EYFS and KS1 Teaching for Mastery Calculation Policy

Date of last review:	Autumn 2021
Policy Reference Number:	131
Date of next review:	Autumn 2025
Staff Member:	Head teacher

EYFS and KS1 Teaching for Mastery Calculation Policy

The National Curriculum 2014

Mathematics is a creative and highly inter-connected discipline that has been developed over centuries, providing the solution to some of history's most intriguing problems. It is essential to everyday life, critical to science, technology and engineering, and necessary for financial literacy and most forms of employment. A high-quality mathematics education therefore provides a foundation for understanding the world, the ability to reason mathematically, an appreciation of the beauty and power of mathematics and a sense of enjoyment and curiosity about the subject.

The aims of this policy

Mastery is for all, and the aim of this policy is to ensure all children leave our school with a secure understanding of the four operations and can confidently use both written and mental calculation strategies in a range of contexts. It aims to ensure consistent strategies, models and images are used across the school to embed and deepen children's learning and understanding of mathematical concepts.

How should this policy be used?

This policy has been designed to support the teaching and planning of mathematics in our school. The policy only details the strategies, teachers must plan opportunities for pupils to apply these; for example, when solving problems, or where opportunities emerge elsewhere in the curriculum. The examples and illustrations are not exhaustive but provide and overall picture of what the mathematics in our school should look like. This is not a scheme of work and must be used in conjunction with other curriculum documents.

This policy sets out the progression of strategies and written methods which children will be taught as they develop in their understanding of the four operations. Strategies are set out in a Concrete, Pictorial, Abstract (CPA) approach to develop children's deep understanding and mastery of mathematical concepts. Children use concrete objects to help them make sense of the concept or problem; this could be anything from real or plastic fruit, to straws, counters or cubes. This is then developed through the use of images, models and children's own pictorial representations before moving on to the abstract mathematics. Children will travel along this continuum again and again, often revisiting previous stages when a concept is extended. It is also worth noting that if a child has moved on from the concrete to the pictorial, it does not mean that the concrete cannot be used alongside the pictorial. Or if a child is working in the abstract, ‘proving’ something or ‘working out’ could involve use of the concrete or pictorial.

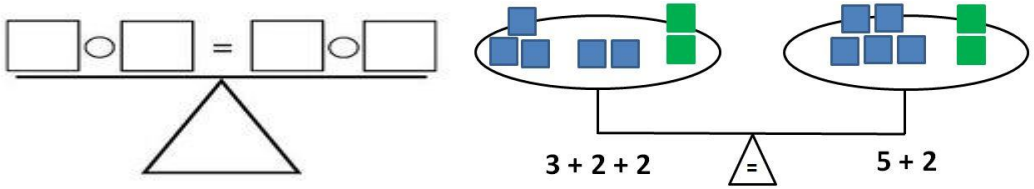
Similarly, although the strategies are taught in a progressive sequence, they are designed to equip children with a 'tool box' of skills and strategies that they can apply to solve problems in a range of contexts. So as a new strategy is taught it does not necessarily supersede the previous, but builds on prior learning to enable children to have a variety of tools to select from. As children become increasingly independent, they will be able to and must be encouraged to select those strategies which are most efficient for the task.

The strategies are separated into the 4 operations for ease of reference. However, it is intended that addition and subtraction, and multiplication and division will be taught together to ensure that children are making connections and seeing relationships in their mathematics. Therefore, some strategies will be taught simultaneously, for example, counting on (addition) and counting back (subtraction).

Children should be moved through the strategies at a pace appropriate to their age related expectations as defined in the EYFS and NC. Effective teaching of the strategies relies on increasing levels of number sense, fluency and ability to reason mathematically. Children must be supported to gain depth of understanding within the strategy through the mastery and CPA approach and not learn strategies as a procedure.

Teaching equality

It is important that when teaching the 4 operations that equality (=) is also taught appropriately. Misconceptions that = means that children must 'do something' and that it indicates that an answer is needed are common and must be addressed early on. Teachers should present children with number sentences and problems which place the = sign in different positions, different context and include missing box problems. For example, ?+4=7; 7=3+?; <, >, or = 5+6__ 7+4. In the concrete phase, scales and Numicon provide a useful resource to demonstrate equality. Pictorial representations of equality can be used as shown below:



Importance of vocabulary

The 2014 National Curriculum places great emphasis on the importance of pupils using the correct mathematical language as a central part of their learning. Children will be unable to articulate their mathematical reasoning if they lack the mathematical vocabulary required to do so. It is therefore essential that teaching using the strategies outlined in this policy is accompanied by the use of appropriate mathematical vocabulary. New vocabulary should be introduced in a suitable context (for example, with relevant real objects, apparatus, pictures or diagrams) and explained carefully. High expectations of the mathematical language used are essential, with teachers modelling and only accepting what is correct. For example:

✓	×
ones	units
is equal to	equals
zero	oh (the letter O)
number sentence	sum/s

End of year expectations for calculations.

EYFS	Year 1	Year 2
• count reliably with numbers from one to 20. • place numbers in order. • say which number is one more or one less than a given number. • using quantities and objects, they add two single-digit numbers and count on to find the answer. • using quantities and objects, they subtract two single-digit numbers and back to find the answer. • solve problems, including doubling, halving and sharing.	• read, write and interpret mathematical statements involving addition (+), subtraction (–) and equals (=) signs • represent and use number bonds and related subtraction facts within 20 • add and subtract one-digit and two-digit numbers to 20, including zero • solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as 7 = ? – 9. • solve one-step problems involving multiplication and division, by calculating the answer using concrete objects • solve one-step problems involving multiplication and division using pictorial representations and arrays with the support of the teacher	• solve problems with addition and subtraction: • using concrete objects and pictorial representations, including those involving numbers, quantities and measures • applying their increasing knowledge of mental and written methods • recall and use addition and subtraction facts to 20 fluently • derive and use related facts up to 100 • add and subtract numbers using concrete objects, pictorial representations, and mentally, including: o a two-digit number and ones o a two-digit number and tens o two two-digit numbers o adding three one-digit numbers • show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot • recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems • recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers • calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs • show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot • solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts

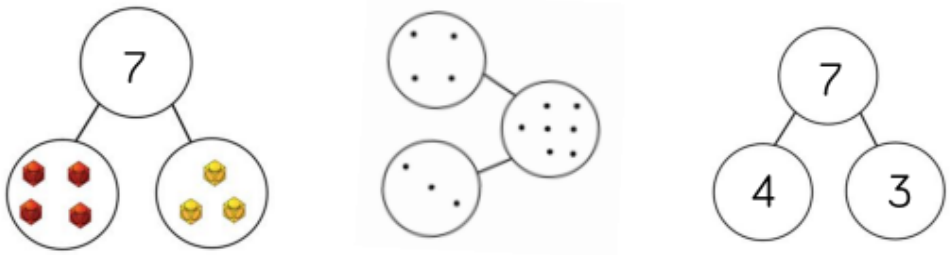
Whole School **Strategies and Resources**

Addition and Subtraction

(Please note; some of these examples go beyond the level of study required for KS1 and are there to show examples of where our children will progress to in KS2)

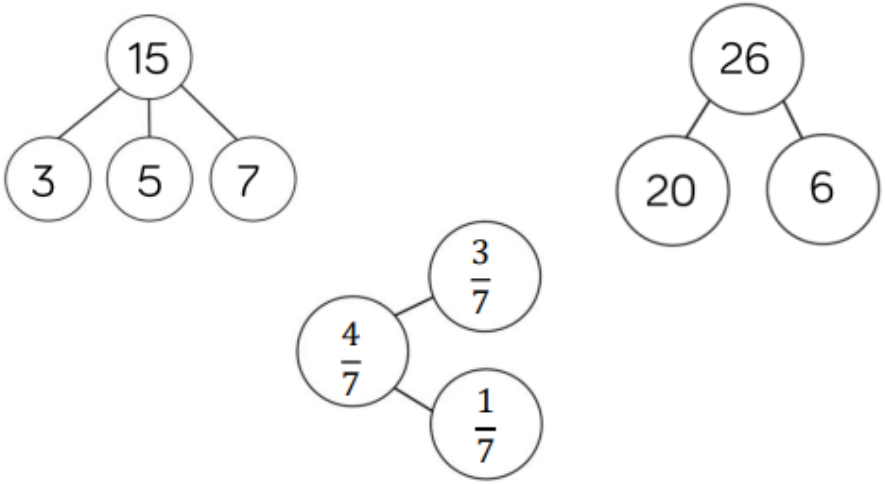
Reception I Year 1 I Year 2

Part-Whole Model



$7 = 4 + 3$ $7 - 3 = 4$

$7 = 3 + 4$ $7 - 4 = 3$



Benefits

This part-whole model supports children in their understanding of aggregation and partitioning. Due to its shape, it can be referred to as a cherry part-whole model.

