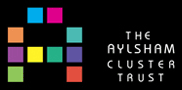
**Aylsham Cluster**

**Calculations Policy**

Amended in line with the

National Curriculum 2014.

[](http://www.aylshamcluster.co.uk/)

**It Takes a Whole Community to Educate a Child**

This document is a collaborative endeavour

produced by Maths leaders from;

[**Aldborough Primary**](http://www.aldborough.norfolk.sch.uk/)[**Aylsham High**](http://www.aylshamhigh.com/)[**Bure Valley Junior**](http://www.burevalleyschool.org.uk/)[**Buxton Primary**](http://www.buxtonschool.co.uk/)[**Colby School**](http://www.colby.norfolk.sch.uk/)[**Erpingham C of E Primary**](http://www.erpinghamprimaryschool.co.uk/)[**Hevingham and Marsham Partnership**](http://www.hevingham.norfolk.sch.uk/)[**John of Gaunt Infant and Nursery**](http://www.johngaunt.norfolk.sch.uk/)[**St Michaels Nursery and Infant**](http://www.stmichaelsaylsham.co.uk/)

**Introduction**

This calculation policy has been written in line with the programmes of study taken from the revised National Curriculum for Mathematics (2014). It provides guidance on appropriate calculation methods and progression. The content is set out under the following headings: addition, subtraction, multiplication and division.

Children will use mental methods as their first port of call when appropriate, but for calculations that they cannot do in their heads, they will need to use an efficient written method accurately and with confidence.

When faced with a calculation problem, encourage children to ask:

\* Can I do this in my head?

\* Can I do this using drawings or jottings?

\* Do I need to use a written method?

\* Should I use a calculator?

Also the children are encouraged to estimate and then check the answer -

Encourage them to ask:

***Is the answer sensible?***

***To further support teaching of mental calculations, consult the teaching of mental calculations booklet.***

**Aims of the policy**

The Cluster Calculations Policy aims to ensure all pupils:

* understand important concepts and make connections within mathematics
* show high levels of fluency in performing written and mental calculations
* are taught consistent calculation strategies
* are ready for the next stage of learning
* have a smooth transition between phases
* are able to add, subtract, multiply and divide efficiently
* are competent in fluency, reasoning and problem solving

**Rationale**

* This policy was borne out of research that was collated from every school in the cluster. Analysis of the data showed that many of the strategies that the children were using were not successful.
* To ensure consistency and progression in the teaching of mathematics throughout the cluster, this Calculations Policy has been produced by the Maths Subject Leaders. In order to do this, every subject leader from each school met regularly, discussed and agreed strategies. The strategies in the policy were informed by a range of research and consideration of successful strategies currently in use. This policy explains the different strategies used for calculations in our cluster from EYFS -KS3.
* Children are introduced to the processes of calculations through practical, oral and mental activities. As children begin to understand the underlying ideas, they develop ways of recording to support their thinking and calculation methods.
* They learn to interpret and use the signs and symbols involved. Children learn how to use models, images and resources, such as empty number lines, to support their mental and informal written methods of calculation.
* However, mental calculation is not at the exclusion of written recording and should be seen as complementary to, and not separate from it. Each of the four operations: addition, subtraction, multiplication and division, build on mental skills which provide the foundations for jottings and informal written methods of recording.
* Skills need to be taught, practised and reviewed constantly. The Teaching children to calculate mentally (Dfe 2010) booklet will provide a framework for teaching mental calculation strategies.

**Pedagogical Approach**

* Developing pupils’ understanding of number and place value is essential and should be explored daily.
* The strategies chosen should aim to develop pupils’ conceptual understanding of calculation.
* Models, images and resources (representations) should be used throughout all key stages.
* Pupils should be encouraged to develop independence, and to select and use resources to support their learning.
* Practical activities should be a regular feature of maths lessons.
* Learning should be differentiated to suit the needs of the pupils.
* Opportunities to work within mixed ability groups should be explored and encouraged.
* It is often more effective to provide pupils with one question to practice the same skill rather than lots of different questions. This allows learning to be extended, rather than learnt at a basic level and allows children to develop fluency.
* Solving problems should be integral to the maths curriculum.
* Pupils should be encouraged to take risks, make mistakes, and learn from their experiences.
* Teachers will explore misconceptions with pupils in order to deepen their understanding.
* Talking and reasoning about mathematics should be a feature of all mathematics lessons.
* A range of teaching styles should be explored to maximise opportunities for learning.

