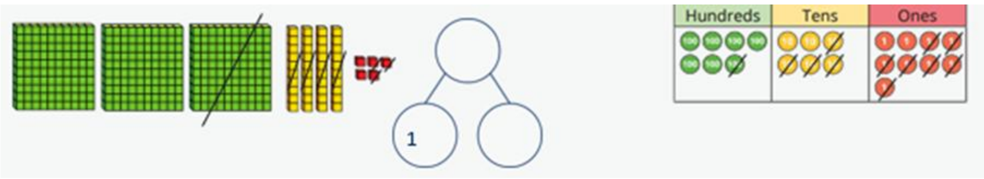


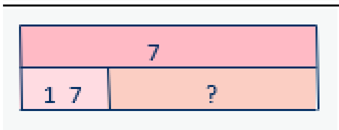
Stage 5: Applying understanding to find missing values



Subtraction

Stage 1: Concrete and Visual Representations

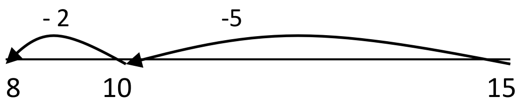




Stage 2: Specific use of Number Lines

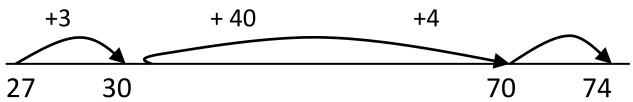
Number lines should be used to count on or count back.

15 – 7 = 8



Using number line to count back

74 – 27 = 47



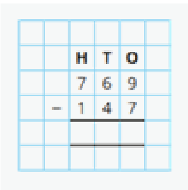
Using a number line to count on from the smallest number to the largest

Stage 3: Partitioning

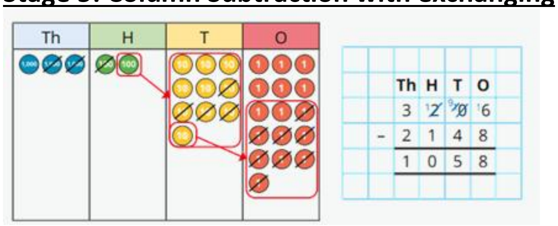
74 - 27=

74-20 = 54
54- 7 = 47

Stage 4: Column Subtraction without exchanging

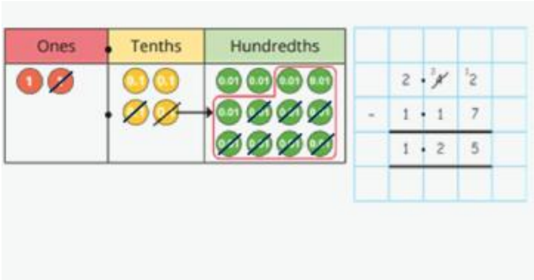


Stage 5: Column Subtraction with exchanging

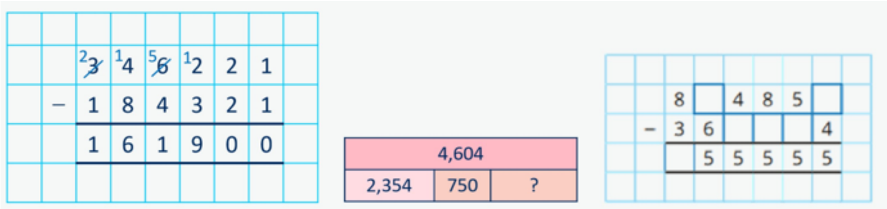


Stage 6: Column Subtraction with larger numbers and decimals

Decimal points should be correctly placed on the line between the ones and tenths columns.
Numbers with a different number of digits should be lined up correctly in place value columns.



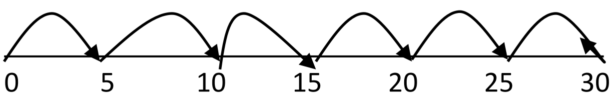
Stage 7: Applying understanding to find missing values