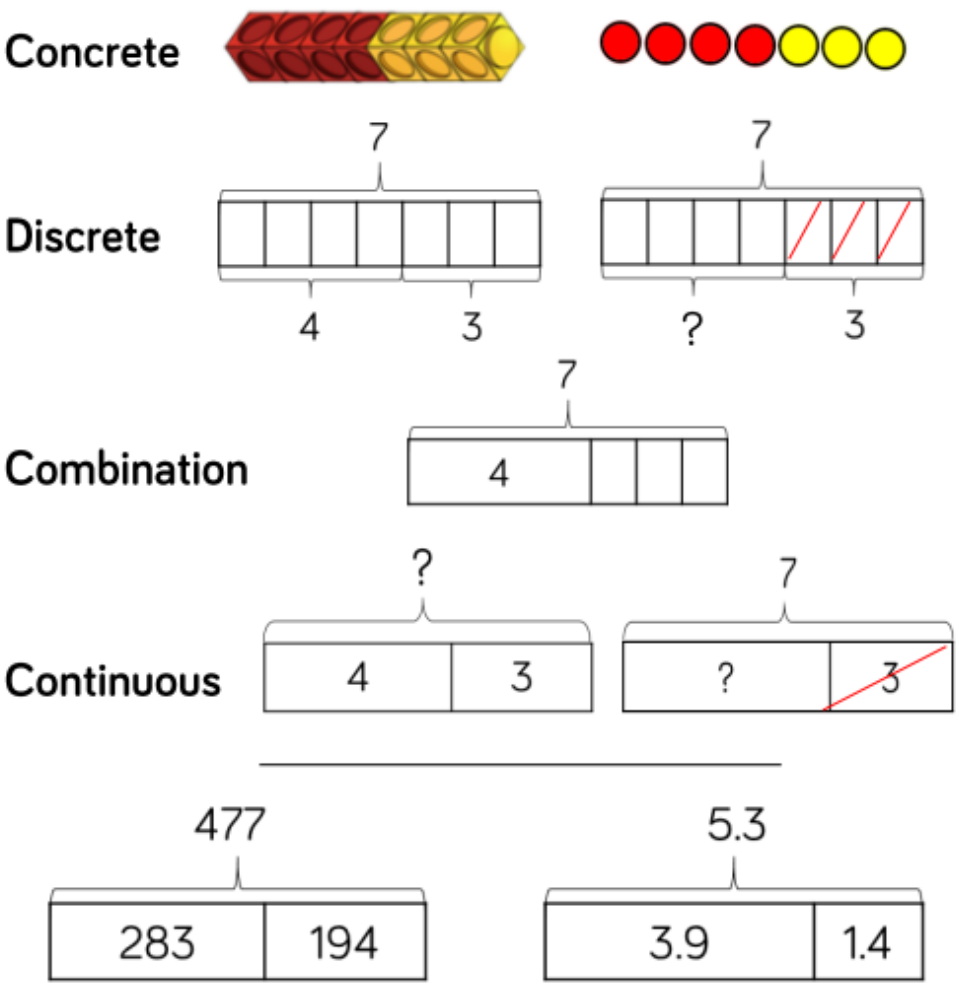
When the parts are complete and the whole is empty, children use aggregation to add the parts together to find the total.

When the whole is complete and at least one of the parts is empty, children use partitioning (a form of subtraction) to find the missing part.

Part-whole models can be used to partition a number into two or more parts, or to help children to partition a number into tens and ones or other place value columns.

In KS2, children can apply their understanding of the part-whole model to add and subtract fractions, decimals and percentages.

Bar Model (single)



Benefits

The single bar model is another type of a part-whole model that can support children in representing calculations to help them unpick the structure.

Cubes and counters can be used in a line as a concrete representation of the bar model.

Discrete bar models are a good starting point with smaller numbers. Each box represents one whole.

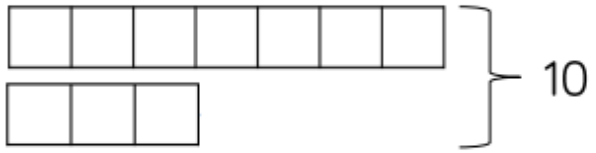
The combination bar model can support children to calculate by counting on from the larger number. It is a good stepping stone towards the continuous bar model.

Continuous bar models are useful for a range of values. Each rectangle represents a number. The question mark indicates the value to be found.

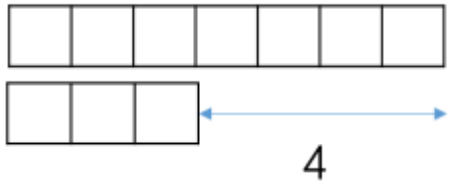
In KS2, children can use bar models to represent larger numbers, decimals and fractions.

Bar Model (multiple)

Discrete

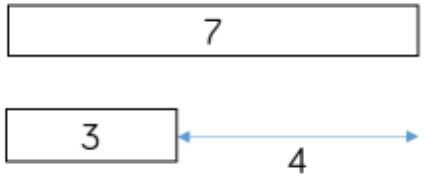


$7 + 3 = 10$

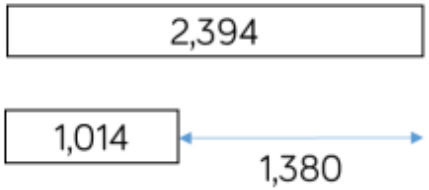


$7 - 3 = 4$

Continuous



$7 - 3 = 4$



$2{,}394 - 1{,}014 = 1{,}380$

Benefits

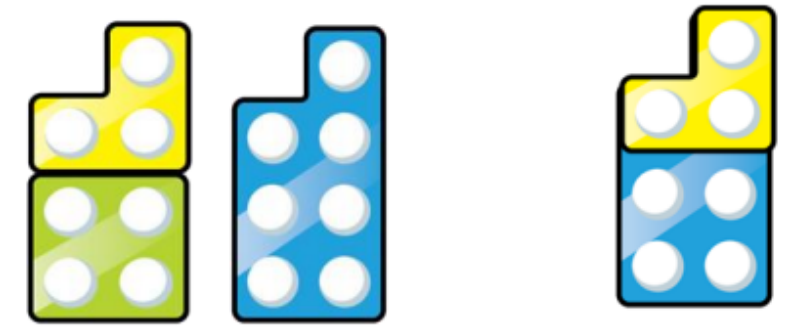
The multiple bar model is a good way to compare quantities whilst still unpicking the structure.

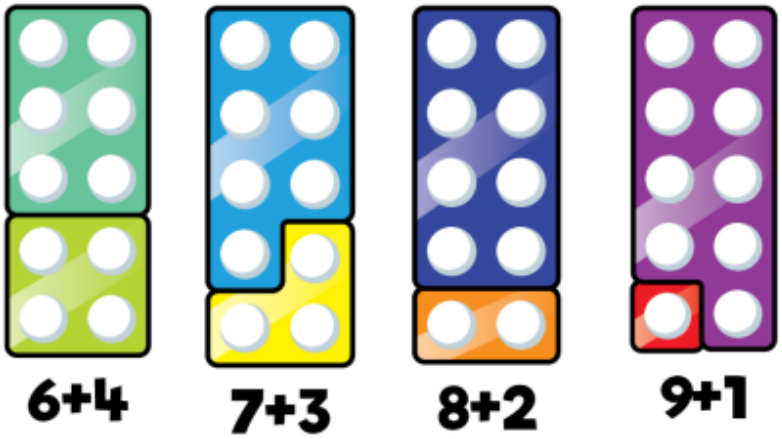
Two or more bars can be drawn, with a bracket labelling the whole positioned on the right hand side of the bars. Smaller numbers can be represented with a discrete bar model whilst continuous bar models are more effective for larger numbers.

Multiple bar models can also be used to represent the difference in subtraction. An arrow can be used to model the difference.

When working with smaller numbers, children can use cubes and a discrete model to find the difference. This supports children to see how counting on can help when finding the difference.

Number Shapes





Benefits

Number shapes can be useful to support children to subitise numbers as well as explore aggregation, partitioning and number bonds.

When adding numbers, children can see how the parts come together making a whole. As children use number shapes more often, they can start to subitise the total due to their familiarity with the shape of each number.

When subtracting numbers, children can start with the whole and then place one of the parts on top of the whole to see what part is missing. Again, children will start to be able to subitise the part that is missing due to their familiarity with the shapes.

Children can also work systematically to find number bonds. As they increase one number by 1, they can see that the other number decreases by 1 to find all the possible number bonds for a number.