**Age stage expectations**

The calculation policy is organised according to age stage expectations as set out in the National Curriculum 2014, **however it is vital that pupils are taught according to the stage that they are currently working at,** being moved onto the next level as soon as they are ready, or working at a lower stage until they are secure enough to move on.

**Providing breadth and depth of conceptual understanding**

It is important that any type of calculation or mathematical concept is given time to be practiced, but of equal importance is the opportunity for children to explore the depth and breadth of that concept or calculation. This can be created with regular problem solving and investigative approaches to mathematical teaching, and making sure that the teaching sequence and progression of lessons gives ample opportunity toapply their understanding in a wide variety of ways.

There are a wide variety of resources to support teaching in a wide and varied way –

**Web links suggested resources**

It is important that with any type of mathematical concept children are given the opportunity to explore the depth and breadth of that concept or calculation.

There are a wide variety of resources to support teaching in a wide and varied way these include:

* NCETM website for examples and activities.
* Nrich website
* IXL for questions on any subject:
* Sheffield Maths
* Progression in Models and Images booklet
* Topmarks for the use of resources and ITP’s.
* Woodlands junior homework
* BBC Bitesize
* Multiplication.co.uk
* Nessy
* My Maths
* TES website

Progression in Models and Images document

P-Came documents (given to class teachers).

Teaching Children to Calculate Mentally document.

The Conceptual Introductions document to teaching shape space and measure etc.

# **Representations**

Representations are vitally important throughout a child’s maths education. Representations provide a ‘hook’ for children to ‘hang’ mathematical concepts, and allow children to manipulate and later visualise the structure of mathematics.

Representations are therefore a significant aid in developing conceptual understanding. Different concepts can be represented using the same resource/representation depending on the child’s age and stage of mathematical development.

Below are some of the key representations, that will be in use throughout a child’s maths education in our cluster.

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| --- | --- | --- |
| C:\Users\MsLewis\Documents\Class Admin\Maths Planning\Calculations Policy and Action Plan\luster calculations policy artwork\CPA.jpg | C:\Users\MsLewis\Documents\Class Admin\Maths Planning\Calculations Policy and Action Plan\luster calculations policy artwork\counters.jpg | C:\Users\MsLewis\Documents\Class Admin\Maths Planning\Calculations Policy and Action Plan\luster calculations policy artwork\cubes.jpg |
| Concrete Pictoral Abstract (CPA) | Counters | Cubes |
| C:\Users\MsLewis\Documents\Class Admin\Maths Planning\Calculations Policy and Action Plan\luster calculations policy artwork\numicon.jpg | C:\Users\MsLewis\Documents\Class Admin\Maths Planning\Calculations Policy and Action Plan\luster calculations policy artwork\Dienes Apparatus.jpg | C:\Users\MsLewis\Documents\Class Admin\Maths Planning\Calculations Policy and Action Plan\luster calculations policy artwork\100 square.jpg |
| Numicon | Dienes | 100 Square |
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| Cubes in arrays | Place value cards | Multiplication Grid |
| C:\Users\MsLewis\Documents\Class Admin\Maths Planning\Calculations Policy and Action Plan\luster calculations policy artwork\cuisinaire rods.jpg | C:\Users\MsLewis\Documents\Class Admin\Maths Planning\Calculations Policy and Action Plan\luster calculations policy artwork\fraction plates.jpg | C:\Users\MsLewis\Documents\Class Admin\Maths Planning\Calculations Policy and Action Plan\luster calculations policy artwork\Thinking strips.jpg |
| Cuisinaire rods | Fraction Plates | Thinking Strips |
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| Bead Strings | Place value chart | Counting Stick |
| C:\Users\MsLewis\Documents\Class Admin\Maths Planning\Calculations Policy and Action Plan\luster calculations policy artwork\number line.png |  |  |
| Number Line |  |  |

**Algebra**

Algebraic manipulation of written number sentences is crucial for a learner to fully understand (if not know the names) of the commutative, associative and distributive laws. It also facilitates proper understanding of inverse procedures.

