Sutton CE (VC) Primary School

Calculation Policy 2018

Approved by Governors: March 2018

Approved by Staff: March 2018

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This policy aims to ensure that all pupils are supported to:

- Understand the key principles of mathematics, enabling them to become fluent in basic mental and written methods. This will require quick and accurate recall of number bonds and multiplication facts; and sound understanding of place value. With these principles firmly in place, pupils will feel comfortable to test new ideas for themselves and will develop the flexibility necessary to apply their knowledge and work through any problem.
- Apply their knowledge of mathematics to understand and solve problems, including realistic "real world" problems that they may not be familiar with. This will require pupils to identify and understand patterns and relationships; understand information that has been provided with a problem, together with which important information is missing; and to communicate their ideas.
- Can use mathematical reasoning, exploring ideas and following a line of enquiry to present reasonable arguments and mathematical proof. This will require pupils to break problems into simpler steps; decide what information to gather or collect for their mathematical solution; and develop persistence in solving problems.

Each mathematical operation is presented in a clear sequence that shows the learning progression from Foundation Stage to Key Stage 2. Many mathematical ideas and methods are linked, so pupils are always encouraged to apply the knowledge that they already possess to new areas of learning.

This document should be used in school to ensure that there is consistency of approaches and complete coverage of the curriculum, and at home to illustrate the important techniques that will be used throughout the children's mathematical learning journey.

There is strong evidence that children who practise and explore maths at home are more confident and able to apply their thinking to new problems and grasp new concepts more readily. Discussion of maths at home allows the children to consolidate what they learn through repetition and demonstration. The role of parents and carers in the mathematical journey is therefore vitally important.

While the new curriculum allows flexibility in the formal written methods used, there is an expectation that children will be able to use – and will be tested on – specific methods for calculating with multi-digit numbers. These methods are referred to within this Calculation Policy.
Throughout this document, we show the stages of mathematical learning. These are the steps that the children go through to achieve understanding across the whole curriculum and do not necessarily relate to any particular year. For example, your child might progress through stages 3, 4 and 5 in one year.

Understanding Number

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Counting – and the understanding of how numbers get bigger and smaller – is the basis of maths. Place value allows children to show a higher number using only the nine digits that they are familiar with (1-9). Place value also introduces the children to the concept of zero, which represents "no value".

Once children progress to ten and beyond, they will come across the idea of "place value". Place value is the value of a digit determined by its place in a number. For example: in the number 346, the three represents three hundred, the four represents forty and the six represents six. However, in the number 463, although the digits are the same, they have different values due to the placement and the number is therefore different. Flexible thinking allows the child to look at one digit in the number and "hold" its value in their head.

In order to calculate successfully children need a secure grasp of place value. This is learnt throughout the school and is crucial in the development of mathematical knowledge. Children need to be aware of the value of the different digits within numbers and are taught this through the partitioning, ordering and rounding of different numbers.

Progression in Counting and Place Value: Back to Contents

Stage 1: Learning to say number names in order and counting forwards and backwards in ones. Counting small collections of objects. Counting and using number up to ten.

Stage 2: Comparing numbers using "more than" and "less than". Recognising and counting in patterns, for example counting in twos, or tens. Recognising a quantity of objects as a number without counting all the objects, for example seeing five chairs as 5, without counting 1-2-3-4-5. Counting and using numbers up to twenty.

Stage 3: Learning about pairs of numbers that belong together to make another number – number bonds. Learning about "equals" as a concept – making amounts or values balance so that they are the same or "equal". Learning that numbers can be odd or even. Beginning to explore what different amounts look like and comparing different quantities. Using this to start estimating quantities. Counting and using numbers up to one hundred.

Stage 4: Ordering and comparing two-digit numbers. Starting to explore and recognise patterns in numbers. Beginning to explore numbers up to one thousand, but counting and using numbers up to one hundred. Recognise that a fraction of a number is less than one whole and begin to explore the meaning of fraction notation.

Stage 5: Positioning two and three digit numbers accurately on a number line. Beginning to partition numbers, for example 365 can be partitioned (split) into three hundred, sixty and five. Recognising that numbers can be approximated by rounding and understanding when this can be useful.