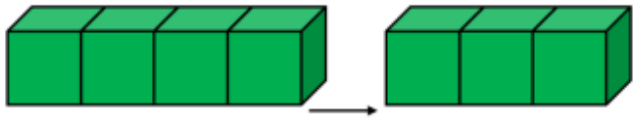
Cubes



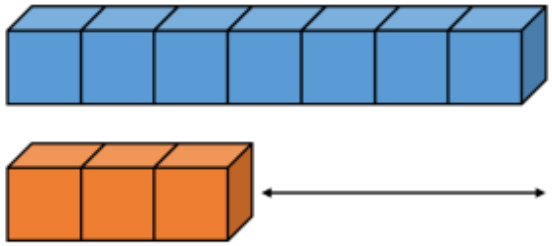
$7 = 4 + 3$



$7 = 3 + 4$



$7 - 3 = 4$



$7 - 3 = 4$

Benefits

Cubes can be useful to support children with the addition and subtraction of one-digit numbers.

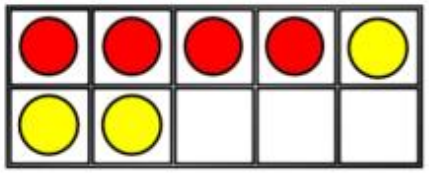
When adding numbers, children can see how the parts come together to make a whole. Children could use two different colours of cubes to represent the numbers before putting them together to create the whole.

When subtracting numbers, children can start with the whole and then remove the number of cubes that they are subtracting in order to find the answer. This model of subtraction is reduction, or take away.

Cubes can also be useful to look at subtraction as difference. Here, both numbers are made and then lined up to find the difference between the numbers.

Cubes are useful when working with smaller numbers but are less efficient with larger numbers as they are difficult to subitise and children may miscount them.

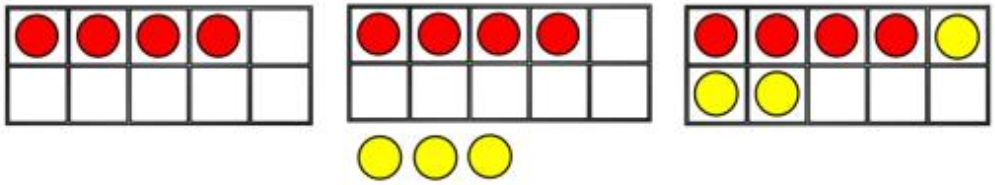
Ten Frames (within 10)



$4 + 3 = 7$
$3 + 4 = 7$
$7 - 3 = 4$
$7 - 4 = 3$

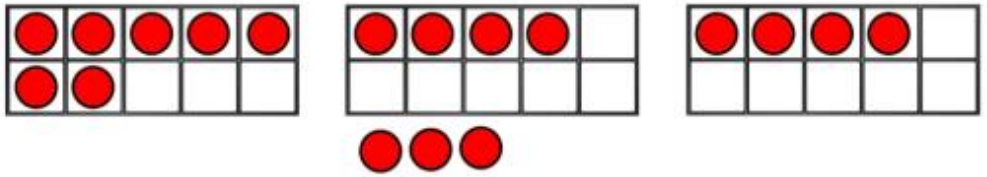
4 is a part.
3 is a part.
7 is the whole.

First Then Now



$4 + 3 = 7$

First Then Now



$7 - 3 = 4$

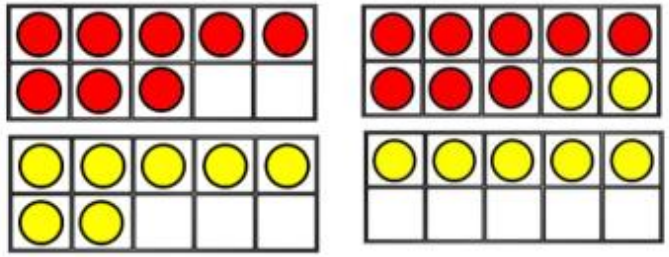
Benefits

When adding and subtracting within 10, the ten frame can support children to understand the different structures of addition and subtraction.

Using the language of parts and wholes represented by objects on the ten frame introduces children to aggregation and partitioning.
Aggregation is a form of addition where parts are combined together to make a whole. Partitioning is a form of subtraction where the whole is split into parts. Using these structures, the ten frame can enable children to find all the number bonds for a number.

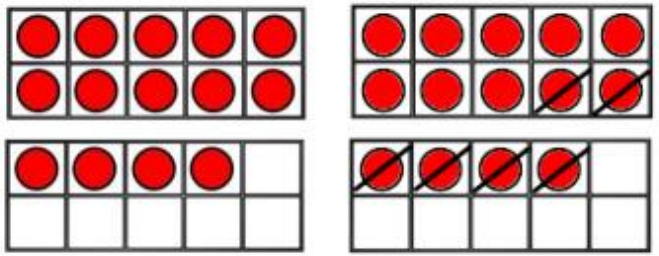
Children can also use ten frames to look at augmentation (increasing a number) and take-away (decreasing a number). This can be introduced through a first, then, now structure which shows the change in the number in the 'then' stage. This can be put into a story structure to help children understand the change e.g. First, there were 7 cars. Then, 3 cars left. Now, there are 4 cars.

Ten Frames (within 20)



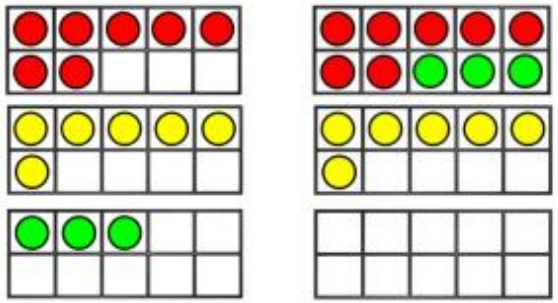
$8 + 7 = 15$

2 5



$14 - 6 = 8$

4 2



$7 + 6 + 3 = 16$

10

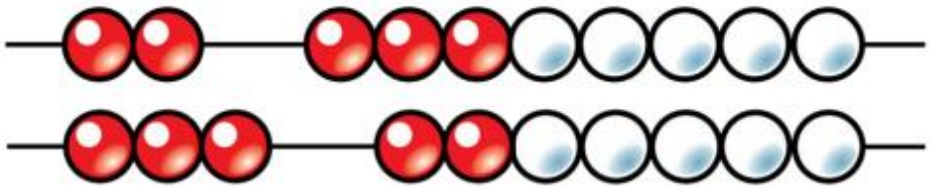
Benefits

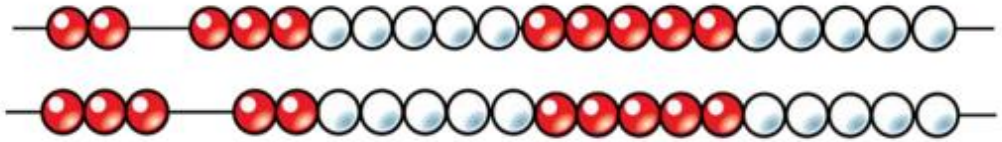
When adding two single digits, children can make each number on separate ten frames before moving part of one number to make 10 on one of the ten frames. This supports children to see how they have partitioned one of the numbers to make 10, and makes links to effective mental methods of addition.

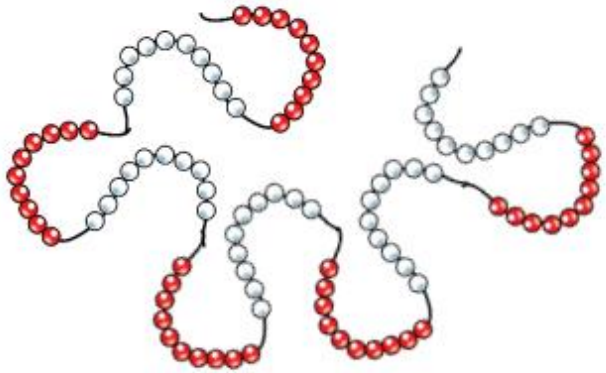
When subtracting a one-digit number from a two-digit number, firstly make the larger number on 2 ten frames. Remove the smaller number, thinking carefully about how you have partitioned the number to make 10, this supports mental methods of subtraction.

When adding three single-digit numbers, children can make each number on 3 separate 10 frames before considering which order to add the numbers in. They may be able to find a number bond to 10 which makes the calculation easier. Once again, the ten frames support the link to effective mental methods of addition as well as the importance of commutativity.

Bead Strings







Benefits

Different sizes of bead strings can support children at different stages of addition and subtraction.

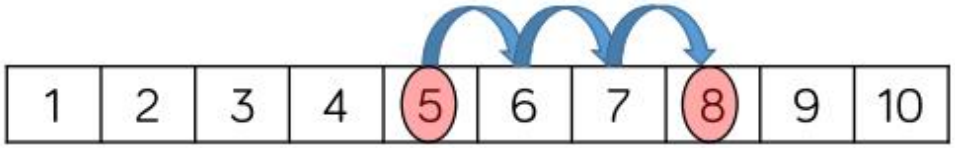
Bead strings to 10 are very effective at helping children to investigate number bonds up to 10.
They can help children to systematically find all the number bonds to 10 by moving one bead at a time to see the different numbers they have partitioned the 10 beads into e.g. $2 + 8 = 10$, move one bead, $3 + 7 = 10$.