Teaching of written calculations need to take these laws into account from an early age to allow the learner maximum control over how they decide to arrange their written methods. The laws permit manipulation to simplify calculations into more familiar numbers or steps to achieve the correct answer.

Questions also need to be presented in a variety of ways to give equal importance to the answer being in any position within the number sentence. This will allow subtraction to be learned alongside addition and division whilst learning multiplication.

When adding, number sentences such as: 35 + 166 = ? need to be presented with the unknown part of the equation in all three position with equal weighting on each of those positions. From this we therefore derive: ? + 166 = 201 and 35 + ? = 201.

Once the written methods are learned for each of the four operations, the inverse can be applied to work out missing numbers. Children need to learn that the order of adding is not fixed and can be manipulated by moving value from one side to another to help in working out missing numbers.

For example,

198 + 65 = 200 + 63.

? + 65 = 263

or

198 + ? = 263.

We can adjust and subtract to complete these sums.

When multiplying the above holds true also.

34 X 65 = ?

? X 65 = 2210

and

34 X ? = 2210

**Models and images: The use of a number line in our schools**

In our schools we initially encourage children to use number lines to support their learning of mathematics.

**“Developing a number line is one of the strongest and most useful mental images in helping us to undertake mental calculations.”**

*Koshy 1999*

In order for children to develop efficient and accurate written methods, these mental images are essential. It is this conceptual understanding that underpins using more formal written methods, as stipulated in the National Curriculum.

There are several types of number line, all of which are used in the classroom to support understanding in mathematics.

***To further explore the conceptual understanding that number lines support, consult the models and images supplement.***

The empty number line has no numbers or intervals marked on it. It allows children to choose ‘landmarks’ to support their calculations. With young children we use 1-20 bead strings where the beads are grouped in 5’s (5 red, 5 white etc) and then the children progress to a 1-100 bead string (10 red, 10 white)

http://www.clairepublications.com/thumb.ashx?file=large-bead-line-1-100-a-(small).jpg&h=120&w=140&q=90

To be able to use the empty number line successfully the children need to be confident in the following skills:

* Making jumps of different sizes
* Counting forwards and backwards
* Using complements of numbers to 10 ( 1+9, 2+8, 3+7 etc)
* Partitioning and re-combining numbers

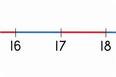
**Number tracks**

Number tracks are recognised as a helpful visual and physical tool for young children. They have numbers in spaces (often pictures or images i.e carriages of a train) It is a track or number ladder with a sequence of numbers which start at 1. They can be vertical, horizontal or diagonal. They can zigzag like a ‘snakes and ladders’ or curve in a spiral. A 100 number square is a form of number track.



**Numbered lines**

Numbered lines include 0 and are a development of the number track. Unlike the track, a numbered line has marks to indicate the position of numbers. The markings are regular and constant but the scale can change i.e. the interval can represent steps of 1, 10, 100, fractions, decimals, negative numbers so on.



**What are the benefits of using a number line?**

* Develops a child’s mental imagery
* Strongly develops sense/relationships of numbers
* Provides a progressive and consistent method of recording calculations
* Requires numbers to be selected for specific calculations
* Does not require different lines to be used in isolation i.e bead string is linked to empty number line
* Underpins children’s acquisition of basic facts
* Allows a child to demonstrate a range of calculation strategies
* Enables more efficient methods to be developed
* Requires only a piece of pencil and paper

(The power of the number line – Norfolk County Council)

**Addition**

Children are taught to understand addition as combining two sets and counting on.

