Heacham Infant and Junior School
Calculations Policy

West Norfolk Academies Trust

Primary Calculations Policy

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Aims

The aim of this calculation policy is simple – to help children perform mental and written calculations fluently, accurately and consistently across the whole school. They should be ready for their next stage of learning and move fluidly from one phase to the next.

Embedded within this aim is the idea that we also need to develop children into good mathematicians who understand the concepts behind mathematical ideas (rather than follow a procedure) and can make connections between their calculation skills and other areas of mathematics.
The aims of the National Curriculum for mathematics will play a central role to this document with fluency, mathematical reasoning and problem solving playing a full part in developing secure calculation strategies.

Rationale

Having conducted school based research into effective calculation strategies, based on the work of A. Borthwick and M. Harcourt-Heath (2007), it was clear that many of the methods children were using were not successful and that those used successfully by children should be built into this policy.
The most successful strategies included a column method for addition, subtraction using a number line, multiplication using a grid and division using a number line or chunking.
Upon analysing a range of different methods used, it was recognised that the formal written methods set out in the 2014 National Curriculum for mathematics may ultimately lead to children being able to perform calculations with more speed; however it is believed that delaying their use will enable children to gain greater conceptual understanding and fluency when calculating. It was agreed that a smoother transition is needed when moving from concrete and representational methods to abstract methods.
In order to develop successful strategies pupils must develop a mastery and ownership of the mathematics they use and this develops best when children can fully understand mathematical concepts. To aid conceptual development this policy and the strategies outlined within will follow a C.P.A approach (Concrete, Pictorial/representational, Abstract) where children use concrete or physical apparatus and resources to develop underlying concepts, begin to represent calculations using pictures, diagrams and jottings before working on abstract calculations and written methods. Mental skills and calculation techniques will always work hand in hand with these methods.

Links to mental maths

Laying the foundations for successful calculation strategies is rooted in developing a secure conceptual understanding of each operation. The use of practical resources and mental mathematics are the structures that written methods are built around.

When children begin learning about solving calculation problems they are introduced to the maths orally, through practical resources and using mental maths.

From these early experiences they begin to understand the underlying mathematical concepts and develop ways of recording in order to support and show their mathematical thinking.

Children will learn how to use and manipulate a range of models, images and resources and develop their use of empty number lines or sharing diagrams e.g. to link mental and informal written methods of calculation.

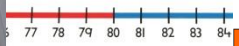
The ideas of mental calculation and written calculation must be seen as equal and interlinked partners and not separate concepts. Written calculations will be built upon successful mental strategies and the informal jottings that stem from them.

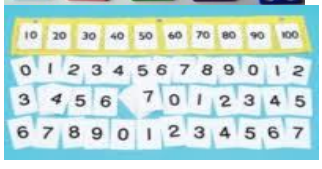
Below is a range of models, images and resources than can support mental and written methods.













Addition

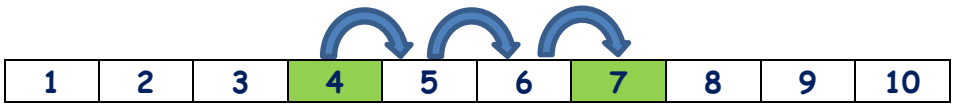
The process of finding the total of two or more amounts. It is the inverse of subtraction.

Early learning and mental maths

Using a range of practical resources and real life contexts, pupils develop their understanding of the concept of addition through counting activities, singing songs, recalling number bonds etc. They then use pictures/diagrams to represent the calculation.

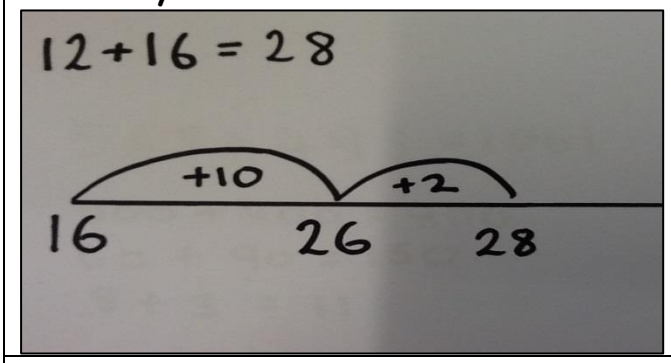
E.g. 4 cats play a game. 3 more join in. How many are playing altogether? 4+3=7

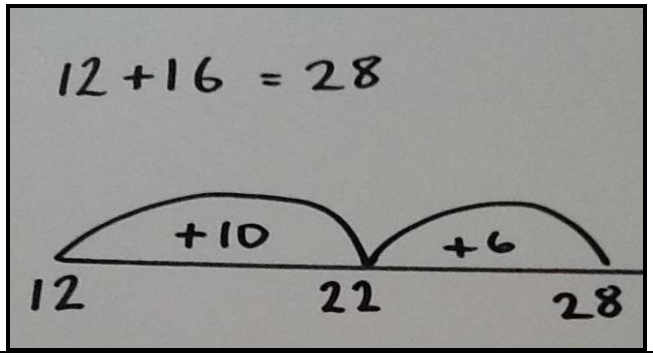
Children will progress to show this using a number track or number line.