Bead strings to 20 work in a similar way but they also group the beads in fives. Children can apply their knowledge of number bonds to 10 and see the links to number bonds to 20.

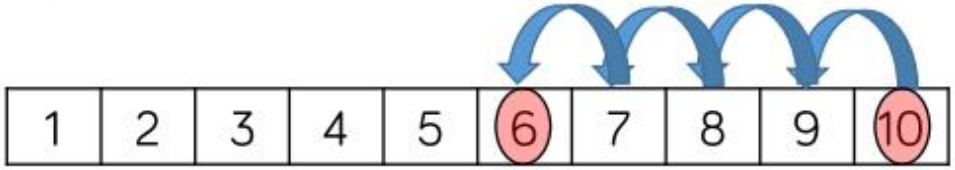
Bead strings to 100 are grouped in tens and can support children in number bonds to 100 as well as helping when adding by making ten. Bead strings can show a link to adding to the next 10 on number lines which supports a mental method of addition.

Number Tracks

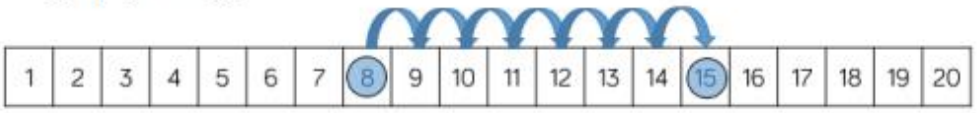
$5 + 3 = 8$



$10 - 4 = 6$



$8 + 7 = 15$



Benefits

Number tracks are useful to support children in their understanding of augmentation and reduction.

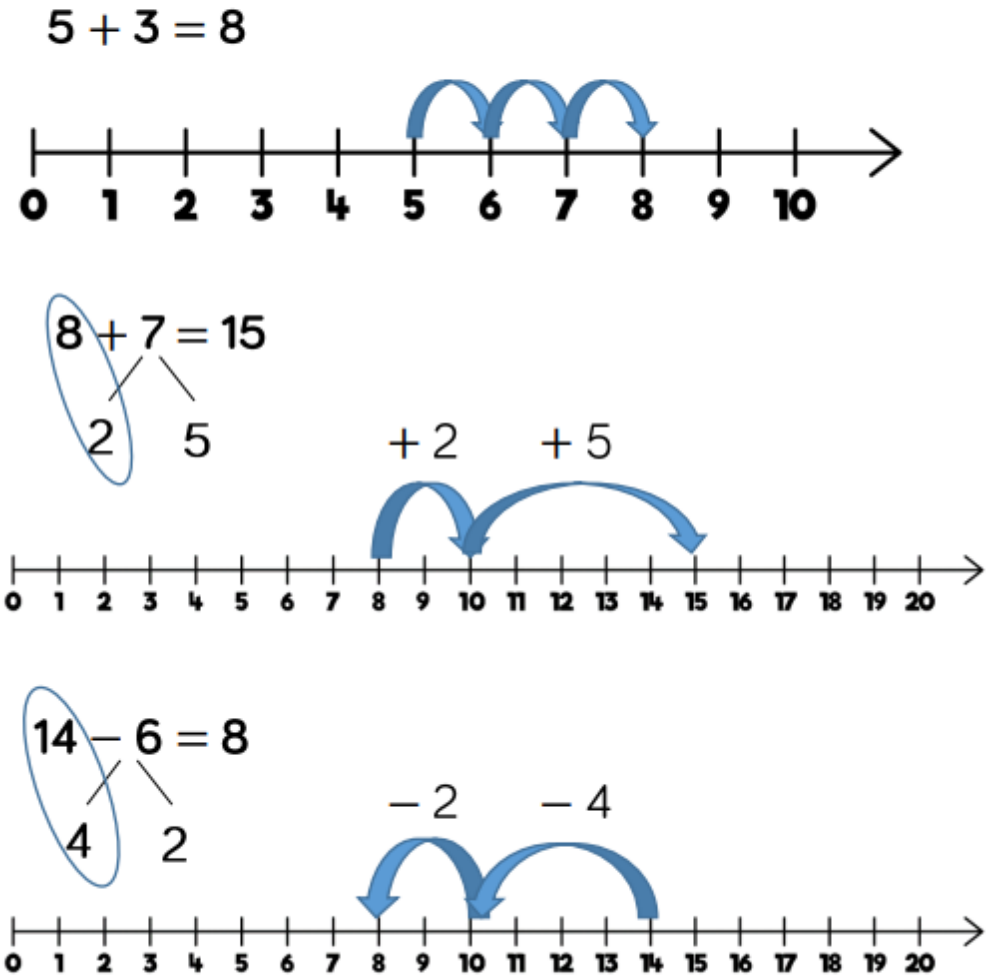
When adding, children count on to find the total of the numbers. On a number track, children can place a counter on the starting number and then count on to find the total.

When subtracting, children count back to find their answer. They start at the minuend and then take away the subtrahend to find the difference between the numbers.

Number tracks can work well alongside ten frames and bead strings which can also model counting on or counting back.

Playing board games can help children to become familiar with the idea of counting on using a number track before they move on to number lines.

Number Lines (labelled)



Benefits

Labelled number lines support children in their understanding of addition and subtraction as augmentation and reduction.

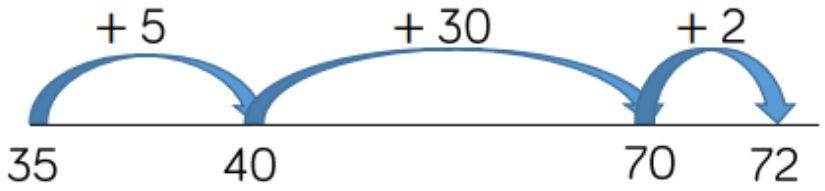
Children can start by counting on or back in ones, up or down the number line. This skill links directly to the use of the number track.

Progressing further, children can add numbers by jumping to the nearest 10 and then jumping to the total. This links to the making 10 method which can also be supported by ten frames. The smaller number is partitioned to support children to make a number bond to 10 and to then add on the remaining part.

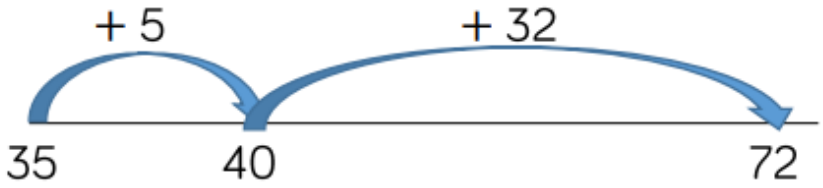
Children can subtract numbers by firstly jumping to the nearest 10. Again, this can be supported by ten frames so children can see how they partition the smaller number into the two separate jumps.

Number Lines (blank)

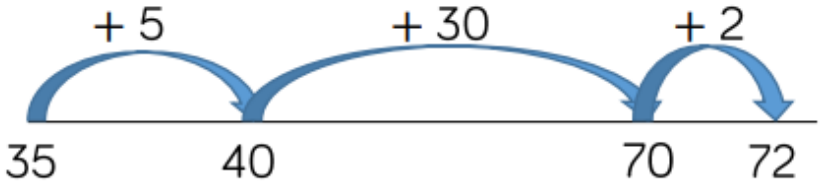
35 + 37 = 72



35 + 37 = 72



72 – 35 = 37



Benefits

Blank number lines provide children with a structure to add and subtract numbers in smaller parts.

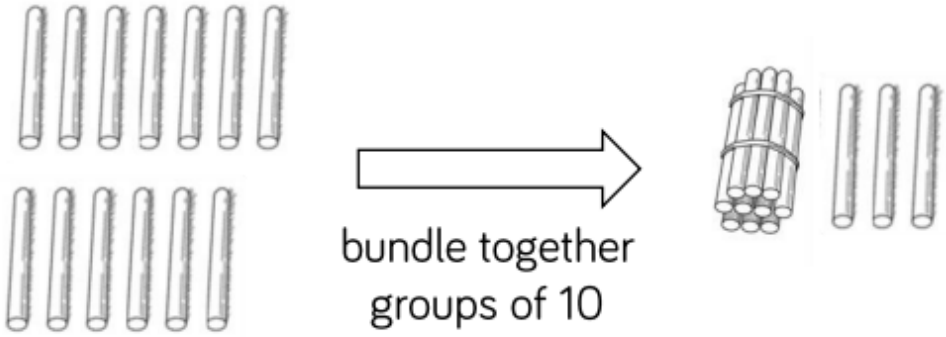
Developing from labelled number lines, children can add by jumping to the nearest 10 and then adding the rest of the number either as a whole or by adding the tens and ones separately.