**The progression of how we teach addition calculations is as follows:**

|  |  |
| --- | --- |
| **2 + 3 = ?**  At a party, I eat 2 cakes and my friend eats 3. How many cakes did we eat altogether?            **http://www.pitterpatterpottery.co.uk/user/cimage/cup-cake.jpghttp://www.pitterpatterpottery.co.uk/user/cimage/cup-cake.jpghttp://www.pitterpatterpottery.co.uk/user/cimage/cup-cake.jpghttp://www.pitterpatterpottery.co.uk/user/cimage/cup-cake.jpg**http://www.pitterpatterpottery.co.uk/user/cimage/cup-cake.jpg | Children could draw a picture to help them work out the answer.  This also involves partitioning the numbers to find out which smaller numbers make it – see the second Numicon example.  **2 + 3 = 5**  **2 + 2 + 1 = 5**  **2 cakes add 3 cakes = 5 cakes.** |
| **5 + 7 = ?**  I buy 5 pens from the newsagents and 7 from the supermarket. How many pens do I have altogether?  +1 +1 +1 +1 +1  7 8 9 10 11 12  +2  +3  7 10 12 | Children may be given a number line to draw on.  Draw a number line and count on in ones. Arrange 5 + 7 as 7 + 5 and count on 5 from 7  Begin to bridge through 10 and later 20. |

|  |  |
| --- | --- |
| **23 + 12 = ?**  There are 23 people in the cinema and 12 arrive late. How many people are there in the cinema now? | Drawing an empty number line helps children to record the steps they have taken in a calculation. (start on 23, + 10 the + 2)  Once children have really understood the place value of digits, they then progress to adding 3 digit numbers by partitioning their numbers further. |
| **7.2 + 2.5 = ?**  +2 +0.5  7.2 9.2 9.7 | Extend to decimals (same number of decimals places) and adding several numbers (with different numbers of digits).  Partitioning is key to introduce adding of decimal numbers.  This will also include bridging through one. |
|  | It is crucial that children understand conceptually how place value works using concrete resources to scaffold the learning.  Children will need lots of opportunities to explore how this works before moving to a more formal and compact representation of this concept. |
| **27 + 36 = ?**  **20 + 30 = 50**  **7 + 6 = 13**  **50 + 13 = 63** | Once children have a firm grasp of partitioning they can move use this understanding with larger numbers arranged horizontally. |
| **27 + 36 = ?**  27  + 36  13 7 + 6  50 20 + 30  **63** | When children are ready, move them onto using the expanded column method for addition.  Partition the tens and ones, add them separately, and then add the two answers for your total. |
| **127 + 136 = ?**  127  + 136  **263**  1 | If children are finding the expanded method slow when adding large numbers, it may be appropriate to bring in the compact written method for addition.  This involved carrying large values into the higher column as you work across –  In this example the **ten** from **6 + 7** **= 13** is carried into the ten column underneath.  Moving on to addition of numbers with decimals up to two places. |

**Subtraction**

**Children are taught to understand subtraction as taking away (counting back from the largest number to the small) and finding the difference (counting up from the small to the largest).**

