Earlsmead Primary School

Calculation Policy - Written Methods

Policy summary	Mathematics Calculation Policy - Written Methods
Affects	For parents and children
Drafted by	Adell Horbury
Approved by	Headteacher
Last approved revision date	October 2020
Review date	October 2022
Related policies, procedures and forms	Mathematics Calculation Policy - Mental Methods

"Without mathematics, there's nothing you can do. Everything around you is mathematics. Everything around you is numbers." Shakuntala Devi

Mathematics is a tool for everyday life. It is a whole network of concepts and relationships which provide a way of viewing and making sense of the world. It is used to analyse and communicate information and ideas and to tackle a range of practical tasks and real life problems. The aim of both the written and mental maths policy is to ensure that children will leave Earlsmead Primary School as mathematically literate individuals who enjoy mathematics.

Through careful planning and preparation we aim to ensure that children are given opportunities for:

- practical activities and mathematical games

- problem solving - children are taught and given time to practise the skills for using and applying which involve the organisation of thinking, the selection of ideas and strategies to implement and evaluate these.

- developing mathematical vocabulary and language through 1:1, group and whole class discussions and activities with peers and adults.

- open and closed tasks

- developing a range of methods of calculating e.g.: mental, informal/formal written calculations and using a calculator

- working with COMPUTING as a mathematical tool

Homework

Out of class activities and homework will focus on consolidating, extending and developing that which has been learnt in the classroom. These activities will be supported by the use of My Maths, an online resource, which will be available to children in Years 1 to 6. There is also an expectation for all year groups to have a weekly times tables focus to support weekly testing.

Links between mathematics and other subjects

Mathematics contributes to many subjects within the primary curriculum and where possible opportunities will be sought to draw mathematical experience out of a wide range of activities. This will allow and support children to begin to use and apply mathematics in real contexts.

Mathematics and Computing

Computing will be used in various ways to support teaching and motivate children's learning. Computing will involve computers, laptops, the Interactive Whiteboard, calculators and iPads. However, they will only be used in a daily mathematics lesson when it is the most efficient and effective way of meeting the lesson objective.

Assessment and Record Keeping

Formative teacher assessment and AFL is ongoing and is an integral part of planning, teaching and learning. Regular feedback to children about their progress and next steps is given to children orally and in written form as appropriate. Formal periodic assessments are carried out in line with the school assessment timetable. Evidence of individual assessment and record keeping can be found in:

- Children's books
- Pupil peer marking
- Evaluated weekly and medium planning sheets drawing upon information gained through observation, discussion, marking and testing.
- Termly Assessments (NC compatible)
- Pupil Progress meeting minutes
- Target Tracker – teacher assessment levels
- Baseline tests –Summer Term
- End of Key Stage SATs –Year 2 and Year 6

Assessment records are passed on to the next teacher at the end of the school year and are used to inform provision for the following academic year. Parents are informed of pupil progress through parent-teacher consultations throughout the year.

Pupils for Whom English is an additional language

When teaching mathematics, teachers will take into account children's needs and experiences. This includes children's mathematical skills and practical knowledge from other cultures. Displays will reflect other languages and cultures, numbers and mathematical vocabulary for example will be available in books as well as displayed in classrooms

All children including EAL (English as an additional language) children need to be engaged through a visual and interactive approach. Work planned needs to be differentiated and structured appropriately to meet the specific needs of EAL and allow them to work independently of both the class teacher and other support teachers.

Pupils with Special Educational Needs (SEN) including gifted mathematics

Children identified with SEN in mathematics are taught within the daily mathematics lesson. Activities are differentiated to ensure that the learning is accessible but challenging and accelerate children's learning. Additional support staff are strategically placed to support groups or individual children. They work collaboratively with the class teacher planning for and assessing pupil's progress; identifying next steps. Additional sessions or intervention programmes will also be delivered to individuals or small groups where appropriate.

In addition to class and school provision, pupils identified as gifted mathematicians may be selected for additional out of class enrichment programmes and opportunities.

<u>Earlsmead Primary School Mathematics Calculation Policy</u>

This policy contains the key pencil and paper procedures that are to be taught throughout the school. It has been written to ensure consistency and progression throughout the school and reflects a whole school agreement. Children should use mental methods when appropriate, but for calculations that they cannot do in their heads, they use an efficient written method accurately and with confidence.

The 'fundamentals' such as number bonds and multiplication tables are stressed and problem solving plays a central role in learners' mathematical development, while motivational activities help to develop inquiring minds.

Using and Applying
Before children move onto the next stage in written calculation, it is important that their skills are broadened through their use and application in a range of contexts (including money, time and other measures).

Aims

- To provide a relevant, challenging and enjoyable curriculum for all pupils, providing equal access and opportunities for all children regardless of race, gender, class, disability or ability.
- To develop a positive attitude and enthusiasm towards mathematics by ensuring that activities are rich and enjoyable experiences which enrich the mathematical experiences of all learners.
- To ensure that mental calculation and strategies are complementary strategies as in all methods there is an element of mental processing.
- To develop children’s ability to calculate, solve problems, to reason, to think logically, and to work systematically and accurately by offering plenty of opportunities to use and apply their mathematical skills.
- To ensure a consistent and progressive approach exists within the school to secure good to outstanding progress in written calculations and use of manipulatives (hands-on materials).
- Although each method will be taught in the year group specified, children should not be discouraged from using previously taught methods with which they are secure, while the new concepts are becoming embedded. In addition, if children are secure in one form of calculation differentiation should provide children the opportunity to progress to a more sophisticated form.
- For children to reflect upon which method to use to solve a problem and ask questions such as 'Can I do this in my head?', 'Can I do this in my head or do I need equipment to help me?', 'Do I need to use a written method?' then ‘Is my answer sensible?’
- For children to be able to clearly explain methods of recording/representation and justify why their answers are correct using sound mathematical vocabulary and universal symbols (strong speaking and listening opportunities underpin good mathematics teaching).
- For KS2 children to develop an efficient, reliable, compact written method of calculation for each operation that they can apply with confidence and understanding when undertaking calculations that they cannot carry out solely mentally.
- To share progress in written calculations with parents so that they have the confidence and knowledge to support their children at home with their mathematical development.