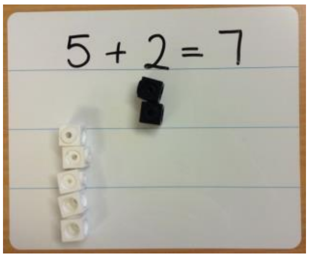
Stage 6: Using counting and place value knowledge to apply things they know about single digit numbers to two and three digits numbers, for example that 4 + 6 = 10, therefore 40 + 60 = 100 and 400 + 600 = 1000. Children also use this knowledge to begin exploring numbers with decimals, particularly with relation to money and measurement. Counting and using numbers up to one thousand whilst beginning to explore numbers beyond this.

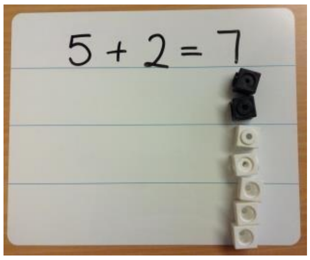
Stage 7: To explore the relationship between positive and negative numbers in context, for example in temperature scales.

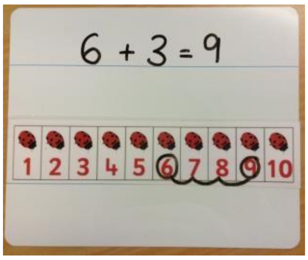
Progression in Addition   Back to Contents

Stage 1:

Begin to solve simple addition calculations in a practical way that involve combining two groups of everyday objects.





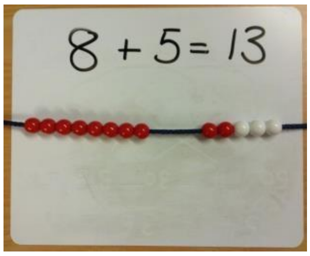


Stage 2:

Use concrete objects and pictorial representations to solve simple addition problems. Introduce counting on using a number track putting the largest number first.

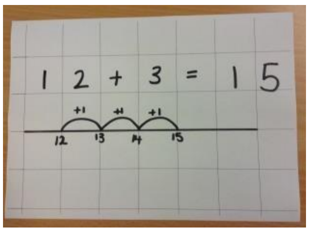
Stage 3: Continue to use practical resources to support calculation. Introduce and model the use of the number line. Children begin to use numbered lines to support their own calculations.

Beadstrings or beadbars can be used to illustrate addition including bridging through ten by counting on 2 then counting on 3 when doing 8+5.

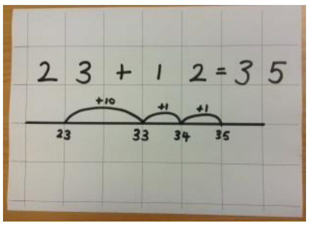


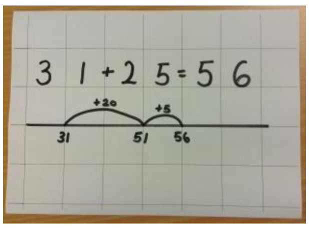
Stage 4: Children will begin to use 'empty number lines' themselves starting with the larger number and counting on, whatever of the order of calculation.

First counting on in ones



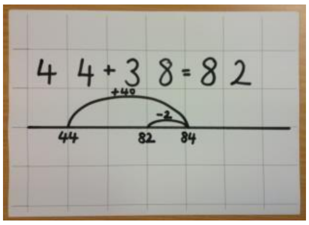
Then counting on in tens and ones then helping children to become more efficient by adding the units in one jump (by using the known fact 4 + 3 = 7).

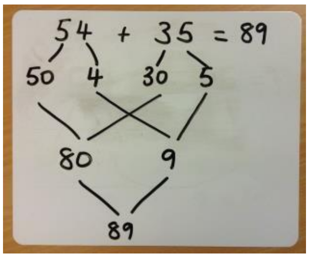




Followed by adding the tens in one jump and the units in one jump.