|  |  |
| --- | --- |
| **5 – 2 = ?**  I had five balloons. Two burst. How many did I have left?  **Take away**  **http://www.cats-grin.co.uk/Red%20Balloon.jpghttp://www.cats-grin.co.uk/Red%20Balloon.jpghttp://www.cats-grin.co.uk/Red%20Balloon.jpghttp://www.cats-grin.co.uk/Red%20Balloon.jpg**http://www.cats-grin.co.uk/Red%20Balloon.jpg  **Find the difference**  A teddy bear costs £5 and a doll costs £2. How much **more** does the bear cost?  **http://i.treehugger.com/images/2007-3-21/US%2520one%2520dollar%2520coin.jpghttp://i.treehugger.com/images/2007-3-21/US%2520one%2520dollar%2520coin.jpghttp://i.treehugger.com/images/2007-3-21/US%2520one%2520dollar%2520coin.jpghttp://i.treehugger.com/images/2007-3-21/US%2520one%2520dollar%2520coin.jpg**http://i.treehugger.com/images/2007-3-21/US%2520one%2520dollar%2520coin.jpg  **http://i.treehugger.com/images/2007-3-21/US%2520one%2520dollar%2520coin.jpghttp://i.treehugger.com/images/2007-3-21/US%2520one%2520dollar%2520coin.jpg** | Drawing a picture helps children to visualise Using dots or tally marks is quicker than drawing a detailed picture.  In these examples, when taking away it is encouraged to take away from the right hand side – as this is the side the larger number would be on a number line.  When finding the difference, the reverse is ideal.  Using Numicon, the children find it easy to place one tile over another to find the difference. |
| **9 – 6 = ?**  Mum baked 9 biscuits. I ate 6. How many were left?  -1 -1 -1 -1 -1 -1  +1 +1 +1   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 1 | 2 | **3** | 4 | 5 | 6 | 7 | 8 | 9 |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 1 | 2 | 3 | 4 | 5 | 6 | **7** | **8** | **9** | | Children should use a completed number line or number track to solve subtraction. Both by counting back and finding the difference.  Encourage one to one matching with fingers,  Or using counters to keep track of where the children are counting.  **Take away** – start at nine and take away 6 – what number are you left with?  **Finding the difference** – start at 6 and count on until you get to 9. |
| **37 – 12 = ?**  I cut 12cm off a ribbon measuring 37cm. How much is left?    -2 -10  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **25** 27 37 | Children could count back using an empty number line. This is a really good way for them to record the steps they have taken. (start on 37 and work backwards, take away 10 and then, takeaway 2)  Extend to taking away multiples of 10. For example 84 cm – 37cm. (Start on 84, -30, then -7) |
| **754 - 468 = ?**  +2 +230 +50 +4  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  468 470 700 750 754  **754 – 468 = ?**  -8 -60 -400  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  286 294 354 754 | Children move on to 3 and 4 digit numbers and decimals using the same principles as above.  **First example** – Finding the difference by adding on from the smaller number.  **Second example –** taking away the small number form the larger number. |
| **7.4 – 4.8 = ?**  - 0.8 - 4  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **2.6** 3.4 7.4 | Children move on to decimal numbers where they can count in logical steps.  First, take back the larger values, and then finally take the decimal numbers. This bridging through tenths may need support. |
| **57 - 36 = ?**  57  - 36  1 7 - 6  20 50 - 30  **21** | When children are ready, move them onto using the expanded column(negative addition) method for subtraction.  Take the lower units from the upper units, and then repeat for the tens.  Finally, add both of your subtraction answers together to find your answer. |
| **31 - 19 = ?**  31  - 19  - 8 1 - 9  20 30 - 10  **12** | This is based on an understanding of place value combined with the use of negative numbers.  For the example take the ‘ones’ lower unit from the upper unit using negative numbers if necessary. Repeat for the tens.  Finally, add the numbers together.  This method will be appropriate for children with a sound knowledge of negative numbers. |
| **342 - 279 = ?**  342  - 279  - 7 2 - 9  - 30 40 - 70  100 300 - 200  **63** | For the example take the ‘ones’ lower unit from the upper unit using negative numbers if necessary. Repeat for the tens and the hundreds.  Finally, add the numbers together. |
| **7.4 – 4.8 = ?**  7.4  - 4.8  - 0.4 0.4 – 0.8  3 7 - 4  **2.6** | **This method can be extended into decimals as well as shown in the example.**  **For the example take the tenths lower unit from the upper unit using negative numbers if necessary. Repeat for the ones, tens and hundreds as required.**  **Finally, add the numbers together.** |
| **C:\Users\MsLewis\Pictures\Dienes Subtraction.jpg** | **As with addition children should be given lots of opportunities to explore place value and exchanging parts of 2 or 3 digit numbers using Dienes apparatus.**  **(NB in this example Tens and Units have been used however units should always be referred to as ones to avoid creating a misconception when working with measures)** |
| **52 - 36 = ?**  **4** 5 **1**2 50 becomes 40,  - 3 6 2 units becomes 12 ones.  6 12 - 6  1 0 40 – 30  **1 6** | When children have a fluent understanding of the concept of place value and manipulating numbers within the context of addition they The next step for children would be exchanging to be able to subtract a big value from a smaller value.  **For this example** –  Taking 6 from 2 is difficult in this method.  Therefore, exchange one 10, and put it in the units column. |
| **227 - 136 = ?**  **1** 2 **1**2 7 200 into 100 (exchanging a 100)  - 1 3 6 and 20 becomes 120.  0 **9 1**  **= 91** | If children are finding the expanded method slow when adding large numbers, it may be appropriate to bring in the compact written method for subtraction.  This involved exchanging smaller upper numbers if needed, as well as carrying larger values underneath the answer bar.  **This example –**  After exchanging a hundred across to make 120, first take 6 from 7 = 1  Next – take 30 from 120 = 90  Finally – 100 – 100 = 0. |