4+3=7

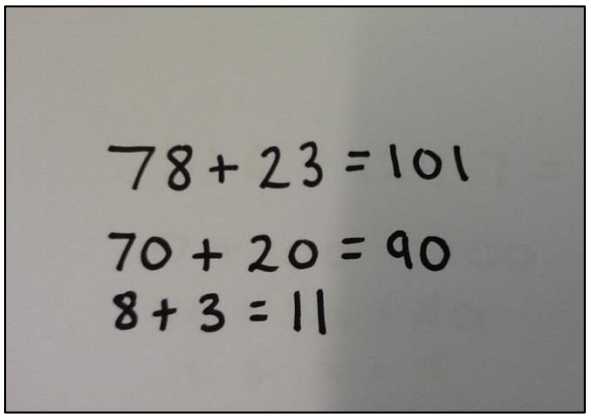
Progress to empty number lines. **A farmer has 12 sheep in one field and 16 in another. How many does he have in total?**

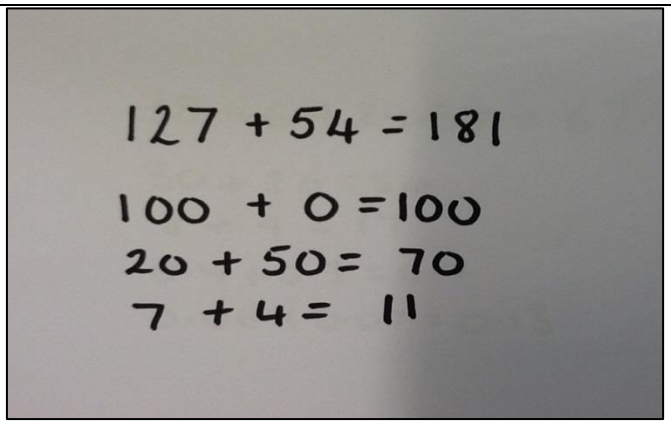


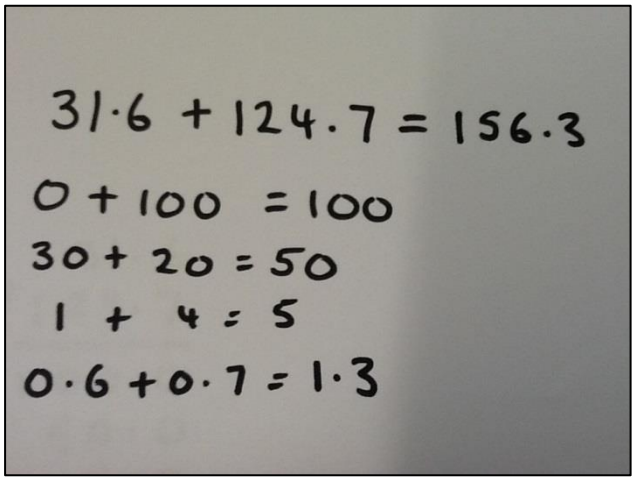


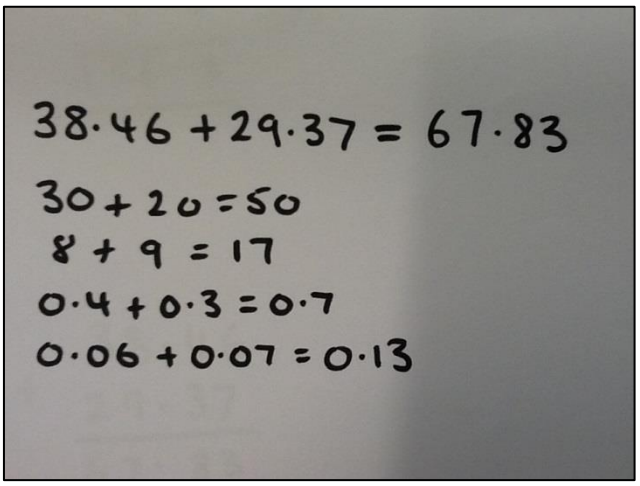
Developing written methods

Children will still be able to use number lines if this is their preferred successful method however as children begin to add more complex numbers they will be taught to partition numbers into tens and ones or hundreds, tens and ones etc. and add the partitioned totals mentally.