Children may also count back on a number line to subtract, again by jumping to the nearest 10 and then subtracting the rest of the number.

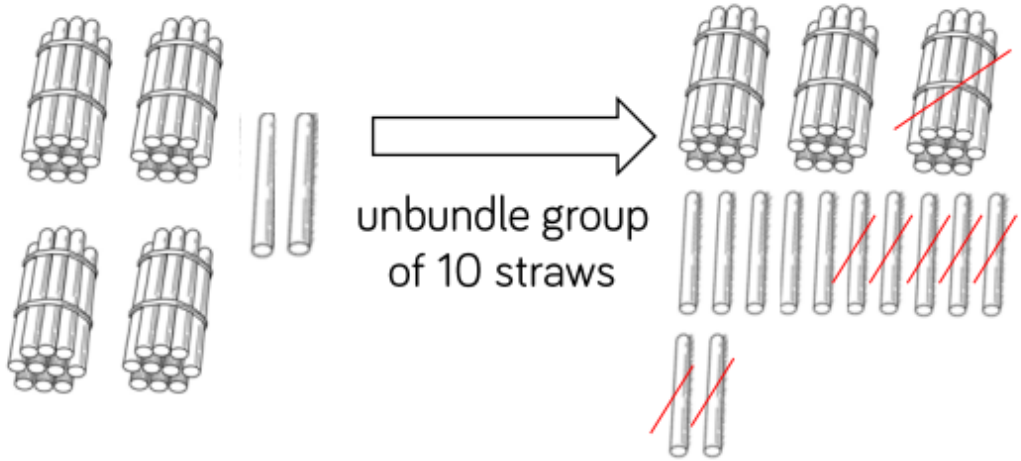
Blank number lines can also be used effectively to help children subtract by finding the difference between numbers. This can be done by starting with the smaller number and then counting on to the larger number. They then add up the parts they have counted on to find the difference between the numbers.

Straws

$7 + 6 = 13$



$42 - 17 = 25$



Benefits

Straws are an effective way to support children in their understanding of exchange when adding and subtracting 2-digit numbers.

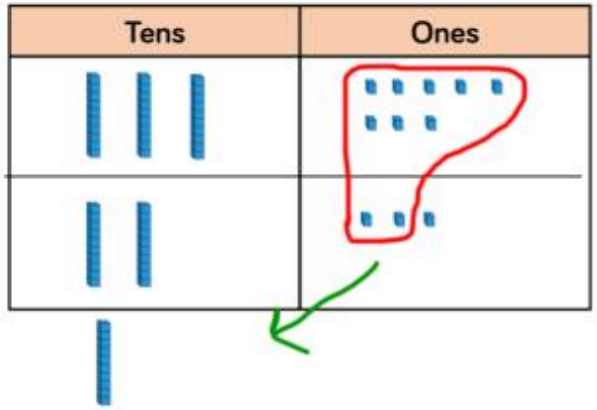
Children can be introduced to the idea of bundling groups of ten when adding smaller numbers and when representing 2-digit numbers. Use elastic bands or other ties to make bundles of ten straws.

When adding numbers, children bundle a group of 10 straws to represent the exchange from 10 ones to 1 ten. They then add the individual straws (ones) and bundles of straws (tens) to find the total.

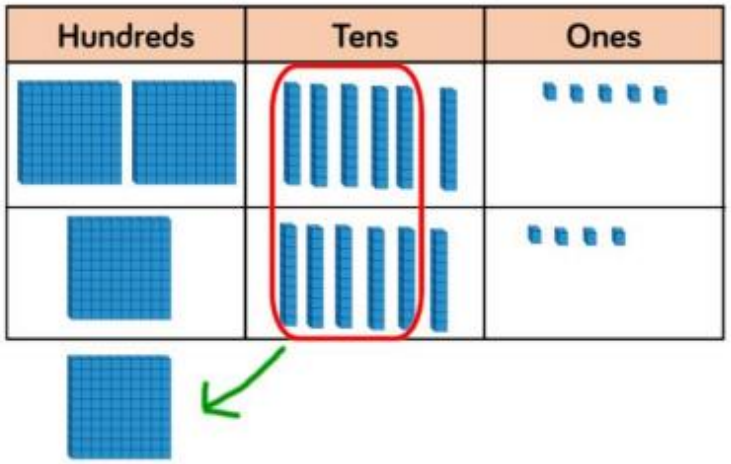
When subtracting numbers, children unbundle a group of 10 straws to represent the exchange from 1 ten to 10 ones.

Straws provide a good stepping stone to adding and subtracting with Base 10/Dienes.

Base 10/Dienes (addition)



$$\begin{array}{r} 38 \\ +\ 23 \\ \hline 61 \\ \hline 1 \end{array}$$



$$\begin{array}{r} 265 \\ +\ 164 \\ \hline 429 \\ \hline 1 \end{array}$$

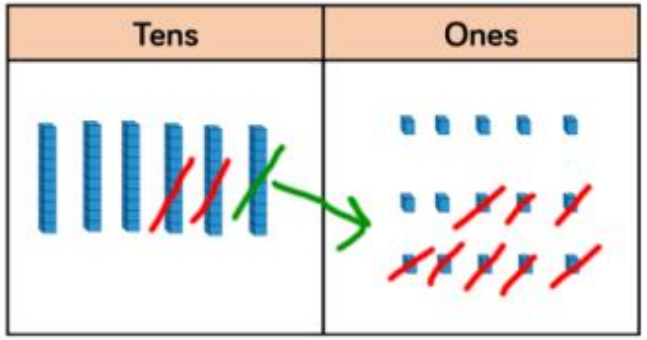
Benefits

Using Base 10 or Dienes is an effective way to support children's understanding of column addition. It is important that children write out their calculations alongside using or drawing Base 10 so they can see the clear links between the written method and the model.

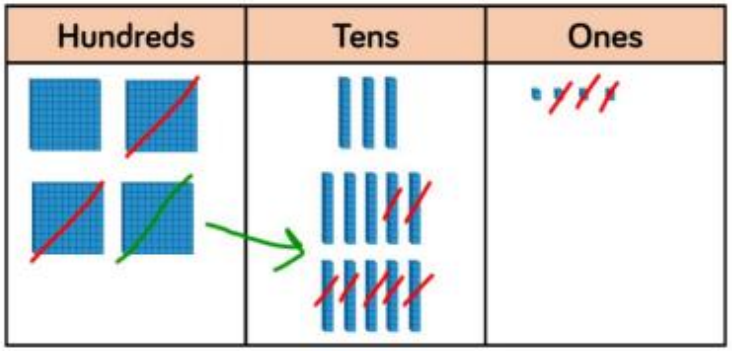
Children should first add without an exchange before moving on to addition with exchange.. The representation becomes less efficient with larger numbers due to the size of Base 10. In this case, place value counters may be the better model to use.

When adding, always start with the smallest place value column. Here are some questions to support children.
How many ones are there altogether?
Can we make an exchange? (Yes or No)
How many do we exchange? (10 ones for 1 ten, show exchanged 10 in tens column by writing 1 in column)
How many ones do we have left? (Write in ones column)
Repeat for each column.

Base 10/Dienes (subtraction)



$$\begin{array}{r} {}^{5}\cancel{6}\,{}^{1}\cancel{5} \\ -\ 28 \\ \hline 37 \end{array}$$



$$\begin{array}{r} {}^{3}\cancel{4}\,{}^{1}\cancel{3}5 \\ -\ 273 \\ \hline 262 \end{array}$$

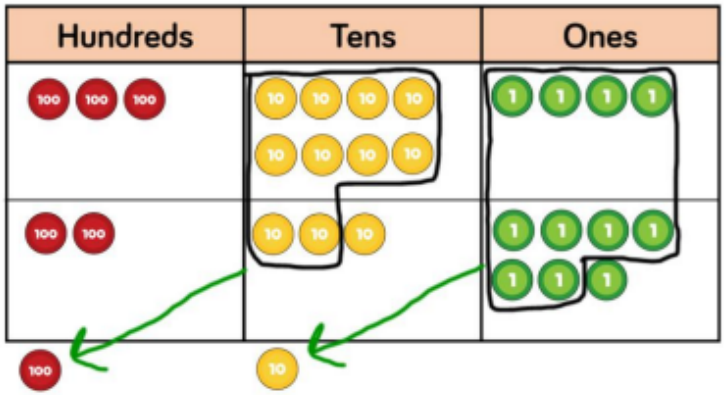
Benefits

Using Base 10 or Dienes is an effective way to support children's understanding of column subtraction. It is important that children write out their calculations alongside using or drawing Base 10 so they can see the clear links between the written method and the model.