**Multiplication**

**Children are taught to understand multiplication both as repeated addition and as the product of an array.**

|  |  |
| --- | --- |
| **4 x 2 = ?**  Each bicycle has two wheels. How many wheels do four bicycles have?  Ladies_safety_bicycles1889Ladies_safety_bicycles1889Ladies_safety_bicycles1889Ladies_safety_bicycles1889  2 + 2 + 2 + 2 | Use objects, counters, images and any other resource available to encourage a wide and deep understanding of the concept of multiplication.  Be clear that this representation shows four **lots of/groups of** two,  two multiplied by four or  two drawn four times.  Although the product of 2 x 4 and 4 x 2 is the same, the visual representation for each is different. |
| **3 x 5 = ?**  There are 5 cakes in a pack. How many cakes in 3 packs?  ●●●●●  ●●●●●  ●●●●●  5 + 5 + 5 | Dots or tally marks are often drawn in groups. This shows 3 lots of 5. Children would then count all of the dots together to find the total.  They should also be encouraged to count up in 5s or 3s to find the answer too. |
| **4 x 3 = ?**  A chew costs 4p. How much do 3 chews cost?  **●●●● ●●●**  **●●●● or ●●●**  **●●●● ●●●**  **●●●** | Making or drawing an **array** (3 rows of 4 or 3 columns of 4) gives children an image of the answer and helps develop the understanding that multiplication is commutative – both 4 x 3 and 3 x 4 will give the same total. |
| **4 x 6 = ?**  There are 4 cats. Each cat has 6 kittens. How many kittens are there altogether?  +6 +6 +6 +6  0 6 12 18 **24**  **4 x 60 =?**  +60 +60 +60 +60  0 60 120 180  **240** | Children can count on in equal steps, recording each jump on an empty number line to re-enforcing the concept of multiplication as **repeated addition** (whether in cubes, dots, or on a number line).  6 has been added 4 times  Combining times tables facts and understanding of place value will allow children to use this method for larger numbers too.  When numbers get bigger it becomes inefficient to do lots of small jumps. |