Building on the Early Learning Goals

Pupils' prior experience of mathematics includes:

- counting and using numbers to at least 10 in familiar contexts
- recognising numerals 1 to 20
- talking about and creating simple patterns
- beginning to understand addition as combining two groups of objects and subtraction as 'taking away'
- describing the shape and size of solid and flat shapes
- using everyday words to describe position
- Using early mathematical ideas to solve practical problems.

WHEN ARE CHILDREN READY FOR WRITTEN CALCULATIONS?

Addition and subtraction

- Do they know addition and subtraction facts to 20?
- Do they understand place value and can they partition numbers?
- Can they add three single digit numbers mentally?
- Can they add and subtract any pair of two digit numbers mentally?
- Can they explain their mental strategies orally and record them using informal jottings?

Multiplication and division

- Do they know the 2, 3, 4, 5 and 10 time table
- Do they know the result of multiplying by 0 and 1?
- Do they understand 0 as a place holder?
- Can they multiply two and three digit numbers by 10 and 100?
- Can they double and halve two digit numbers mentally?
- Can they use multiplication facts they know to derive mentally other multiplication facts that they do not know?
- Can they explain their mental strategies orally and record them using informal jottings?

The above lists are not exhaustive but are a guide for the teacher to judge when a child is ready to move from informal to formal methods of calculation.

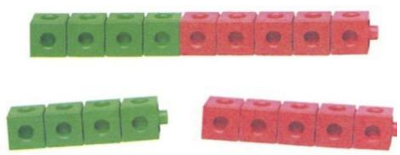
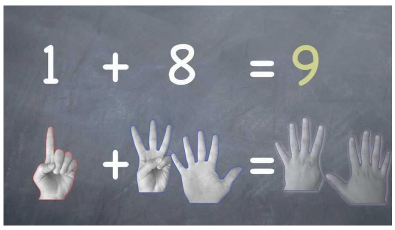
Addition

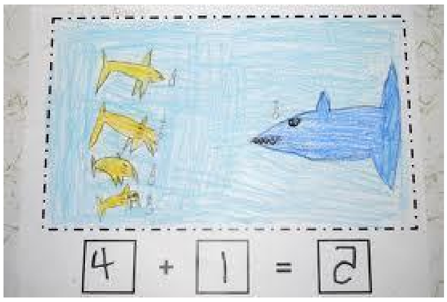
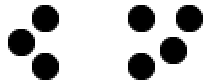
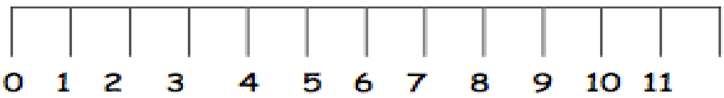
The aim is that children use mental methods when appropriate but, for calculations that they cannot do in their heads, they use an efficient written method accurately and with confidence. Children are entitled to be taught and to acquire secure mental methods of calculation and one efficient written method of calculation for addition, which they know they can rely on when mental methods are not appropriate. These notes show the stages in building up to using an efficient written method for addition of whole numbers.

Mental Strategies required for adding successfully

- Count forward in 1's, 2's, 5's and 10's etc.
- Recall all addition pairs to 9 + 9 and complements in 10, (such as 7+ 3 =10) and apply them in calculations
- Add mentally a series of one-digit numbers, (such as 5 + 8 + 4);
- Add multiples of 10 (such as 60 + 70) or of 100, (such as 600 + 700) using the related addition fact, 6 + 7, and their knowledge of place value;
- Partition two-digit and three-digit numbers into multiples of 100, 10 and 1 in different ways. It is important that children's mental methods of calculation are practiced and secured alongside their learning and use of an efficient written method for addition.

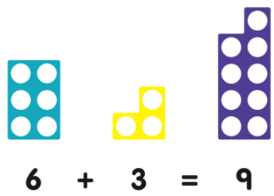
<table>
<tr><td><u>Counting in ones</u>
Starting from 0 and then from any number.</td><td>Counting out loud and practicing 1:1 correspondence (knowing that each object is a separate unit)
It is also important that each number represents a group of objects (e.g. 3 = 3 teddies)
</td></tr>
<tr><td><u>Practical addition (first 'count all' and then 'count on')</u>
Count all: 2 + 3 is counted 1, 2 and then 3, 4, 5 (out loud)