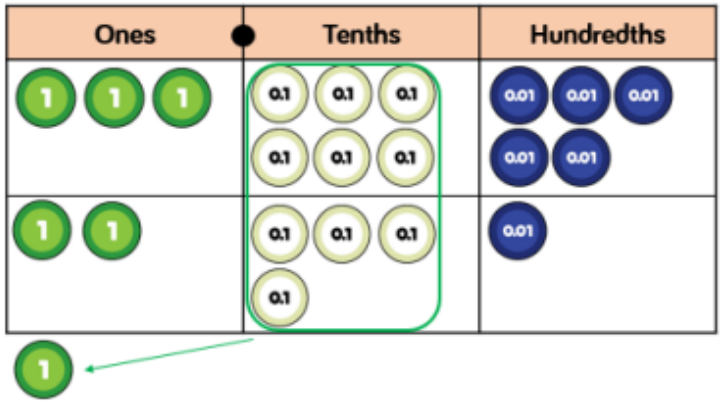
Children should first subtract without an exchange before moving on to subtraction with exchange. When building the model, children should just make the minuend using Base 10, they then subtract the subtrahend. Highlight this difference to addition to avoid errors by making both numbers. Children start with the smallest place value column. When there are not enough ones/tens/hundreds to subtract in a column, children need to move to the column to the left and exchange e.g. exchange 1 ten for 10 ones. They can then subtract efficiently.

This model is efficient with up to 4-digit numbers. Place value counters are more efficient with larger numbers and decimals.

Place Value Counters (addition)



$$\begin{array}{r} 384 \\ +\ 237 \\ \hline 621 \\ \hline 1\ \ 1 \end{array}$$



$$\begin{array}{r} 3.65 \\ +\ 2.41 \\ \hline 6.06 \\ \hline 1 \end{array}$$

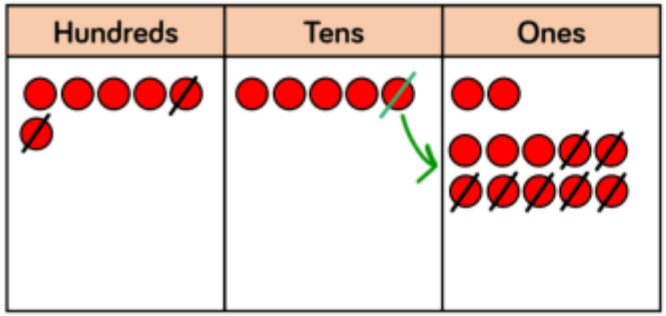
Benefits

Using place value counters is an effective way to support children's understanding of column addition. It is important that children write out their calculations alongside using or drawing counters so they can see the clear links between the written method and the model.

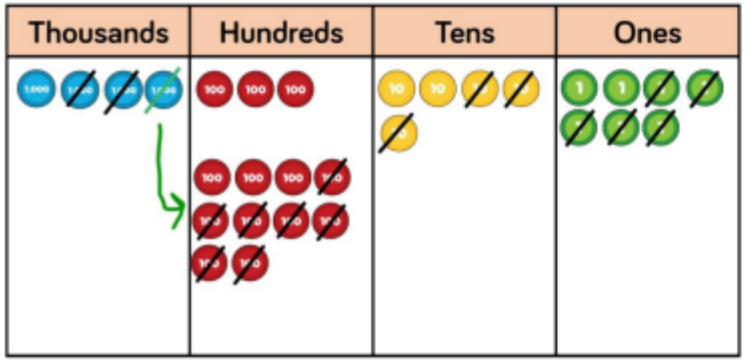
Children should first add without an exchange before moving on to addition with exchange. Different place value counters can be used to represent larger numbers or decimals. If you don't have place value counters, use normal counters on a place value grid to enable children to experience the exchange between columns.

When adding money, children can also use coins to support their understanding. It is important that children consider how the coins link to the written calculation especially when adding decimal amounts.

Place Value Counters (Subtraction)



$$\begin{array}{r} 6\cancel{5}^{4}\cancel{2}^{1} \\ -\ 207 \\ \hline 445 \end{array}$$



$$\begin{array}{r} 3\cancel{4}^{1}357 \\ -\ 2735 \\ \hline 1622 \end{array}$$

Benefits

Using place value counters is an effective way to support children's understanding of column subtraction. It is important that children write out their calculations alongside using or drawing counters so they can see the clear links between the written method and the model.

Children should first subtract without an exchange before moving on to subtraction with exchange. If you don't have place value counters, use normal counters on a place value grid to enable children to experience the exchange between columns.

When building the model, children should just make the minuend using counters, they then subtract the subtrahend. Children start with the smallest place value column. When there are not enough ones/tens/hundreds to subtract in a column, children need to move to the column to the left and exchange e.g. exchange 1 ten for 10 ones. They can then subtract efficiently.

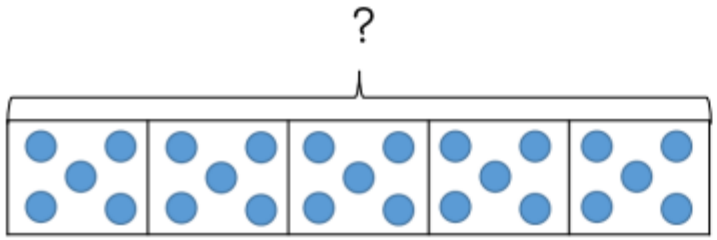
Whole School **Strategies and Resources**

Multiplication and Division

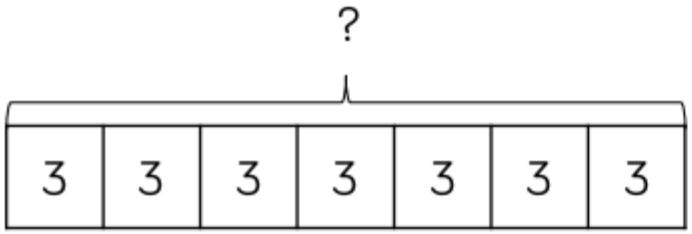
(Please note; some of these examples go beyond the level of study required for KS1 and are there to show examples of where our children will progress to in KS2)

Reception I Year 1 I Year 2

Bar Model

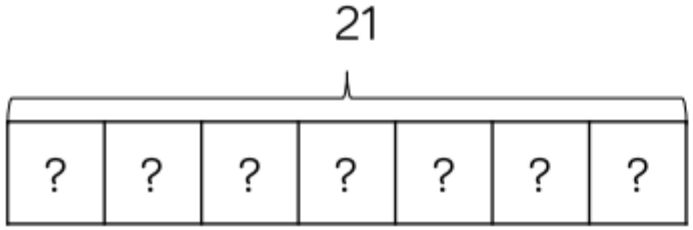


$5 \times 5 = 25$

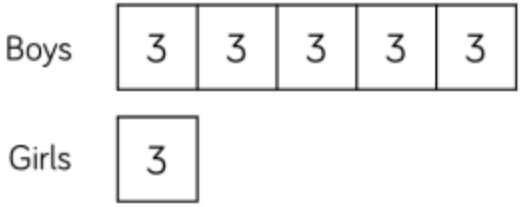


$3 \times 7 = 21$

$7 \times 3 = 21$



$21 \div 7 = 3$



Benefits

Children can use the single bar model to represent multiplication as repeated addition. They could use counters, cubes or dots within the bar model to support calculation before moving on to placing digits into the bar model to represent the multiplication.

Division can be represented by showing the total of the bar model and then dividing the bar model into equal groups.

It is important when solving word problems that the bar model represents the problem.

Sometimes, children may look at scaling problems. In this case, more than one bar model is useful to represent this type of problem, e.g. There are 3 girls in a group. There are 5 times more boys than girls. How many boys are there?
The multiple bar model provides an opportunity to compare the groups.

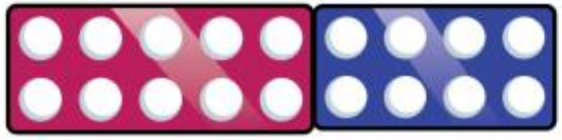
Number Shapes



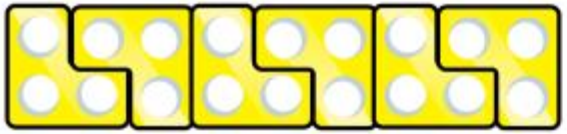
$5 \times 4 = 20$
$4 \times 5 = 20$



$5 \times 4 = 20$
$4 \times 5 = 20$



$18 \div 3 = 6$



Benefits

Number shapes support children's understanding of multiplication as repeated addition.

Children can build multiplications in a row using the number shapes. When using odd numbers, encourage children to interlock the shapes so there are no gaps in the row. They can then use the tens number shapes along with other necessary shapes over the top of the row to check the total. Using the number shapes in multiplication can support children in discovering patterns of multiplication e.g. odd × odd = even, odd × even = odd, even × even = even.