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **23 x 7 = ?**  There are 23 biscuits in a packet. How many biscuits are there altogether in 7 packets?  **23 = 10 + 10 + 3**  **. . . . . . . . . . . . . . . . . . . . . . .**  **. . . . . . . . . . . . . . . . . . . . . . .**  **. . . . . . . . . . . . . . . . . . . . . . .**  **. . . . . . . . . . . . . . . . . . . . . . .**  **. . . . . . . . . . . . . . . . . . . . . . .**  **. . . . . . . . . . . . . . . . . . . . . . .**  **. . . . . . . . . . . . . . . . . . . . . . .**    **70 + 70 + 21**     |  |  |  |  |  | | --- | --- | --- | --- | --- | | 7 | 10 10 3 | | | | |  | 10 x 7 = **70** | 10 x 7 = **70** | 3 x 7 = **21** | | | The **array method** (grid method)  An array can be created to represent 23 lots of 7 *(or the inverse)* and thetwo digit numbers partitioned (see the **blue** lines).  Here 23 has been partitioned into tens and ones. Each part is then multiplied by 7. The subtotals are added to give the total answer.  **= 161**  Children can also partition the numbers involved into other parts, depending on their personal strengths and preferences.  To be more efficient, boxes can be drawn to represent the parts of an array.  When boxes are used these should be drawn proportionally. |
| **72 x 38=**  A car is 72cm long. A train is 34 times longer. How long is the train?   |  |  |  | | --- | --- | --- | |  | 70 | 2 | | 30 | 30 x 70 =  2100 | 30 x 2  =  60 | | 8 | 8 x 70 =  560 | 8 x 2 =  16 |   Top row – 2100 + 60 = 2160  Next row – 560 + 16 = 576  Total = **2736** | The array method also works when multiplying bigger numbers. Again, partition the numbers into a proportional grid and multiply each separate section.  This needs a good understanding of place value – 70 x 30 can be accessed using 7 x 3 but misconceptions around x 10, x 100 will need to be attended to.    This method can be extended for multiplying larger numbers such as 327 x 24.  Partition the hundreds, tens and ones into a larger 3 x 3 grid. |
| **C:\Users\MsLewis\Downloads\IMG_0813.JPG** | This could be extended for those children who have a very secure understanding of place value and fluency in multiplication to use a more compact method. |
| **23**  **X 32**  **6 (2 x 3)**  **40 (2 x 20)**  **90 (30 x 3)**  **600 (30 x 20)**  **736**  **1** | Continuing on to 2 digit numbers |

**Division**

When faced with any calculation problem, encourage children to ask:

\* Can I do this in my head?

\* Can I do this using drawings or jottings?

\* Do I need to use a written method?

\* Should I use a calculator?

**Mental Strategies**

Key stage 1

Children should experience [regular counting](file:///C:\Users\sbishop\Documents\new%20curriculum%20calculations%20policy%202014\subtraction\Hyperlinked%20files%20for%20subtraction\Counting%20ideas.doc) on and back from different numbers in 1s and in multiples of 2, 5 and 10. Children who are able to count in twos, threes, fives and tens can use this knowledge to work out other facts

Key Stage 2

They should begin to recognise the number of groups counted to support understanding of relationship between multiplication and division.

Children are encouraged to use what they know about known times table facts to work out other times tables.

This then helps them to make new connections (e.g. through doubling they make connections between the 2, 4 and 8 times tables).

Children should count regularly using a range of multiples, and powers of 10, 100 and 1000, building fluency.

Children should practice and apply the multiplication facts to 12 x 12.

Children should be given the opportunity to further develop understanding of division (sharing) to be used to find a fraction of a quantity or measure.