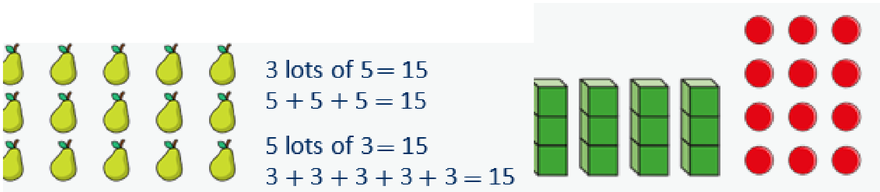


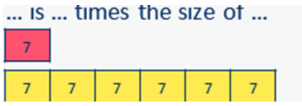
Multiplication

Stage 1: Concrete and Visual Representations

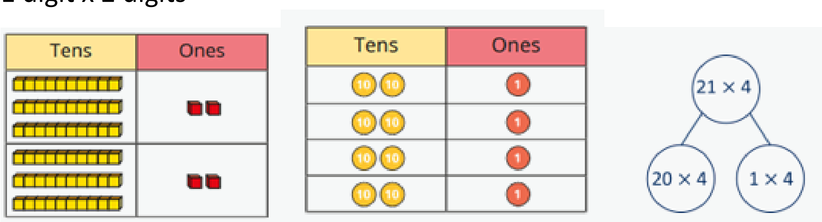
1 digit x 1 digit







1 digit x 2 digits

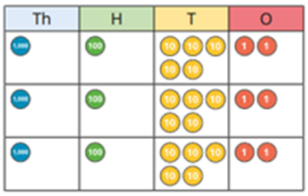


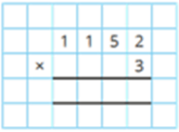
Stage 2: Partitioning

38 X 7 = (30 X 7) + (8 X 7)
= 210 + 56
= 266

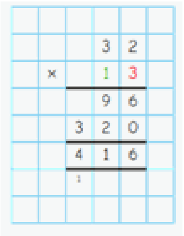
TO X O

Stage 3: Short Multiplication



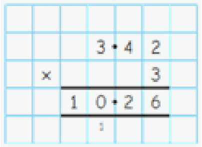


Stage 4: Long Multiplication



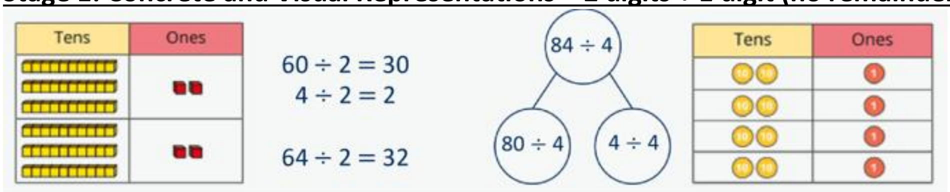
Stage 5: Multiplication with decimals

Decimal points should be correctly placed on the line between the ones and tenths columns.

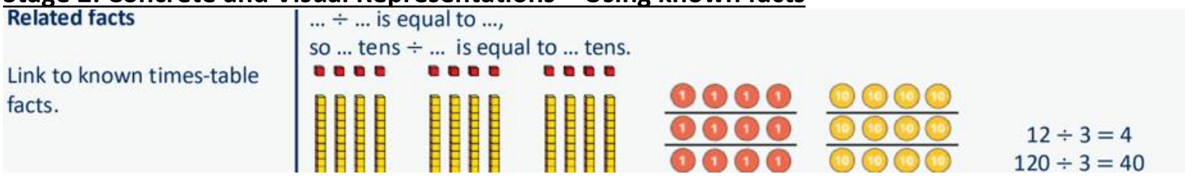


Division

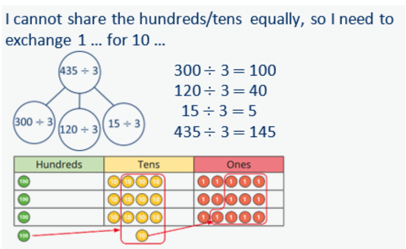
Stage 1: Concrete and Visual Representations – 2 digits ÷ 1 digit (no remainders)



Stage 2: Concrete and Visual Representations – Using known facts

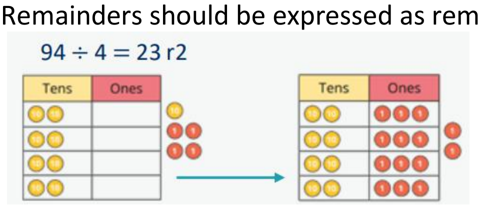


Stage 3: Concrete and Visual Representations – 2 or 3 digits ÷ 1 digit (with exchanging)



Stage 4: Concrete and Visual Representations – 2 or 3 digits ÷ 1 digit (with remainders)

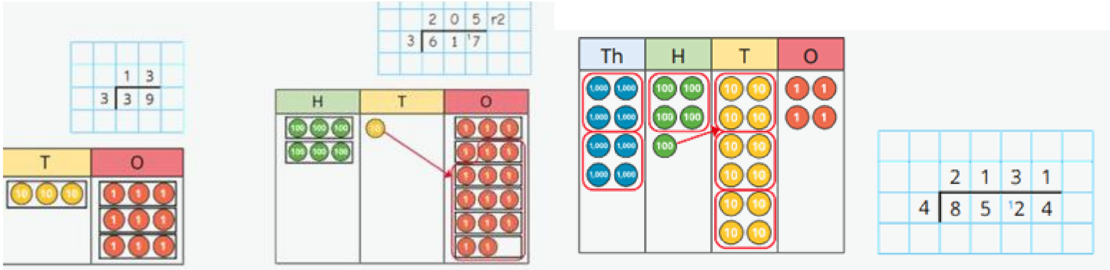
Remainders should be expressed as remainders (e.g. r2).



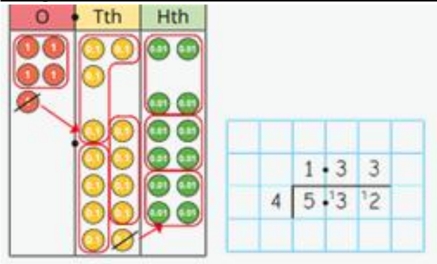
Stage 5: Short Division

The progression outlined in stages 1, 3 and 4 should be followed when introducing short division.

Initially remainders should be recorded as remainders (e.g. r2) but then should progress to recording as a fraction or decimal where appropriate for the context of the answer.



Stage 6: Short Division for decimal ÷ integer



Stage 7: Long Division

The times table for the divisor should be recorded alongside the calculation.