When dividing, number shapes support children's understanding of division as grouping. Children make the number they are dividing and then place the number shape they are dividing by over the top of the number to find how many groups of the number there are altogether e.g. There are 6 groups of 3 in 18.

Bead Strings



$5 \times 3 = 15$
$3 \times 5 = 15$

$15 \div 3 = 5$



$5 \times 3 = 15$
$3 \times 5 = 15$

$15 \div 5 = 3$



$4 \times 5 = 20$
$5 \times 4 = 20$

$20 \div 4 = 5$

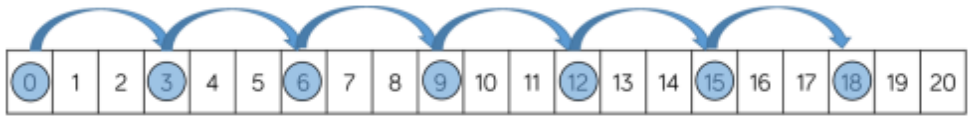
Benefits

Bead strings to 100 can support children in their understanding of multiplication as repeated addition. Children can build the multiplication using the beads. The colour of beads supports children in seeing how many groups of 10 they have, to calculate the total more efficiently.
Encourage children to count in multiples as they build the number e.g. 4, 8, 12, 16, 20.

Children can also use the bead string to count forwards and backwards in multiples, moving the beads as they count.

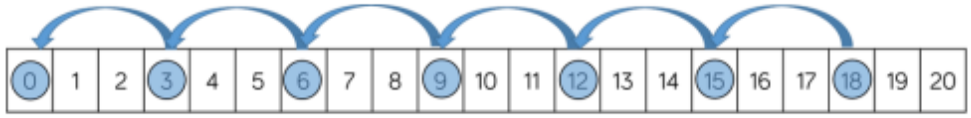
When dividing, children build the number they are dividing and then group the beads into the number they are dividing by e.g. 20 divided by 4 – Make 20 and then group the beads into groups of four. Count how many groups you have made to find the answer.

Number Tracks





$6 \times 3 = 18$
$3 \times 6 = 18$



$18 \div 3 = 6$

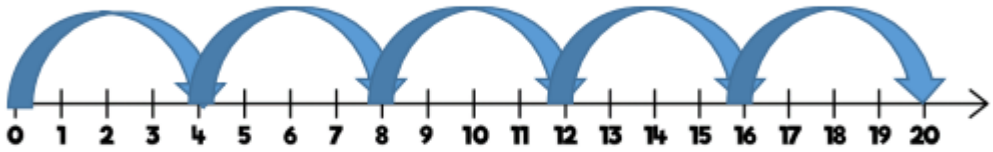
Benefits

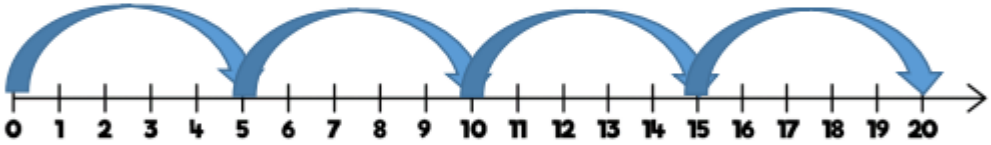
Number tracks are useful to support children to count in multiples, forwards and backwards. Moving counters or cubes along the number track can support children to keep track of their counting. Translucent counters help children to see the number they have landed on whilst counting.

When multiplying, children place their counter on 0 to start and then count on to find the product of the numbers.
When dividing, children place their counter on the number they are dividing and the count back in jumps of the number they are dividing by until they reach 0. Children record how many jumps they have made to find the answer to the division.

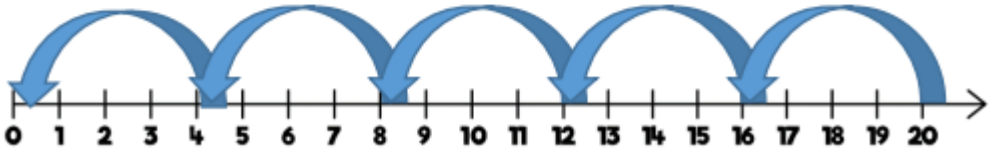
Number tracks can be useful with smaller multiples but when reaching larger numbers they can become less efficient.

Number Lines (labelled)





$4 \times 5 = 20$
$5 \times 4 = 20$



$20 \div 4 = 5$

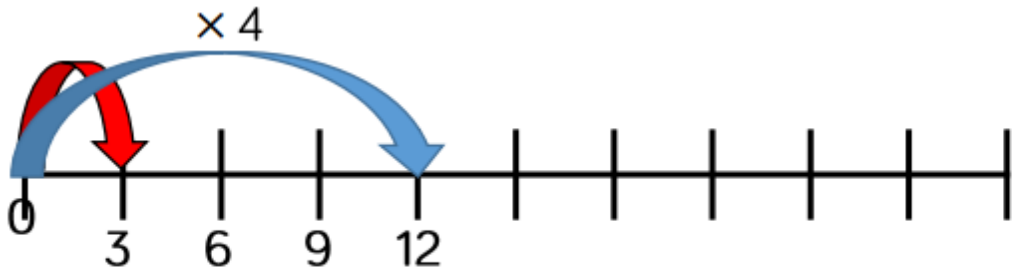
Benefits

Labelled number lines are useful to support children to count in multiples, forwards and backwards as well as calculating single-digit multiplications.

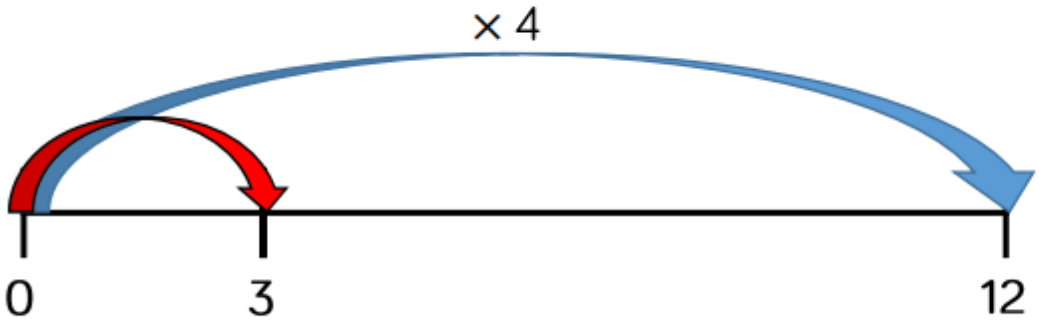
When multiplying, children start at 0 and then count on to find the product of the numbers.
When dividing, start at the number they are dividing and the count back in jumps of the number they are dividing by until they reach 0.
Children record how many jumps they have made to find the answer to the division.

Labelled number lines can be useful with smaller multiples, however they become inefficient as numbers become larger due to the required size of the number line.

Number Lines (blank)



A red car travels 3 miles.
A blue car 4 times further.
How far does the blue car travel?



A blue car travels 12 miles.
A red car 4 times less.
How far does the red car travel?

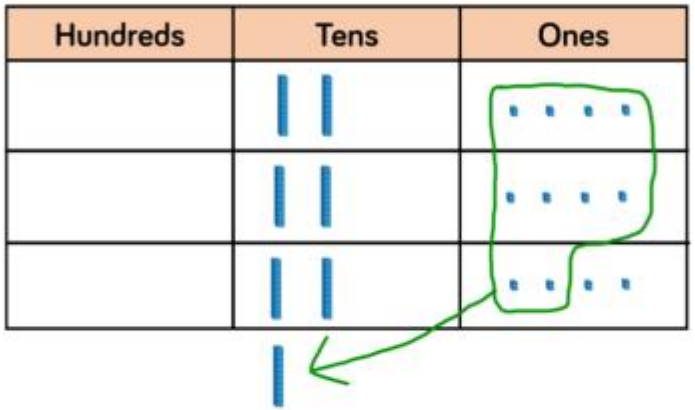
Benefits

Children can use blank number lines to represent scaling as multiplication or division.

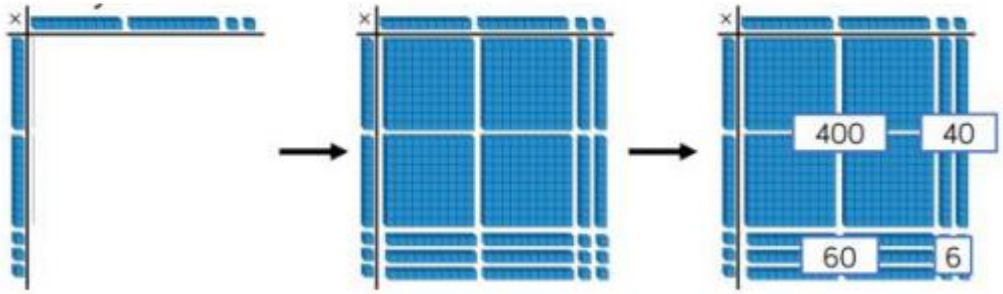
Blank number lines with intervals can support children to represent scaling accurately. Children can label intervals with multiples to calculate scaling problems.