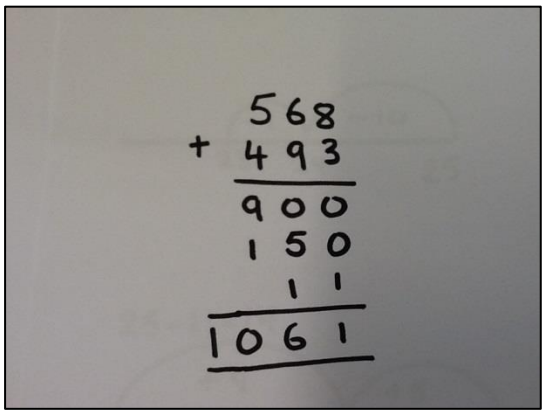


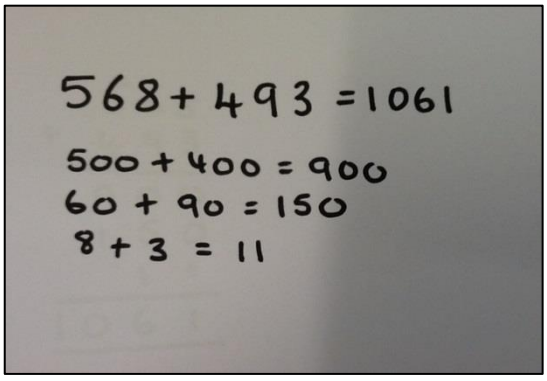


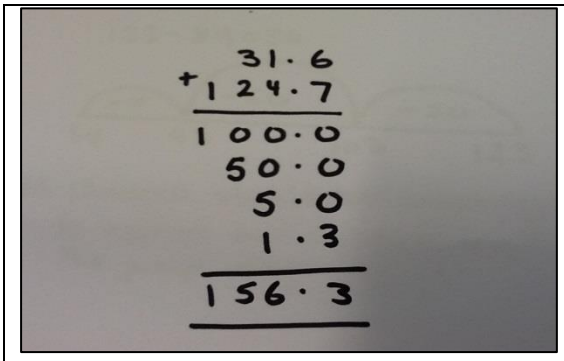




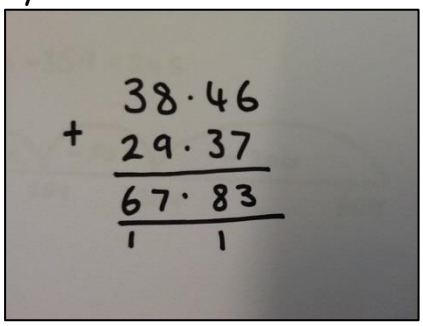
Children will still be able to use the partitioning method if this is their preferred successful method however to increase efficiency and to scaffold the transition towards statutory requirements children will begin to be taught the expanded column method (adding the largest numbers first). NB children must have a secure understanding of partitioning before beginning to use any column method.







By the end of KS2 children will be shown the statutory formal column method for addition.



At Springwood we will continue to use the column method for addition.

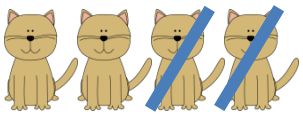
Subtraction

The process of taking one number away from another number or finding the difference between two numbers. It is the inverse of addition.

Early learning and mental maths

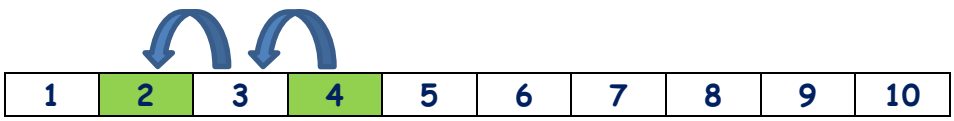
Using a range of practical resources and real life contexts, pupils develop their understanding of the concept of subtraction through counting activities, singing songs, recalling number bonds etc. They then use pictures/diagrams to represent the calculation.

There are 4 cats in the street. A dog scares 2 away. How many are left?

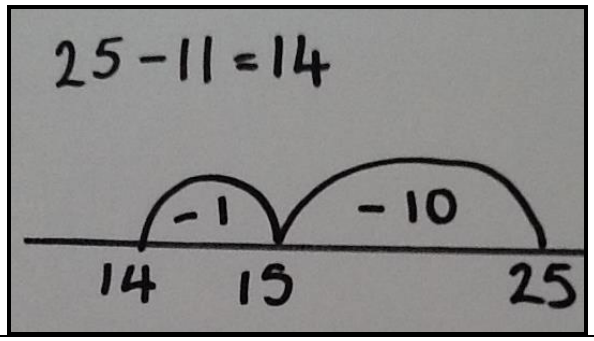


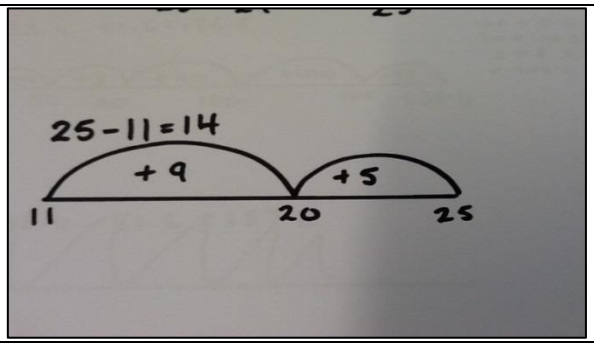
4-2=2

Children will progress to showing this on a number track or number line.



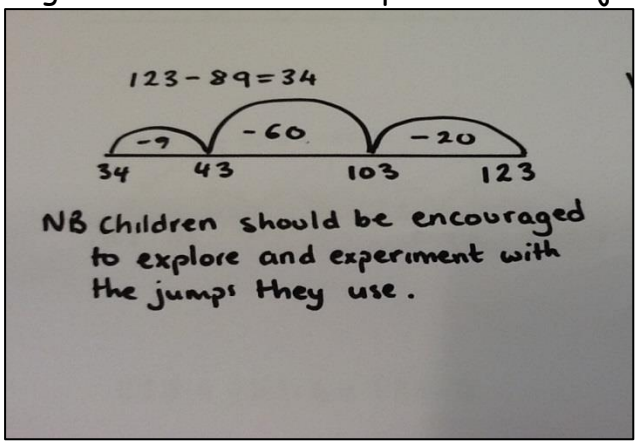
Progress to counting backwards and forwards on empty number lines. Children are encouraged to add any jumps mentally. **There are 25 birds in a tree and 11 fly away. How many are left in the tree? 25-11=14**