Stage 5: Children will continue to use empty number lines with increasingly large numbers, including compensation where appropriate. Compensation means counting on beyond your number using a more straightforward number (for example adding 40, rather than 38), then counting back to your original number (remembering to take the difference off - 2).



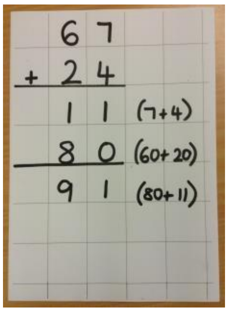


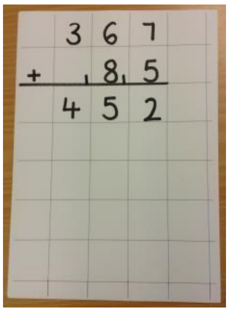
Stage 6: Children will begin to use informal pencil and paper methods (jottings) to support, record and explain mental methods building on existing strategies.

Stage 7:

Secure informal methods leading to the development of more formal written methods.

e.g. Partitioning by adding the smallest digits first (preparation for regrouping). This is known as the "extended column" method.

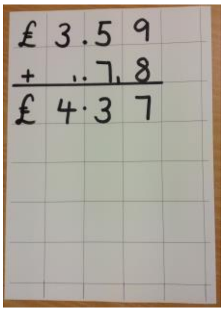




From this, children will begin to regroup numbers and record this accurately. This is known as the "compact column" method, because the whole calculation can be achieved in one row of calculation.

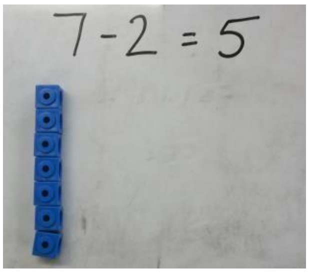
Stage 8: Children should extend the regrouping method to include numbers with decimals in a range of contexts, for example for money and measurement.

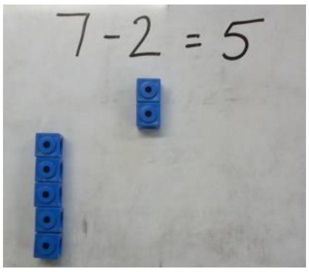
At this point, place value knowledge it vital. Children need to understand that decimal points should line up under each other in column calculations, particularly when adding or subtracting mixed amounts, e.g. £3.59 + 78p. To achieve this, children need the flexibility of thinking to recognise and understand that 78p is actually a decimal of whole pounds - £ 0.78.



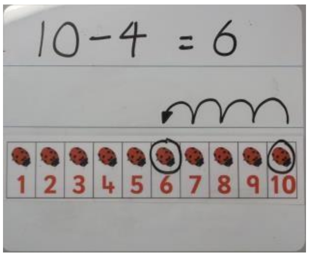
Progression in Subtraction [Back to Contents]

Stage 1: Children begin to understand subtraction as taking away. Using everyday objects they start with a group, take some away and count what is left.



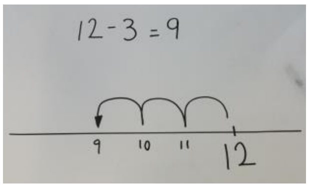


Stage 2: Children begin to use numberlines, number tracks or beadstrings to solve subtraction calculations by starting on the largest number and counting backwards by the subtracted number.

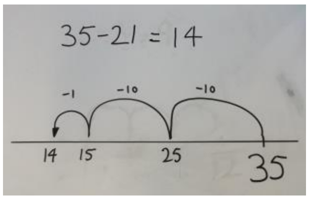


Stage 3: Children will begin to use empty number lines to support calculations.