Children are taught to understand division as sharing and grouping

|  |  |
| --- | --- |
| **6 ÷ 2 =**  6 lollies are shared between 2 children. How many lollies does each child get?  MC900445730[1]MC900445730[1] Sharing  between  2  There are 6 lollies. How many children can have two each?  MC900445730[1]MC900445730[1]MC900445730[1]  grouping  in 2’s | Drawing gives the children an excellent starter in sharing objects or dots into equal group.  This includes one to one matching, and sharing each items slowly.  **Sharing -** sharing the total number by the divisor – six shared into two separate lots.  **Grouping –** Finding how many groups of the divisor in the total number –  How many groups of two in 6. |
| **12 ÷ 4 =?**  12 apples are shared equally between 4 baskets. How many apples are in each basket?   |  |  | | --- | --- | | **III** | **III** | | **III** | **III** |   sharing  between 4  4 apples are packed in a basket. How many baskets can you fill with 12 apples?  grouping  in 4’s  ●●●●  ●●●●  ●●●● | Dots or tally marks can either be shared out one at a time or split into groups.  Again, teach the difference between grouping and sharing, and teach both methods. |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **18 ÷ 3 =?**   |  |  |  | | --- | --- | --- | | 5  1 | 5  1 | 5  1 |   *How many in each group?* | The next step in sharing would be using a grid method to organise small sharing.  To make the method quicker than sharing one at a time, children are encouraged to share out larger numbers until they reach the total number. |
| **18 ÷ 3 =?**  A chew bar costs 3p. How many can I buy with 18p?  ***How many groups of three in 18?***  +3 +3 +3 +3 +3 +3    0 3 6 9 12 15 18 | Next, children will be encouraged to use a number line for grouping. |
| **61 ÷ 4 =?**  I need 4 drawing pins to put up a picture. How many pictures can I put up with 61 pins?  61÷4 = 15 r1 or 15¼ or 15.25  10 x 4 5 x 4  +40 +20 +1  0 40 60 61  15 groups of 4 with 1 remaining. | As children take on larger number to divide, the idea of remainders is taught.  This also includes ‘chunking’ to save time. It would take a long time to jump in 4’s to 61 so children can jump on in bigger ‘chunks’.  A jump of 10 lots of 4 takes you to 40.  Then you need another 5 lots of 4 to make 60. Altogether that is 15 fours with 1 left over (remainder 1 or r1, ¼ or 0.25)  We would normally write 15r1 in this case. |
| **166 ÷ 6 = ?**  I have 166 pencils which need to be shared out between 6 groups. How many will each group have?     |  |  |  |  |  | | --- | --- | --- | --- | --- | | 6  **60** | **60** | **36** | **6** | **R4** |   **X 10 10 6 1** | Following on from the previous method, children are able to apply knowledge of multiplication to answer division questions using the array method.  Drawing the grid children can ‘chunk’ numbers into groups of. For example 10 lots of 6 and continue until they reach the number.  This method relies on secure understanding of times tables. |
|  | Moving on to divide larger numbers by two digit numbers. This method relies on the ability to use their multiplication knowledge to allow them to find a variety of factors so that they can move towards the target number in large jumps (ideally no more than 3 jumps) to prevent the calculation becoming too complicated.  Remainders can converted into fractions or their decimal equivalent as appropriate. |
|  | For those children who are mathematically mature (old curriculum level 5/6) a more formal method of division could be introduced. This method would still need to be introduced conceptually with examples that are expanded and explained to check understand what they are doing in the shorter version. |
|  | These formal compact methods for division will only be introduced once children need a more efficient method when dealing with larger numbers or when dealing with remainders as decimals to 2 or 3 digits. |

# **Frequently Asked Questions?**

What if pupils join the school with a different method?

Discuss how their previous methods worked and show them how we complete the methods in our schools. Explain that everyone in the school can choose from the methods we teach and give them the chance to practice and understand how they work.

What if pupils ‘can’t’ do the method?

If pupils ‘can’t’ do the methods they are telling you that they do not have the understanding of number and need to revisit a stage. This will ensure they have the place value understanding to help them to complete the method. This will be at the teachers’ discretion.

What if parents don’t like the methods adopted?

Explain to the parents that we have chosen these methods as we feel this helps the children to understand why they have to complete certain steps to gain the answer. Offer the parents the chance to show them how the methods work and encourage them to use the same ones at home. There is a parents’ calculations guide available.

What if some teaching staff lack the confidence to support the methods?

If you are not confident in supporting the methods to the children then seek help yourself. Ask people within your year group or your Maths Co-ordinator and they would be willing to explain to you how you can help support the children to gain a better understanding.

What if the children confuse themselves between the methods?

This indicates a gap in their conceptual understanding. Revisit the preceeding stage (or more!) and ensure the children are aware of the differences between the methods given to them. Get the children to explore the differences between the different methods and how they all support/represent the same calculation.