Count on: 2 + 3 is counted 2 and then 3, 4, 5</td><td></td></tr>
</table>

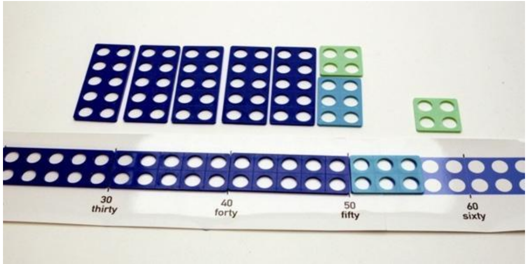
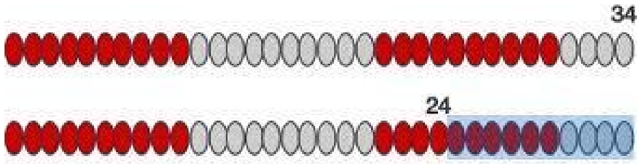
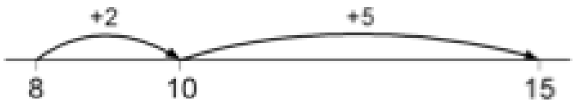
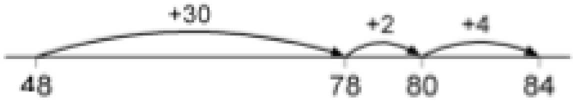
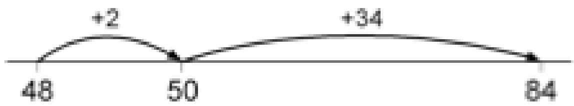
<table>
<tr>
<td><u>Simple addition using picture jottings</u>
Drawing a picture
There were 4 yellow sharks and I blue. How many sharks were there altogether?
Dots or tally marks
3 kids were on a bus and then 4 more got on. How many were on the bus in total?</td>
<td>
$3 + 4 = 7$
</td>
</tr>
<tr>
<td><u>Counting in ones along a number line/track</u>
Children could use a pre-drawn number line or number tracks and then begin to create their own, e.g. 5 children are at school. 4 children arrive late. How many children are at school now?</td>
<td>

5 + 4 = 9</td>
</tr>
<tr>
<td><u>Practical addition</u>
Use of Numicon:
- To help children to learn number facts and visualize quantities and what digits represent.

- To look for patterns and relationships in number.

- Use of Numicon number line to add amounts.</td>
<td>
</td>
</tr>
<tr>
<td><u>Practical and informal partitioning</u>
Use of practical apparatus such as Numicon, Dienes, and Cuisenaire to partition and present place value of digits.

Place value cards can be used to additional support understanding of place value.</td>
<td></td>
</tr>
</table>

<u>Using addition facts to 10 to bridge the ten during addition</u> Here Numicon is used to bridge the ten, e.g. in 56 + 8 the 8 is split into two 4's in order to form a number bond of 6 + 4. This enables the next multiple of 10 (60) to be reached before adding on the remaining 4. Bead lines can also be used to show this method. 24 + 10 = 24 + 6 + 4	 
<u>The empty number line</u> The mental methods that lead to column addition generally involve partitioning. Children need to be able to partition numbers in ways other than into tens and ones to help them make multiples of ten by adding in steps. The empty number line helps to record the steps on the way to calculating the total. One step in their development when using a number line is to first be able to count on in tens and of course ones.	**8 + 7 = 15**  **48 + 36 = 84**  **or**  **Steps in addition can be recorded on a number line. The steps often bridge through a multiple of 10.**
<u>Partitioning by horizontal expansion method</u> The next stage is to record mental methods using partitioning into tens and ones separately. Add the tens and then the ones to form partial sums and then add these partial sums. Partitioning both numbers into tens and ones mirrors the column method where ones are placed under ones and tens under tens. This method builds on mental methods as each part is	Record steps in addition using partitioning: 47 + 76 47 + 76 47 + 70 = 117 40 + 70 = 110 117+ 6 = 123 7 + 6 = 13 110 + 13 = 123

<table>
<tr>
<td>calculated mentally and recorded. It also makes the value of digits clear to children.
Before calculation, children should be able to make a sensible estimate by rounding to the nearest 10 or 100 (e.g. 487 + 546 = 500+500=1000) so they can check the reasonableness of their answer.</td>
<td>Partitioned numbers are then written under one another, for example:

47 = 40 + 7

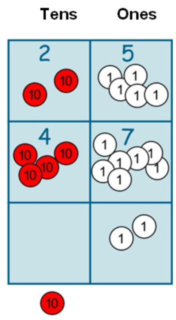
76 = 70 + 6

110 + 13 = 123</td>
</tr>
<tr>
<td><u>Vertical expansion method</u>
Move on to a layout showing the addition of the tens to the tens and the ones to the ones separately. To find the partial sums initially the tens, not the ones, are added first, following mental methods. The total of the partial sums can be found by adding them together.

The addition of the tens in the calculation 47 + 76 is described in the words ‘forty plus seventy equals one hundred and ten’, stressing the link to the related fact ‘four plus seven equals eleven’. As children gain in confidence, ask them to start by adding the ones digits first every time.</td>
<td>Write the numbers in columns.

Adding the tens first:

25
<u>47</u>
6 0 (20+40)
<u>1 2 (5+7)</u>
7 2



Adding the ones first:
25
<u>47</u>
1 2 (5+7)
<u>6 0</u> (20+40)
7 2

Discuss how adding the ones first gives the same answer as adding the tens first. Refine over time to adding the ones digits first consistently.</td>
</tr>
<tr>
<td colspan="2">The expanded method leads children to the more compact methods so that they understand its structure and efficiency. The amount of time that should be spent teaching and practicing the expanded method will depend on how secure the children are in their recall of number facts and in their understanding of place value. Ensure that digits are kept in the correct columns throughout and columns may be labelled with H, T and U to show place value.</td>
</tr>
<tr>
<td><u>Compact column method</u>
In this method, recording is reduced further. Carry digits are recorded below the line, using the words ‘carry ten’ or ‘carry one hundred’, not ‘carry one’.
Later, extend to adding three two-digit numbers, two three-digit numbers and numbers with different numbers of digits.</td>
<td>258   366
<u>87</u>   <u>458</u>
<u>345</u>   <u>824</u>
1 1   1 1

Column addition remains efficient when used with larger whole numbers and decimals. Once learned, the method is quick and reliable.</td>
</tr>
</table>

Subtraction

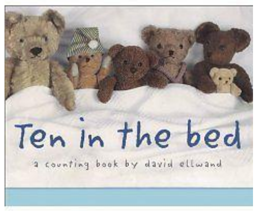
The aim is that children use mental methods when appropriate but, for calculations that they cannot do in their heads they use an efficient written method accurately and with confidence. Children are entitled to be taught and to acquire secure mental methods of calculation and one efficient written method of calculation for subtraction, which they know they can rely on when mental methods are not appropriate.