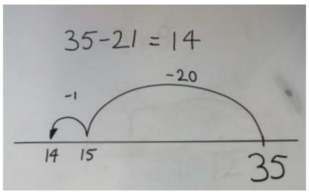
First counting back in ones

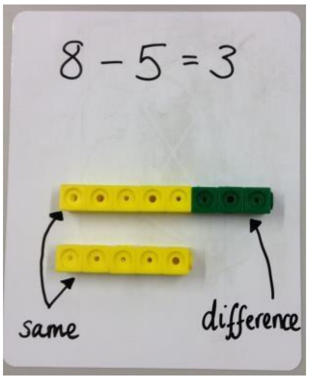


Then counting back in tens and ones

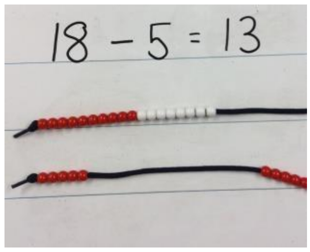


Followed by subtracting the tens in one jump and the units in one jump





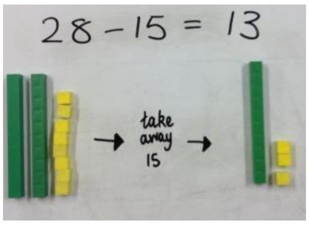
Stage 4: Children are taught an alternative method for solving subtraction calculations where they need to 'find the difference'. Children count on from the smaller number to the larger number.



First using objects and counting on in ones

Then using a beadstring or numberline and counting in tens and ones

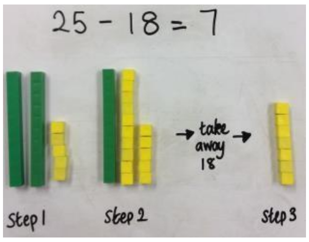
Stage 5: Children work towards using the column method for subtraction involving numbers that do not require regrouping.



First using objects to represent amounts

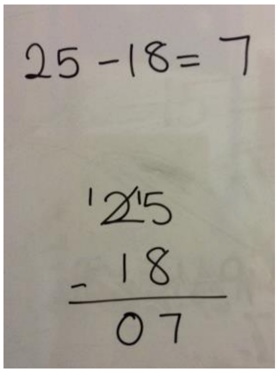
Then arranging numbers using their place value knowledge, then recording this representation.

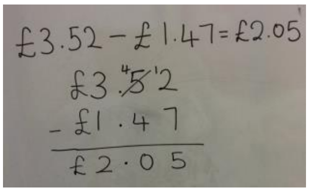
Stage 6: The children now develop a consistent method of laying out a calculation. This is known as the column method and can be recorded in either "expanded", or "compact" styles. Children begin to work with numbers that do require regrouping.



First using objects to represent the regrouping of a number

Then recording this representation



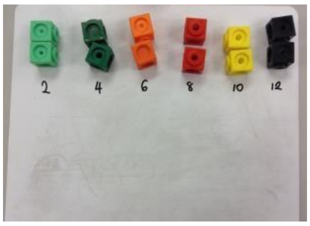


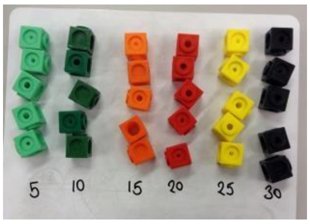
Stage 7: Children should extend the regrouping method to numbers with decimals in a range of contexts e.g. money and measurement

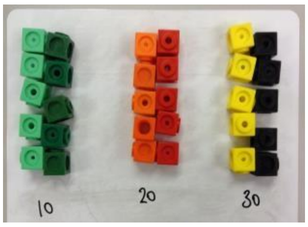
At this point, as with addition, place value knowledge it vital. Children need to understand that decimal points should line up under each other in column calculations, particularly when adding or subtracting mixed amounts, e.g. £3.59 + 78p. To achieve this, children need the flexibility of thinking to recognise and understand that 79p is actually a decimal of whole pounds – £ 0.79.

Progression in Multiplication [Back to Contents]

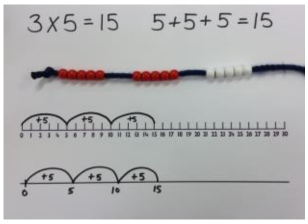
Stage 1: Children will practise counting objects in groups of 2's, 5's and 10's.

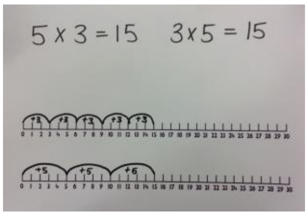






Stage 2: Children will develop their understanding of multiplication as repeated addition using a beadstring, numbered line or blank numberline.