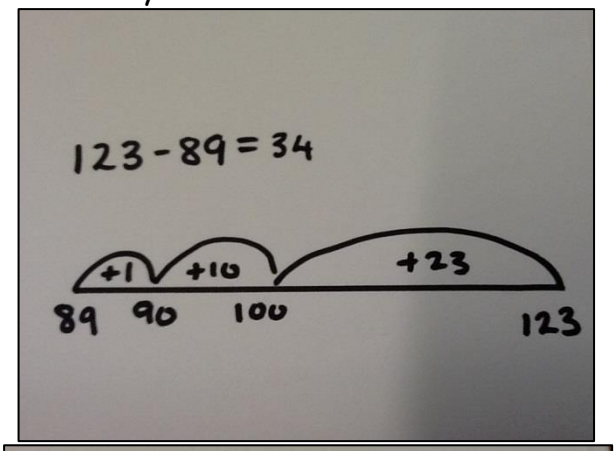


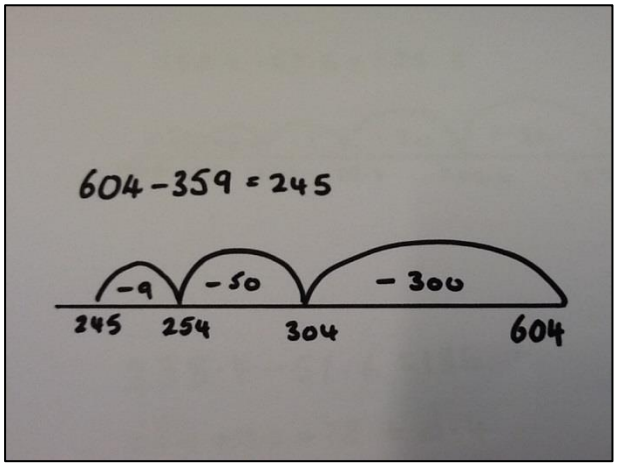


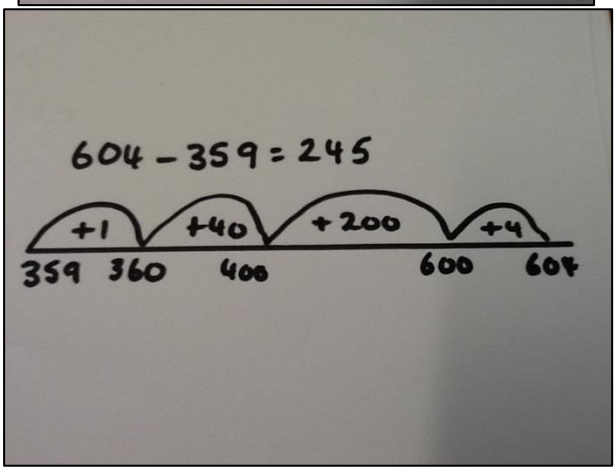
Developing written methods

Children will continue to count forwards or backwards (both ways to be modelled) with larger numbers and be expected to add jumps mentally.

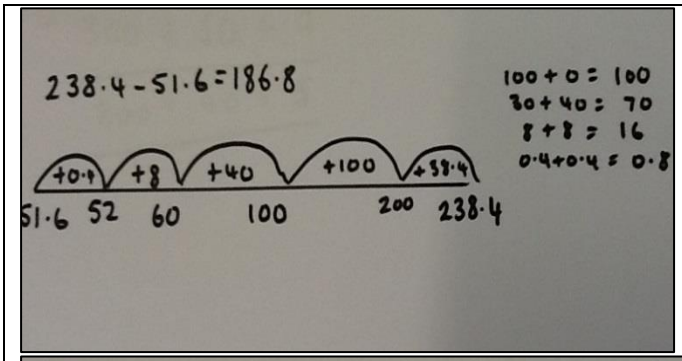


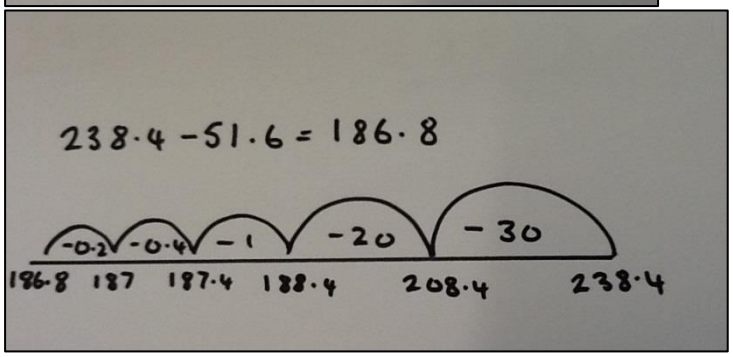




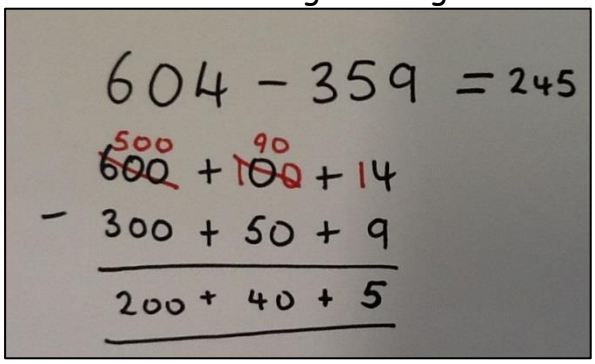


Where it may be difficult to add jumps mentally children can use partitioning to support their calculation.