These notes show the stages in building up to using an efficient method for subtraction of two-digit and three-digit whole numbers. These will be introduced to children after they have understood the term subtraction by using objects and pictures to reinforce the idea. Children will always have had experience of using a numbered number line as well.

Mental Strategies required for subtracting successfully

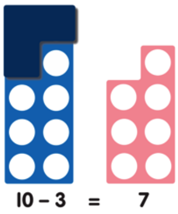
- Count back in ones, and tens from any number
- Recall all addition and subtraction facts to 10 and 20;
- Subtract multiples of 10 (such as 160 – 70) using the related subtraction fact, 16 – 7, and their knowledge of place value;
- Partition two-digit and three-digit numbers into multiples of one hundred, ten and one in different ways (e.g. partition 74 into 70 + 4 or 60 + 14).

It is important that children's mental methods of calculation are practiced and secured alongside their learning and use of an efficient written method for subtraction.

<u>Counting backwards in ones</u> Starting from 10 and then from any number.	Counting out loud and singing number rhymes and songs e.g. 'Five Currant buns' or 'Ten Green bottles', using books, visual pictures, role play and puppets to show the process of getting less.  
<u>Practical subtraction (first 'count all' then 'count on')</u> Practical 1:1 correspondence of finding the first number and taking away the second to find out what is left: I found 3 pebbles on a beach but I lost one! How many did I have left?	 

Practical subtraction

Use of Numicon to subtract using subatised pieces of equipment (**subitise** means to perceive at a glance the number of items presented, the limit for humans being about seven).



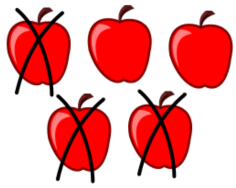
Simple subtraction using picture jottings

Drawing a picture

I had 5 apples but my teacher ate 3 of them. How many did I have left?

Dots or tally marks

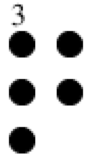
There were 5 people of the bus but 2 got off at the first stop. How many people were still on the bus?



5 - 3 = 2

5-2=3

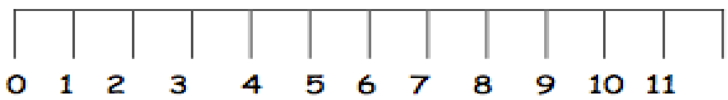
5 - 2 = 3



Counting back in ones along a number line/track

Children could use a pre-drawn number line and then begin to create their own, e.g. Nine children are at school. Four children go home because they feel sick. How many children are left in school?

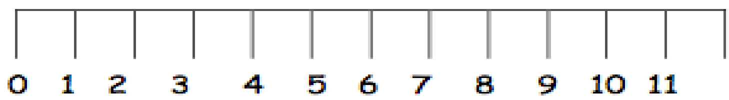
9
9



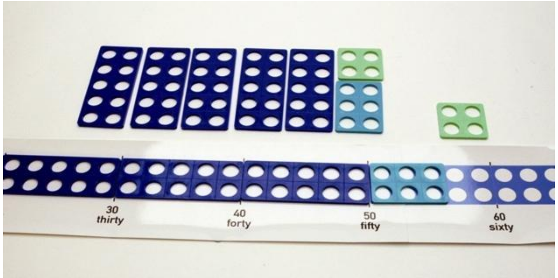
Children should use counting back briefly in their development when subtracting small single digit numbers and then move to using counting on in terms of finding the difference predominantly.

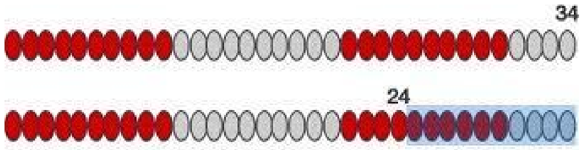
Finding the difference

Children are taught to count on from the smallest number to find the difference (This can be done in their head or on a number line), e.g. there are 10 children in our class today and 7 of them are having school dinner. How many are having packed lunch?

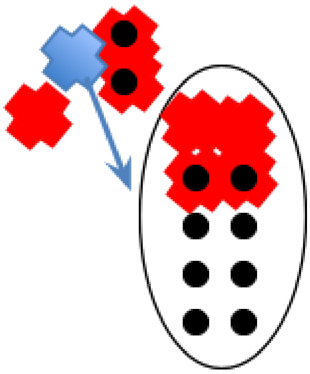
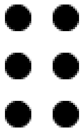


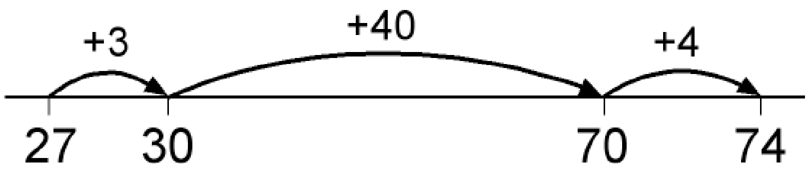
<table>
<tr>
<td><u>Using addition facts to 10 to bridge the ten during subtraction by counting up to find the difference</u>
Here the use of a Numicon can be used to help bridge the ten when counting up to find the difference, e.g. in 64 – 56, 4 is added to the 56 to reach 60 and then 4 again to reach 64. Thereby finding the difference of 8 by counting up.