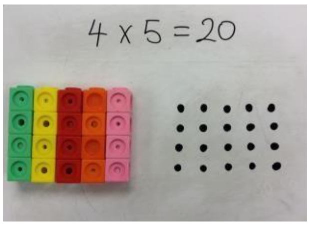


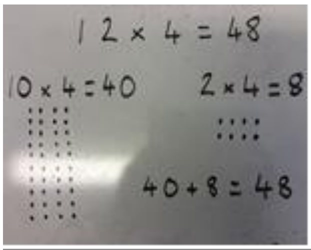


Commutativity

Children should know that 3 x 5 has the same answer as 5 x 3. This can also be shown on the number line.

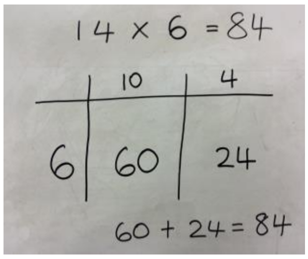
Stage 3: Children use an array as a pictorial method for solving multiplication calculations.

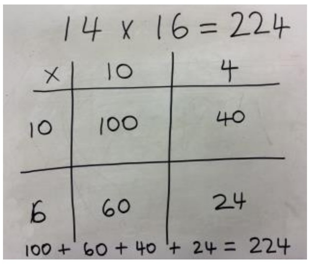




Stage 4: Children will continue to use arrays, partitioning numbers where appropriate to lead into the grid method of multiplication.

Stage 5: Children use the grid method to solve multiplication calculations. First multiplication calculations that are a two digit number multiplied by a one digit number.

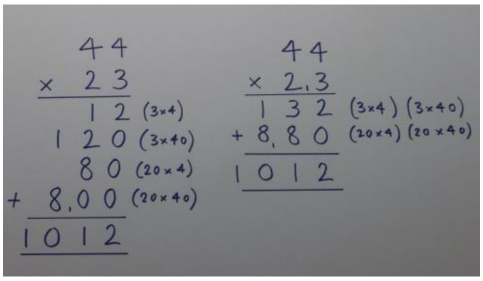




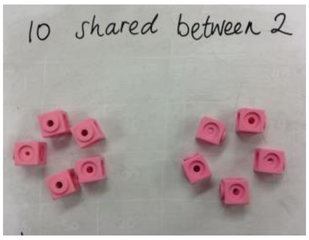
Next a two digit number by a two digit number.

Followed by extending the numbers beyond 3 digits where one of the numbers might have a decimal, using place value knowledge to check that digits show the correct value in their answer.

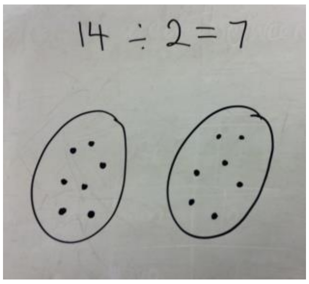
Stage 6: Children use the grid method to solve multiplication calculations where both numbers have decimals.



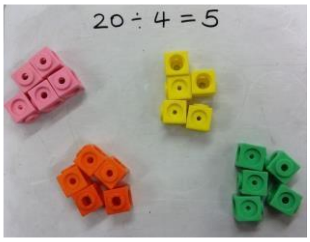
Stage 7: Children will explore alternative methods for solving multiplication calculations including the column method for long multiplication, first in "expanded" form and then in "compact" form.



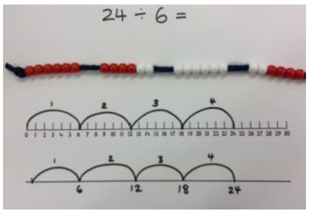
Stage 1: Children begin to solve division calculations by sharing in practical situations using everyday objects.