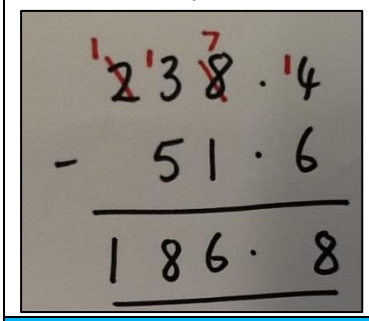


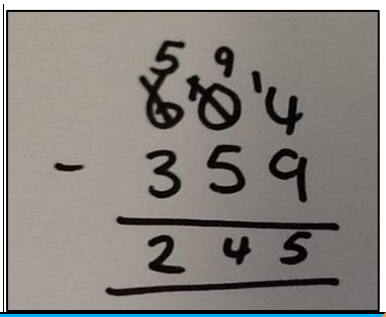


Children will still be able to use a number line if this is their preferred successful method however in order to support the transition towards the statutory decomposition method children will be taught a partitioned column subtraction method. Children must have a secure understanding of using number lines before moving on to a partitioned column.



By the end of KS2 children will be shown the statutory decomposition method for subtraction.





At Springwood we will continue to use number lines and column methods.

Multiplication

The process of repeated addition or the product of two numbers. It is the inverse of division.

Early learning and mental maths

Using a range of practical resources and real life contexts, pupils develop their understanding of the concept of multiplication by making sets or groups using a range of practical resources such as bead strings, Numicon, cubes etc. as well as objects from everyday life. Children will begin to link these to number line representations.

Outside a classroom there are 4 pairs of wellies. How many wellies are there altogether?

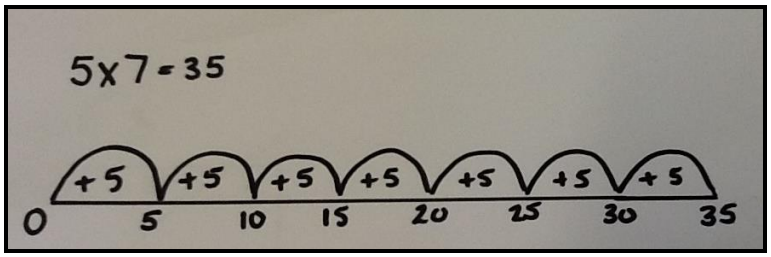
2x4=8

Bill gives his 5 friends 4 sweets each. How many sweets does he give away?

4x5=20

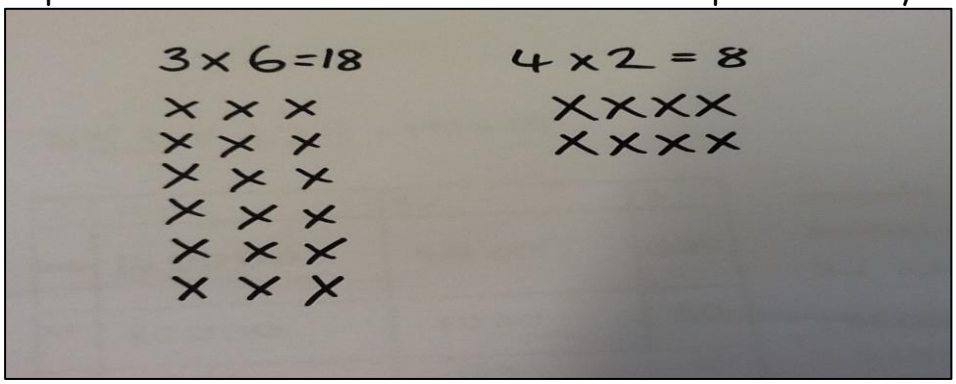
Using number lines

Number lines can be used alongside practical resources to show repeated addition or counting on in equal steps.