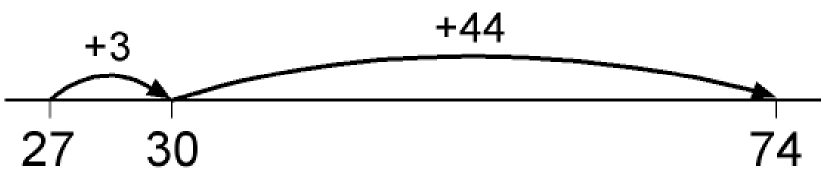
Bead lines can also be used to show this method.</td>
<td>




34 – 24 = 6 + 4</td>
</tr>
<tr>
<td>Practical partitioning where the units bridge the ten/hundreds

As there are only 2 units, children should be taught to exchange 1 ten for ten units. This now means that there are 12 units and 2 tens (still 42). Children are then able to subtract 6 units and 1 ten, as in the previous example.</td>
<td>4 2 - 1 6 = 2 6




</td>
</tr>
<tr>
<td><u>Using an empty number line to find the difference and finding an answer by counting up</u>
The steps can also be recorded by counting up from the smaller to the larger number to find the difference, for example by counting up from 27 to 74 in steps totaling 47 (shopkeepers method). With practice, children will need to record less information and decide whether to count back or forward. It is useful to ask children whether counting up or back is the more efficient for calculations such as 57 – 12, 86 – 77 or 43 – 28.</td>
<td>74 – 27 =
or:




</td>
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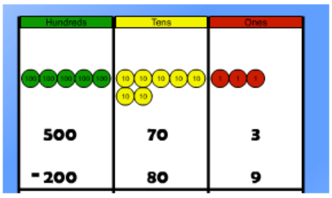
</table>

<u>Expanded layout, leading to column method (Decomposition)</u> Partitioning the numbers into tens and ones and writing one under the other mirrors the column method, where ones are placed under ones and tens under tens. This does not link directly to mental methods of counting back or up but parallels the partitioning method for addition. It also relies on secure mental skills.	Example: 563 - 241, no adjustment or decomposition needed **Expanded method** 500 60 3 −200 40 1 300 20 2 Start by subtracting the ones, then the tens, then the hundreds. Refer to subtracting the tens, for example, by saying 'sixty take away forty', not 'six take away four'.

The expanded method leads children to the more compact method so that they understand its structure and efficiency. The amount of time that should be spent teaching and practicing the expanded method will depend on how secure the children are in their recall of number facts and with partitioning.

Compact Method

$$\begin{array}{rrr} ^{4}5 & ^{1\,6}7 & ^{1}3 \\ -\ 2 & 8 & 9 \\ \hline 2 & 8 & 4 \end{array}$$



Ensure that children can explain the compact method, referring to the real value of the digits. They need to understand that they are repartitioning. **Ensure that children are confident to explain how the numbers are repartitioned and why.**

Multiplication

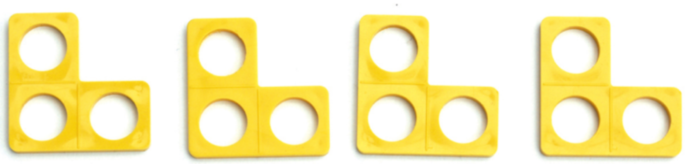
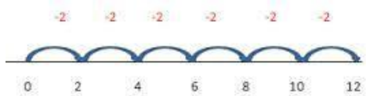
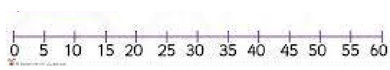
The aim is that children use mental methods when appropriate, but for calculations that they cannot do in their heads, they use an efficient written method accurately and with confidence. Children are entitled to be taught and to acquire secure mental methods of calculation and one efficient written method of calculation for multiplication, which they know they can rely on when mental methods are not appropriate.

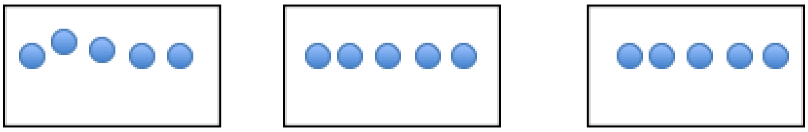
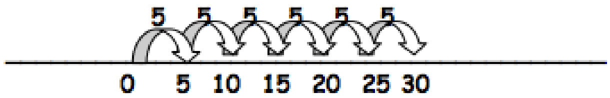
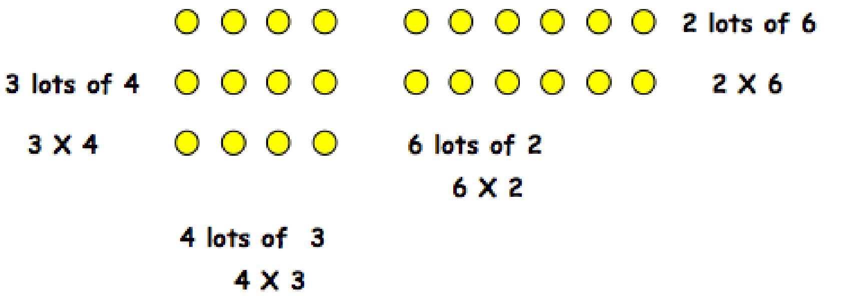
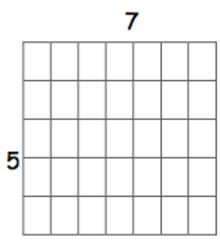
To multiply successfully, children need to be able to:

- Recall all multiplication facts to 12 x 12;
- Partition numbers into multiples of one hundred, ten and one;
- Apply multiplication facts e.g. 70 × 5, 70 × 50, 700 × 5 or 700 × 50 using the related fact 7 × 5 and their knowledge of place value;
- Double numbers to 10. Then 20, 50, 100, 500 progressively
- Multiply by 10,100 and 1000 by shifting digits 1, 2, 3, place value to the left respectively
- Utilise closely related multiplication facts e.g. 13 x 11 = (13 x 10) + 13 = 130 +13 = 143 and 40 x 30 = (4 x 3) x 100 = 1200 and later with decimals 4 x 0.3 = (4 x 3) ÷ 10 = 1.2
- Add two or more single-digit numbers mentally;
- Add multiples of 10 (such as 60 + 70) or of 100 (such as 600 + 700) using the related addition fact, 6 + 7, and their knowledge of place value;
- Add combinations of whole numbers using the column method (see above).
- Square numbers and prime numbers

It is important that children's mental methods of calculation are practiced and secured alongside their learning and use of an efficient written method for multiplication.

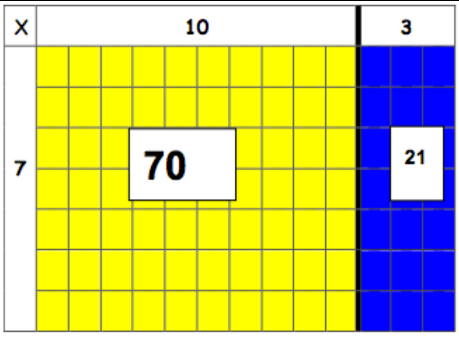
Develop the mental image of multiplication

<u>Putting objects into equal groups</u> Putting objects into equal groups and then checking there are for example, 2 in each group. Begin counting in equal steps by counting the number in 2 groups and then 3 and then 4 etc.	 2 4 6 8
<u>Counting in equal steps, starting with 2s, 10s and 5s, then progressing to 3s, 4s and then 6s, 7s, 8s and 9s</u> Using practical apparatus such as Numicon. Understanding how to count in these steps is an important foundation to learning multiplication facts (tables).	 3 6 9 12 

<u>Multiplication as repeated addition</u> 5 x 3 = There are 5 cakes in a pack. How many cakes in 3 packs? Dots or tally marks are often drawn in groups. This shows 3 groups of 5.	 5 + 5 + 5
<u>Number lines</u> This model illustrates how multiplication relates to repeated addition. Pattern work on a 100 square helps children begin to recognise multiples and rules of divisibility Using Numicon number line to solve repeated addition problems by laying pieces upon track.	6 x 5 = 30 or 5 + 5 + 5 + 5 + 5 + 5 = 30  
<u>Arrays</u> Successful written methods depend on visualising multiplication as a rectangular array. It also helps children to understand why 3 X 4 = 4 X 3	
<u>Rectangular Arrays</u> The rectangular array gives a good visual model for multiplication. The area can be found by repeated addition (in this case 7+7+7+7+7). Children should then commit 7 x 5 to memory and know that it is the same as 5 x 7. Area models like this discourage the use of repeated addition. The focus is on the multiplication facts.	

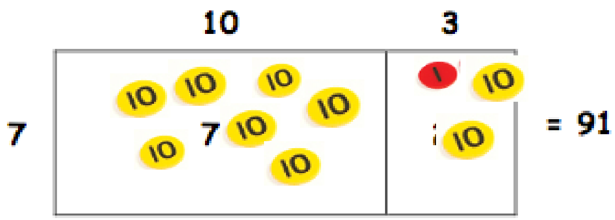
Mental multiplication using arrays and partitioning to multiply a two- digit number by a one-digit number

An array illustrates the distributive law of multiplication i.e.
13 x 7 is the same as (10 x 7) + (3 x 7)
Please note that the squares are used to ensure that children have a secure mental image of why the distributive law works



Grid Method using place value counters.

13 x 7 = 91



This can lead to the use of a "blank rectangle/open arrays" to illustrate:
13 x 7 = (10 x 7) + (3 x 7)

	10	3	
7	70	21	= 91

Note the rectangle is drawn to emphasize the comparative size of the numbers.

Using the grid method to multiply two- digit by one-digit numbers

At first children will probably need to partition into 10's (example A). It is important, if they are to use a more compact method, that they can multiply multiples of 10 (example B), i.e. 38 x 7 they must be able to calculate 30 x 7 as well as 8 x 7. **Note the grid is drawn to emphasise the comparative size of the numbers.**

This will lead to a more formalised layout.

38 X 7 is approximately 40 X 7 = 280

Example A

	10	10	10	8
7	70	70	70	56

Example B

	30	8	
7	210	56	=266

Leading to the layout

X	30	8	
7	210	56	= 266

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<u>**Two-digit by two-digit products using the grid method**</u>

Extend to TU × TU, asking children to estimate first.

Start by completing the grid. The partial products in each row are added, and then the two sums at the end of each row are added to find the total product.

Please note that at this stage the grid is no longer drawn to reflect the respective size of the digits. If a child shows signs of insecurity return to rectangular arrays to ensure understanding.

<u>**Three-digit by two-digit products using the grid method**</u>

Extend to HTU × TU asking children to estimate first.

Ensure that children can explain why this method works and where the numbers and the grid come from. Place Value counters can help children who are less secure in their number facts.