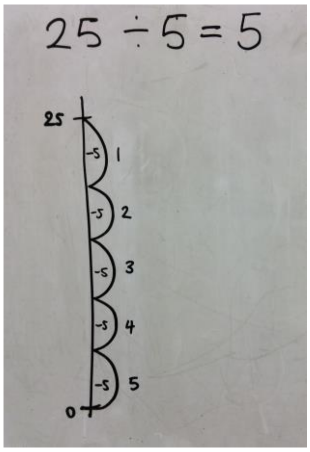
Stage 2: children solve division calculations using sharing and record this using dots in circles.



Stage 3: Children begin to solve division calculations by grouping everyday objects in to equal groups.

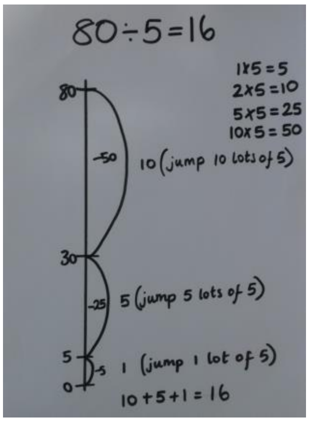


Stage 4: Children use a beadstring, numbered line or blank numberline as a representation of the grouping method for solving division calculations.



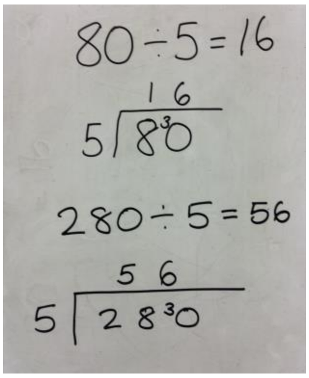
Stage 5: Children use repeated subtraction on a beadstring, numbered line or blank numberline as a method for solving division calculations.

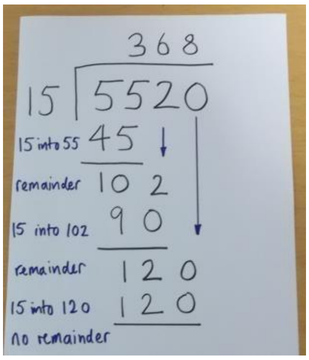
Stage 6: Children move on to solving division calculations involving remainders. Any remainders should be shown as integers, i.e. 14 remainder 2 or 14 r 2.



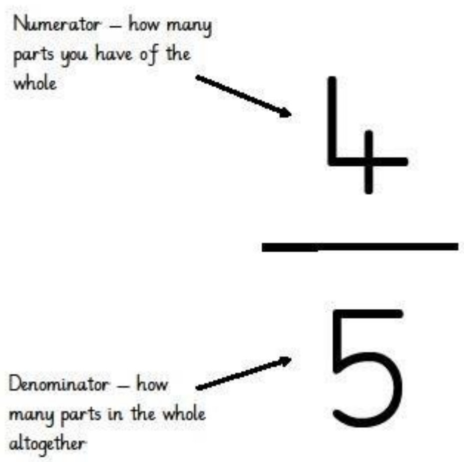
Stage 7: Children develop their use of repeated subtraction, using larger 'jumps' to move along the numberline. Children use this method as a basis for recording efficient jumps counting on or back, recording the process alongside the numberline to clearly show the steps in the calculation.

Stage 8: Children use a standard written method for solving division calculation including the calculation of decimals, rather than remainders. This method is commonly known as the "bus stop" method.

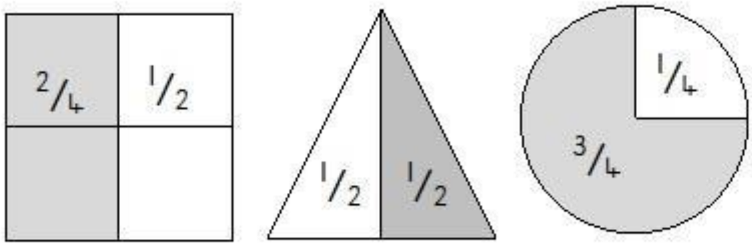


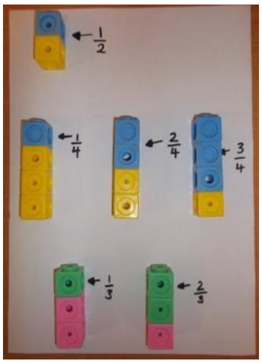


Stage 9: Children extend the use of "bus stop" method to include larger numbers using the process known as "long division".