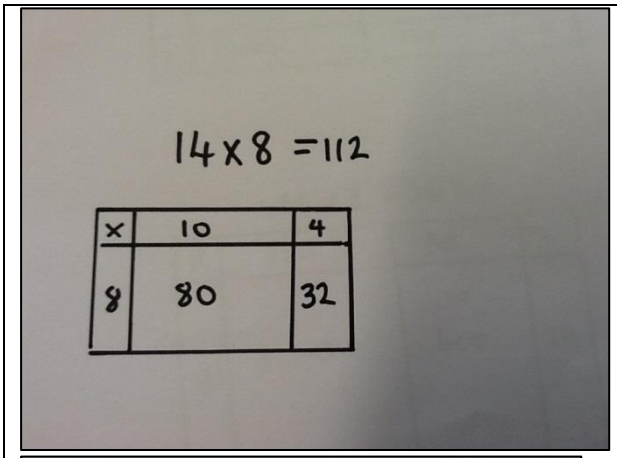


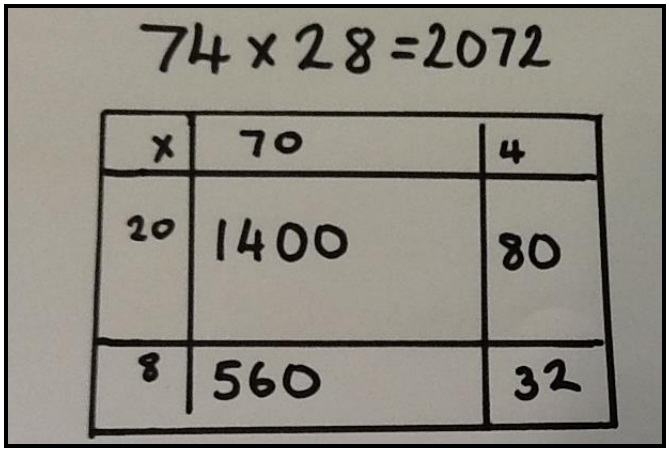
Developing written methods

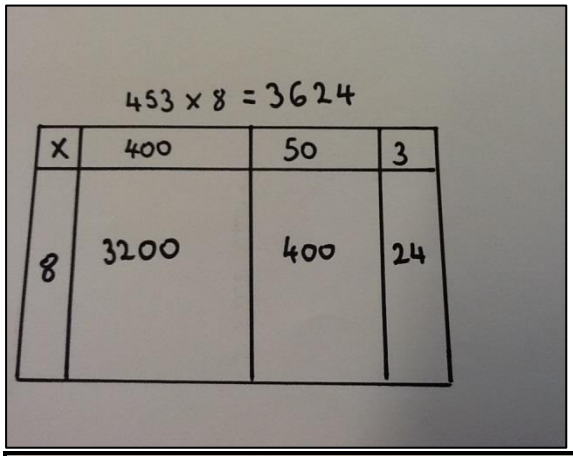
Using arrays is an important step in developing a conceptual understanding of multiplication and lays the foundations for developing the grid method which will be used later. A range of practical resources should also be used to represent arrays.

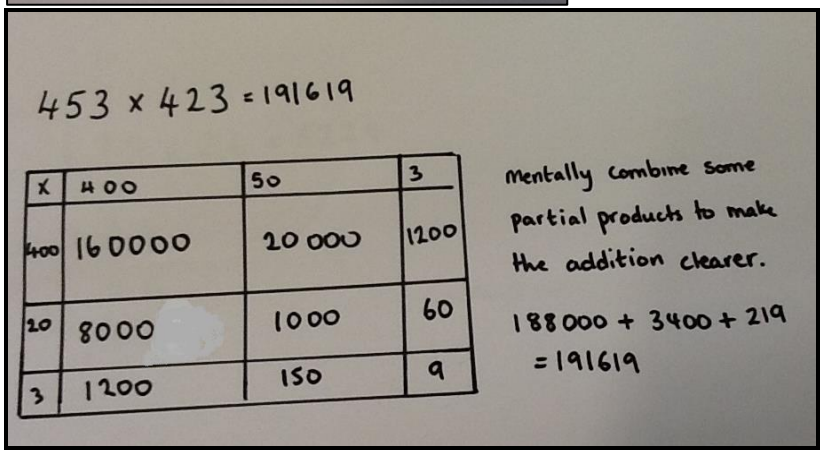


The grid method should be used to organise more complex multiplication calculations (beyond multiplication table knowledge) and should be set out proportionally. Children should add up the partial products mentally but may use jottings when needed.

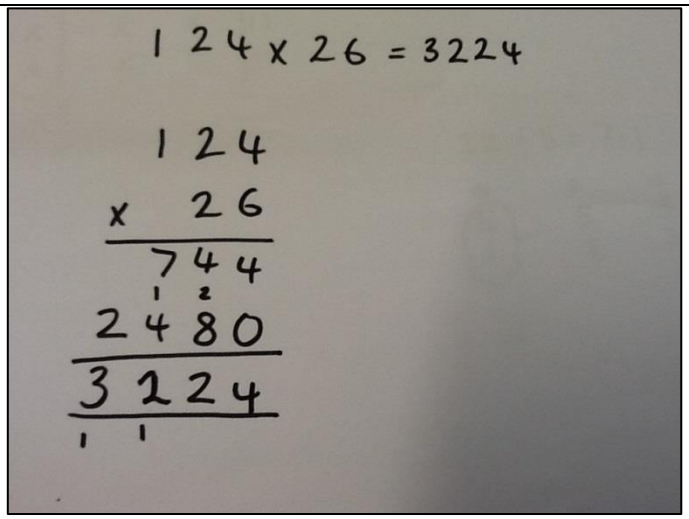








Children will still be able to use the grid method if this is their preferred successful method however by the end of KS2 children will be shown the statutory column method of multiplication. Children must have a secure understanding of the grid method before moving on to this method.



At Springwood we will continue to use the grid method to support multiplication.

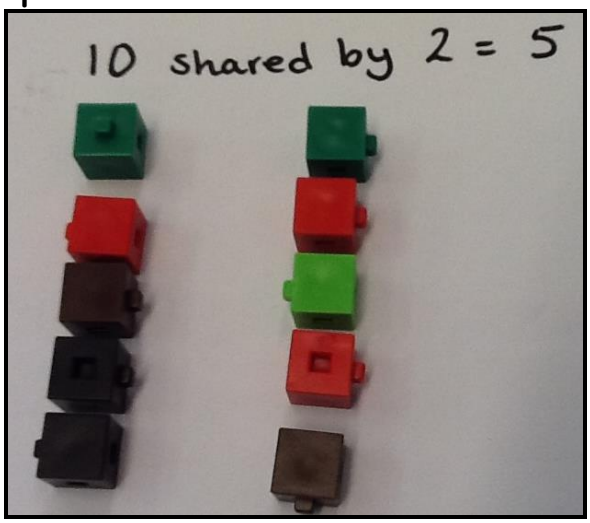
Division

The process of repeated subtraction or splitting a number into equal groups. It is the inverse of multiplication.