The grid method works just as satisfactorily with decimal numbers as long as the children can apply their knowledge of multiplication facts to decimal numbers.

</td>
<td>

38 x 14

x	30	8	
10	300	80	380
4	120	32	152
			532

138 x 24 =

x	100	30	8	
20	2000	600	160	2760
4	400	120	32	552
				3312

38.5 x 24 =

x	30	8	0.5	
20	600	160	10	770
4	120	32	2	154
				924

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It will be down to the class teacher as to whether they move onto the next stage with their pupils. Children need to be confident with the grid method before this can be considered.

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</table>

<u>Expanded short multiplication leading to column method</u> The first step is to represent the method of recording in a column format, but showing the working. Draw attention to the links with the grid method above. Children should describe what they do by referring to the actual values of the digits in the columns. For example, the first step in 38 × 7 is 'thirty multiplied by seven', not 'three times seven', although the relationship 3 × 7 should be stressed.	**38 x 7 is approximately 40 x 7 = 280** **30 + 8** **x 7** **210 (30 x 7)** **56 (8 x 7)** **266**
<u>Short multiplication</u> The recording is reduced further, with carry digits recorded below the line. **If, after practice, children cannot use the compact method without making errors, they should return to the expanded format of the grid method.** **<u>Multiplying two-digit by two-digit numbers</u>** includes the working to emphasise the link to the grid method.	38 x 7 is approximately 40 x 7 = 280 3 8 X 7 ——— 2 6 6 5 The step here involves adding 210 and 50 mentally with only the 5 in the 50 recorded. This highlights the need for children to be able to add a multiple of 10 to a two- digit or three-digit number mentally before they reach this stage. 56 × 27 is approximately 60 × 30 = 1800. 5 6 X 2 7 42 (6 x 7) 350 (50 x 7) 120 (6 x 20) 1000 (50 x 20) 1512 1

<table>
<tr>
<td><u>Three-digit by two-digit numbers</u>
Continue to show working to link to the grid method.
This expanded method is cumbersome, with six multiplications and a lengthy addition of numbers with different numbers of digits to be carried out. There is plenty of incentive for more confident children to move on to a more compact method.</td>
<td>2 8 6
2 9
54 (6 X 9)
720 (80 X 9)
1800 (200 X 9)
120 (6 X 20)
1600 (80 X 20)
4000 (200 X 20)
8294
2</td>
</tr>
<tr>
<td colspan="2">If secure with the expanded method, and children are making very few errors, then they can move on to the compact method. This is at the discretion of the class teacher.</td>
</tr>
<tr>
<td><u>Optional: Compact method for TU x TU and HTU x TU</u></td>
<td>2 3
x 1 2
4 6 (2 x 23)
2 3 0 (10 x 23)
2 7 6

1 2 3
x 1 2
2 4 6 (2 x 123)
1 2 3 0 (10 x 123)
1 4 7 6</td>
</tr>
</table>

Division

The aim is that children use mental methods when appropriate but, for calculations that they cannot do in their heads, they use an efficient written method accurately and with confidence. Children are entitled to be taught and to acquire secure mental methods of calculation and one efficient written method of calculation for division, which they know they can rely on when mental methods are not appropriate.

To divide successfully in their heads, children need to be able to:

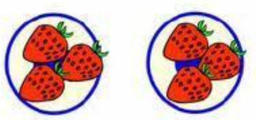
- Understand and use the vocabulary of division
- Partition two-digit and three-digit numbers into multiples of 100, 10 and 1 in different ways;
- Halves of numbers to 20, 50, 100, 200, 500 progressively
- Recall multiplication and division facts to 12 × 12, recognise multiples of one-digit numbers and divide multiples of 10 or 100 by a single-digit number using their knowledge of division facts and place value;
- Use and apply division facts e.g. 60 ÷ 3 = (6 ÷ 3) x 10 = 20
- Know how to find a remainder working mentally – for example, find the remainder when 48 is divided by 5
- Understand and use multiplication and division as inverse operations
- **U**nderstand division as repeated subtraction (Grouping)
- Know square roots
- Estimate how many times one number divides into another – for example, how many sixes there are in 47, or how many 23s there are in 92
- Know subtraction facts to 20 and to use this knowledge to subtract multiples of 10 e.g.120 - 80, 320 – 90.

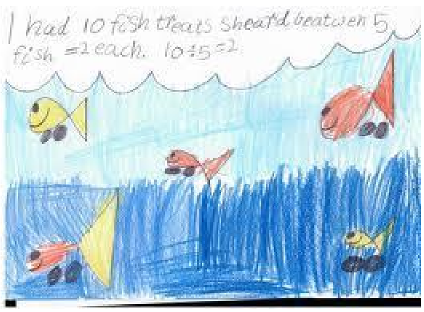
It is important that children's mental methods of calculation are practiced and secured alongside their learning and use of an efficient written method for division. To carry out written methods of division successfully, children also need to be able to:

<u>Division by sharing</u>

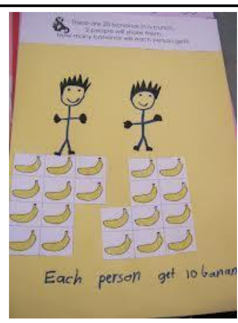
Practical sharing along with more pictures and jottings.