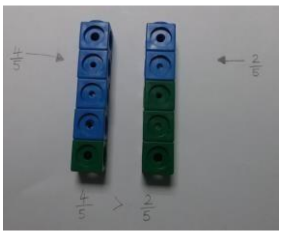


Stage 1: Children will recognise and name 1/2, 1/4, 2/4 and 3/4 of a shape, object or quantity and be able to identify these parts of a shape or object

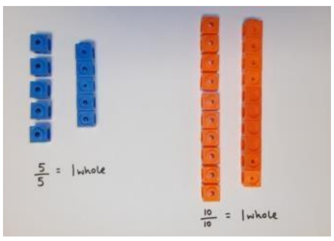




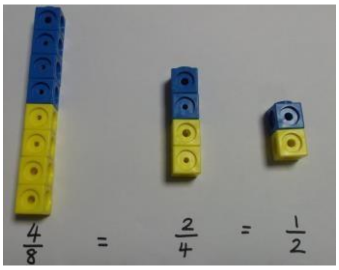
Stage 2: children will recognise, name and write fractions 1/2, 1/4, 2/4, 3/4s, 1/3 and 2/3 of a whole. Children will count in halves and quarters to ten.



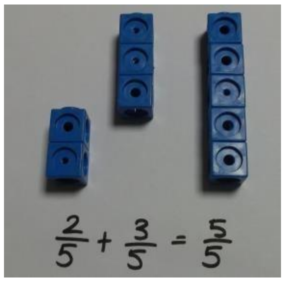
Stage 3: Children will identify, name and write unit fractions up to 1/12 and will compare and order fractions with the same denominators. Children will recognise fractions which are equivalent to 1 whole and pairs of fractions that add up to 1 whole.



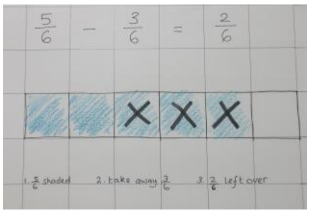
Children will count up and down in tenths. Children will recognise that tenths come from dividing an object, or quantity into ten equal parts.



Stage 4: Children will identify and name and write equivalent fractions, with a denominator not greater than 12. Children will begin to reduce fractions to their simplest form.



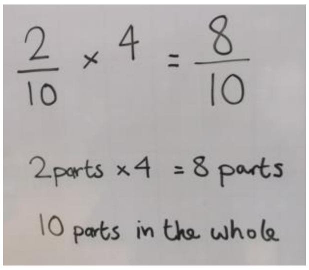
Children will add and subtract two fractions with common denominators within one whole.



Mixed number fraction – where there are whole numbers and a fraction

2 1/4

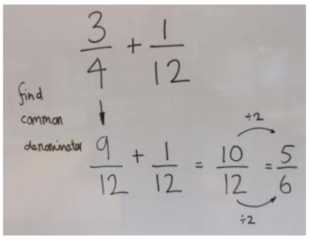
Stage 5: Children will compare and order fractions with different denominators. Children will recognise mixed numbers and improper fractions and convert from one form to the other. Children will add and subtract fractions. Children will write mathematical statements that exceed 1 as a mixed number: (e.g. 2/5 + 4/5 = 6/5; 6/5 = 1 and 1/5). Children will multiply proper fractions and mixed numbers by whole numbers.

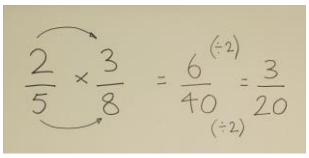


Improper fraction – where the numerator is greater than the denominator

9/4

Stage 6: Children will add and subtract mixed numbers and fractions with different denominators.





Children will multiply proper fractions together writing the answer in its simplest form.

Children will divide proper fractions by whole numbers. Children will associate a fraction with the division process to calculate decimal fraction equivalents (e.g. 4/8 is 4 ÷ 8 to equal 0.5).