Early learning and mental maths

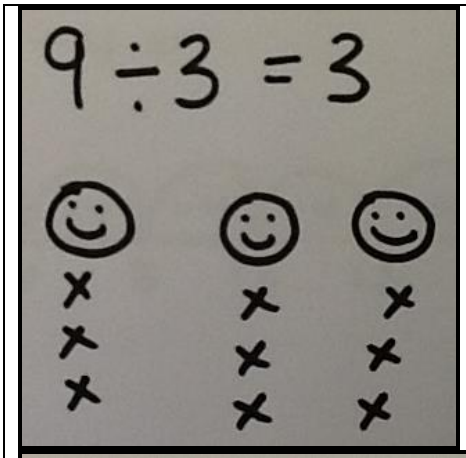
Pupils should have many practical experiences of sharing objects e.g. sharing between 2 people, or finding $\frac{1}{2}$ of a group of objects.

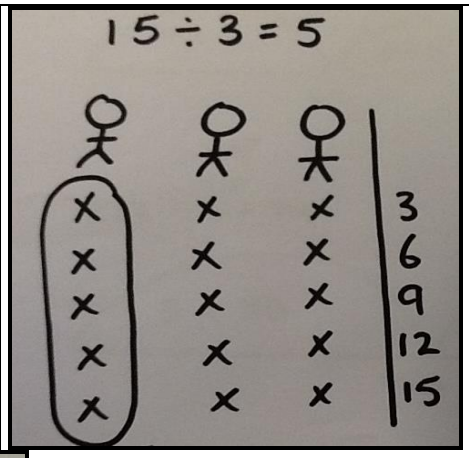
Sarah has 10 stickers and shares them evenly with her friend. How many do they end up with each?

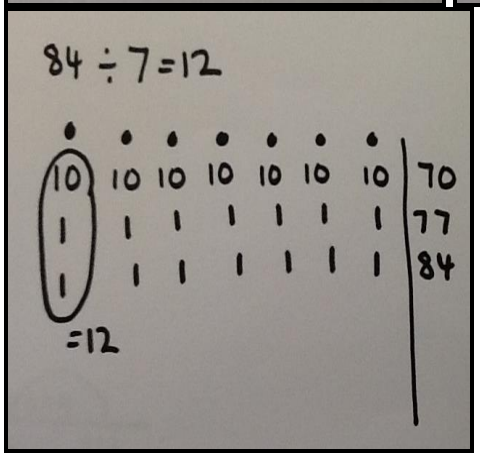


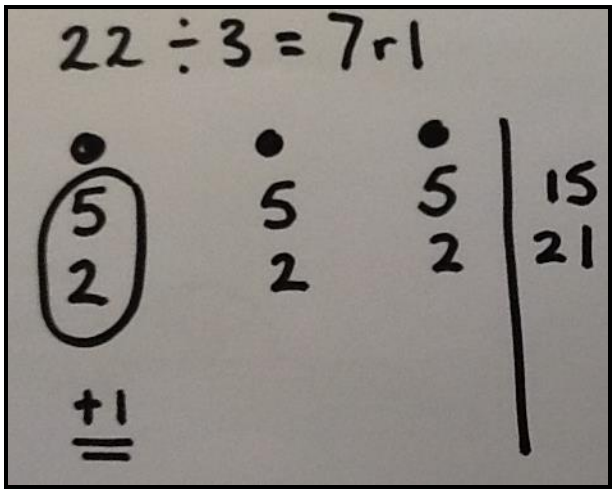
Pictures should be introduced as a next step to represent this.

Drawings and diagrams should be increasingly used to represent and demonstrate sharing.