6 strawberries shared between 2 children. How many eggs do they get each? 6÷2 =



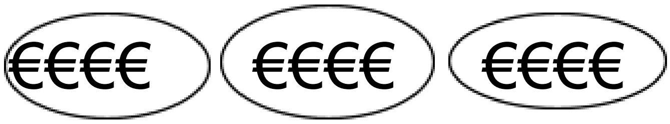
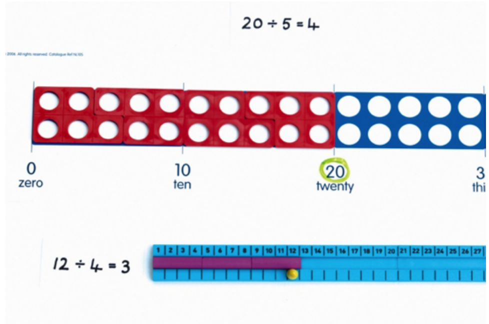
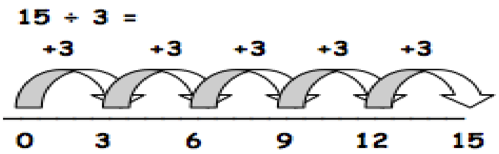
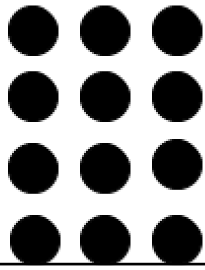
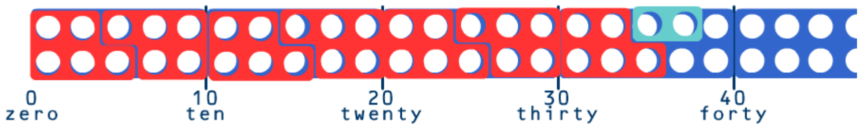


I had 10 fish treats shared between 5 fish. 10 ÷ 5 = 2

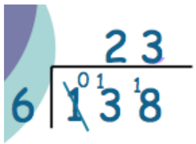


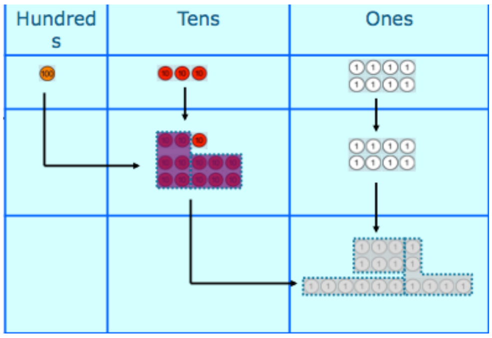
Two boys shared 20 bananas. How many did they get each? 20 ÷ 2 = 10

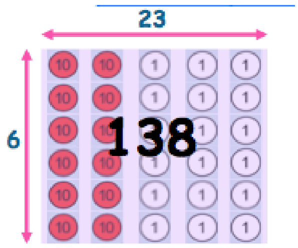
Sharing should only be used briefly as a precursor to grouping, which is a more preferable method and should be moved onto as soon as possible. Solving division by grouping strengthens mental calculation strategies.

<u>Division by grouping</u> 4 apples are packed in a basket. How many baskets can you fill with 12 apples? 12 ÷ 4 = 3	Practical grouping with 12 objects, grouped into 4's. Dots or tally's marks can be split up into groups, e.g. draw 12 dots representing apples and grouping into 4's to find how many groups. 12÷4 =3 
<u>Numicon number line</u> How many 5's are in 20? **<u>Number lines (Repeated +)</u>** Counting on in equal steps based on adding multiples up to the number to be divided. Counting back in equal steps based on subtracting multiples from the number to be divided ***Note: Counting on is a powerful tool for mental calculation but does not lead onto written calculation for division***	  A chocolate bar costs 3p. How many can I purchase for 15p?
<u>Using an array to divide</u> Children can build upon what they have learnt about arrays in multiplication and it is vital that links between multiplication and division are made in a visual way.	 12 dots arranged into rows of 3 123= There are 4 rows/groups so the answer is 4
<u>Finding remainders using Numicon</u> 37 ÷ 5 = 7 r2	
<u>Counting on by chunking</u> This method is based on adding multiples of the divisor, or 'chunks'. Initially children add several chunks, but with practice they should look for the biggest multiples of the divisor that they can find to add. Chunking is useful for reminding children of the link between division and repeated addition. Initially children add several chunks, but with practice they should look for the biggest multiples of the divisor that they can find to add.	100 ÷ 7 = **10 x 7 = 70** **4 x 7 = 28** 1 0 4 **0 70 98** **Answer 14 remainder 2** As you record the division, ask: 'How many sixes in 100?' as well as 'What is 100 divided by 6?' ***Children need to recognise that chunking is inefficient if too many additions have to be carried out. Encourage them to reduce the number of steps and move them on quickly to finding the largest possible multiples.***

Bus stop method using place value counters







Bus stop method for when dividing by a 1-digit number

Children should first be introduced to this method by working through calculations where there are no remainders. Children should then solve calculations with remainders Children can look at putting remainders into decimals using this method.

98 ÷ 7 becomes

1 4
7 | 9 ²8

Answer: 14

432 ÷ 5 becomes

8 6 r 2
5 | 4 ³3 2

Answer: 86 remainder 2

496 ÷ 11 becomes

4 5 r 1
1 1 | 4 ⁵9 6

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

Bus stop method for when dividing by a 2-digit number

Children should first be introduced to this method by working through calculations where there are no remainders. Children should then solve calculations with remainders Children can look at putting remainders into decimals using this method.

24) 560
480 — 24×20
80
72 — 24×3
8
Answer: 23 R 8

23
24) 560
−480
80
−72
8
Answer: 23 R 8

432 ÷ 15 becomes

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

Answer: 28·8

2 8
1 5 | 4 3 2
3 0 0 — 15×20
1 3 2
1 2 0 — 15×8
1 2

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

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