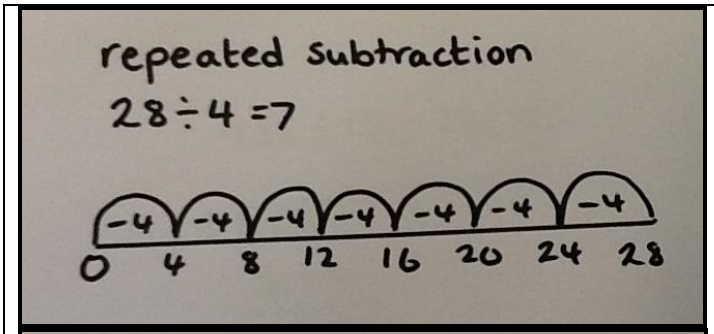


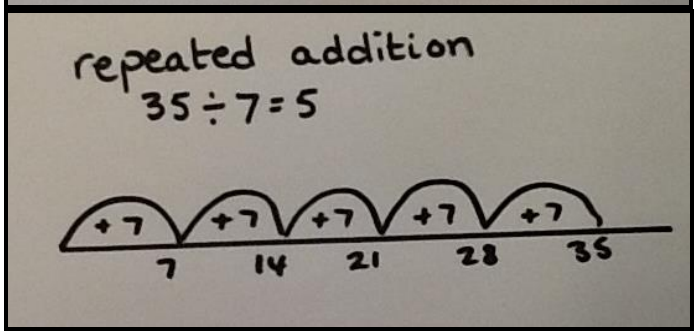




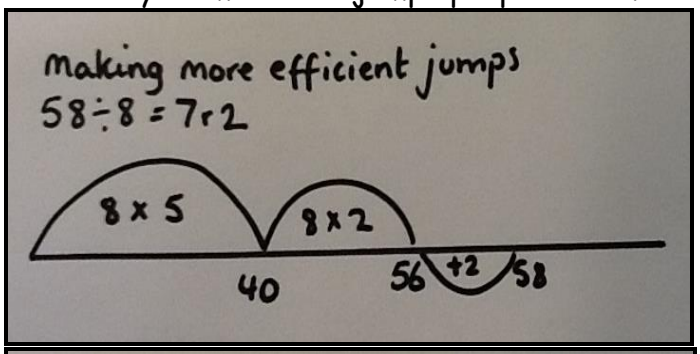
Developing written methods

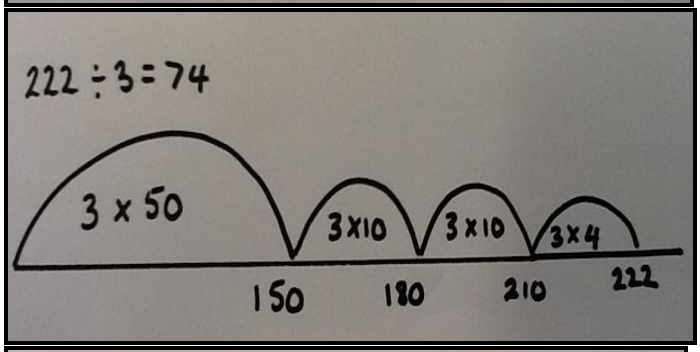
Number lines should be introduced to help record grouping strategies. This would involve the principle of repeated subtraction (and repeated addition as an alternative strategy).

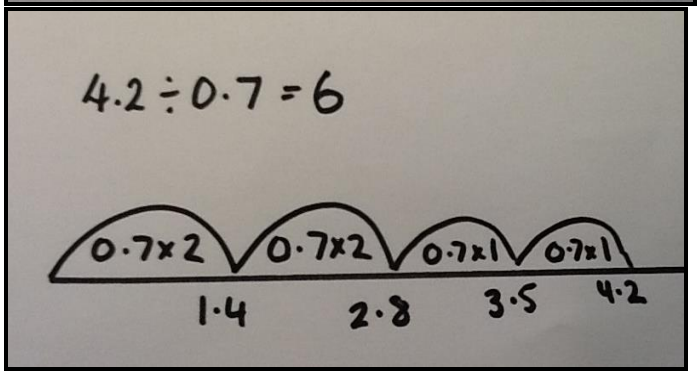




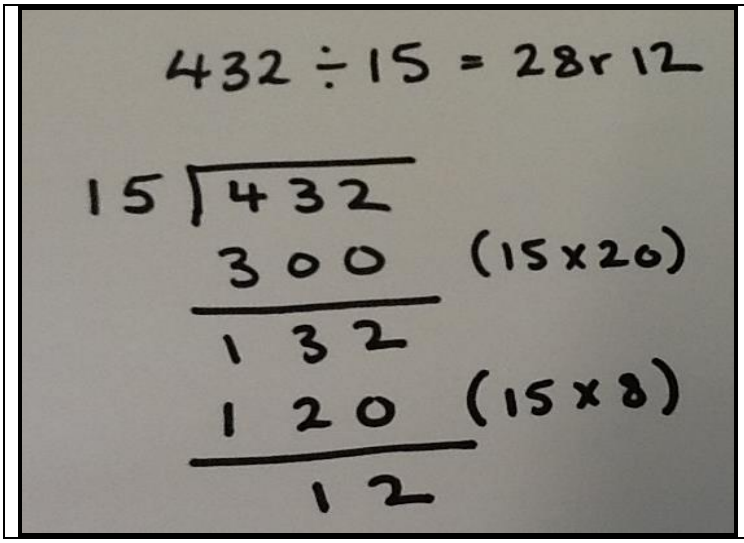
As pupils develop the concepts of repeated addition and subtraction they begin to look at making more efficient jumps. (Showing the remainder under the number line). Children should try to make the jumps proportional.







Children will still be able to use a number line if this is their preferred successful method however by the end of KS2 children will be shown the statutory method of division. Children must have a secure understanding of number lines before moving on to this method.



At High School we will continue to use chunking methods and long division.

Frequently asked questions

What if pupils prefer or already use a different method?

These will be the methods that we teach – teachers will follow the policy. If children already have a good conceptual understanding of an alternative method and use it successfully then they can continue to use it.

What if parents don't like the methods adopted?

Teachers should work with parents to explain the reasons behind the methods selected in this policy – much of this could take place in the launch of the policy to parents. If needed, parents could have a copy of the policy to look through.

What if teaching staff are not able to support the methods?

This is a school policy and must be followed. Training is essential for all staff to feel happy and confident in delivering the methods selected. This must take place before the policy is started in schools and updated regularly.

When should children move on to a standard algorithm?

The legal requirement for this is before the end of KS2. Teachers will work together as a whole staff to discuss which method they feel is appropriate to be introduced at each stage however as pupils learn at different rates some methods may be delayed to support those finding it difficult or contexts and problems broadened to challenge higher achievers. Children must have a good

conceptual understanding of the operation and supporting method before moving on to more abstract algorithms.