Blank number lines without intervals can also be used for children to represent scaling.

Base 10/Dienes (multiplication)



$$\begin{array}{r} 24 \\ \times \quad 3 \\ \hline 72 \\ \hline 1 \end{array}$$



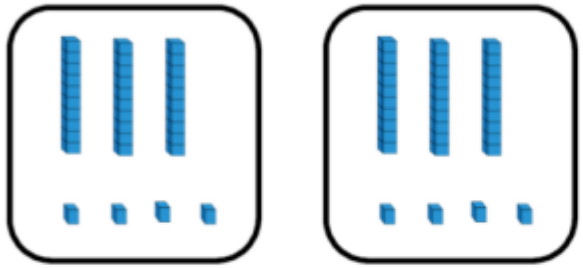
Benefits

Using Base 10 or Dienes is an effective way to support children's understanding of column multiplication. It is important that children write out their calculation alongside the equipment so they can see how the concrete and written representations match.

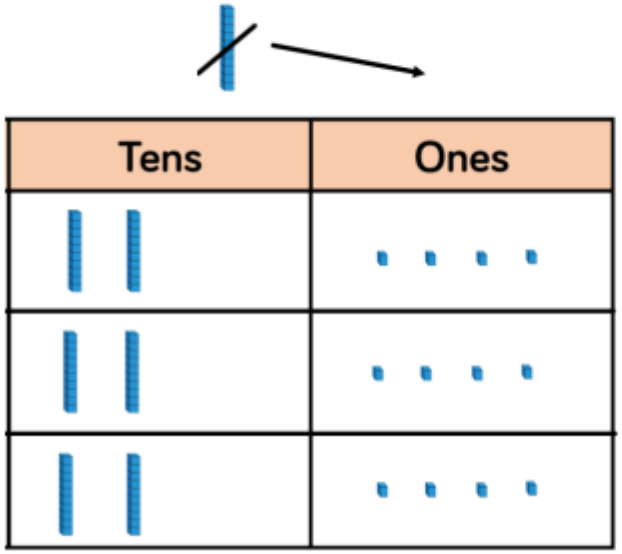
As numbers become larger in multiplication or the amounts of groups becomes higher, Base 10 / Dienes becomes less efficient due to the amount of equipment and number of exchanges needed.

Base 10 also supports the area model of multiplication well. Children use the equipment to build the number in a rectangular shape which they then find the area of by calculating the total value of the pieces This area model can be linked to the grid method or the formal column method of multiplying 2-digits by 2-digits.

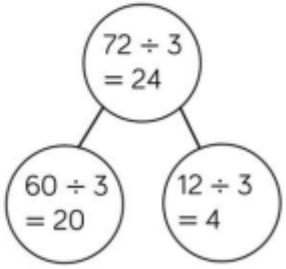
Base 10/Dienes (division)



$68 \div 2 = 34$



$72 \div 3 = 24$



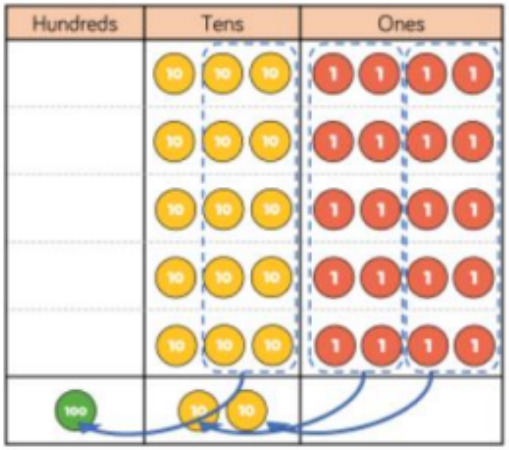
Benefits

Using Base 10 or Dienes is an effective way to support children's understanding of division.

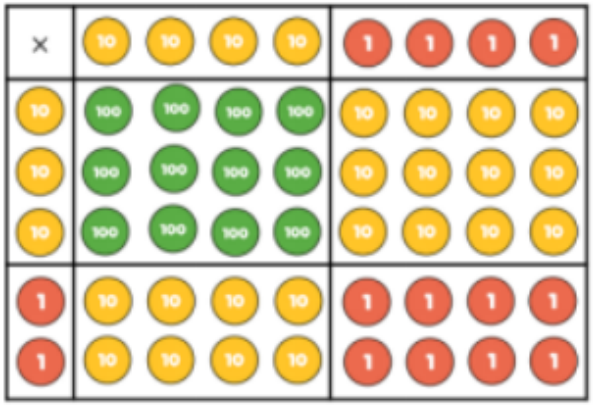
When numbers become larger, it can be an effective way to move children from representing numbers as ones towards representing them as tens and ones in order to divide. Children can then share the Base 10/ Dienes between different groups e.g. by drawing circles or by rows on a place value grid.

When they are sharing, children start with the larger place value and work from left to right. If there are any left in a column, they exchange e.g. one ten for ten ones. When recording, encourage children to use the part-whole model so they can consider how the number has been partitioned in order to divide. This will support them with mental methods.

Place Value Counters (multiplication)



$$\begin{array}{r} 34 \\ \times\ 5 \\ \hline 170 \\ \hline 1\ 2 \end{array}$$



$$\begin{array}{r} 44 \\ \times\ 32 \\ \hline 8 \\ 80 \\ 120 \\ +\ 1200 \\ \hline 1408 \\ \hline 1 \end{array}$$

Benefits

Using place value counters is an effective way to support children's understanding of column multiplication. It is important that children write out their calculation alongside the equipment so they can see how the concrete and written match.

As numbers become larger in multiplication or the amounts of groups becomes higher, Base 10 / Dienes becomes less efficient due to the amount of equipment and number of exchanges needed The counters should be used to support the understanding of the written method rather than support the arithmetic.

Place value counters also support the area model of multiplication well. Children can see how to multiply 2-digit numbers by 2-digit numbers.

Suggested **Representations and Models** KS1

(See separate teacher guidance for EYFS)

Year 1 | Year 2

Addition

Skill	Year	Representations and models	
Add two 1-digit numbers to 10	1	Part-whole model Bar model Number shapes	Ten frames (within 10) Bead strings (10) Number tracks
Add 1 and 2-digit numbers to 20	1	Part-whole model Bar model Number shapes Ten frames (within 20)	Bead strings (20) Number tracks Number lines (labelled) Straws
Add three 1-digit numbers	2	Part-whole model Bar model	Ten frames (within 20) Number shapes
Add 1 and 2-digit numbers to 100	2	Part-whole model Bar model Number lines (labelled)	Number lines (blank) Straws Hundred square

Add two 2-digit numbers	2	Part-whole model Bar model Number lines (blank) Straws	Base 10 Place value counters Column addition

Subtraction

Skill	Year	Representations and models	
Subtract two 1-digit numbers to 10	1	Part-whole model Bar model Number shapes	Ten frames (within 10) Bead strings (10) Number tracks
Subtract 1 and 2-digit numbers to 20	1	Part-whole model Bar model Number shapes Ten frames (within 20)	Bead string (20) Number tracks Number lines (labelled) Straws
Subtract 1 and 2-digit numbers to 100	2	Part-whole model Bar model Number lines (labelled)	Number lines (blank) Straws Hundred square
Subtract two 2-digit numbers	2	Part-whole model Bar model Number lines (blank) Straws	Base 10 Place value counters Column addition

Multiplication

Skill	Year	Representations and models	
Recall and use multiplication and division facts for the 2-times table	2	Bar model Number shapes Counters Money	Ten frames Bead strings Number lines Everyday objects
Recall and use multiplication and division facts for the 5-times table	2	Bar model Number shapes Counters Money	Ten frames Bead strings Number lines Everyday objects
Recall and use multiplication and division facts for the 10-times table	2	Hundred square Number shapes Counters Money	Ten frames Bead strings Number lines Base 10

Skill	Year	Representations and models	
Solve one-step problems with multiplication	1/2	Bar model Number shapes Counters	Ten frames Bead strings Number lines

Division

Skill	Year	Representations and models	
Solve one-step problems with division (sharing)	1/2	Bar model Real life objects	Arrays Counters
Solve one-step problems with division (grouping)	1/2	Real life objects Number shapes Bead strings Ten frames	Number lines Arrays Counters

Progression in Calculations

Reception | Year 1 | Year 2

Addition

Reception (Please also see separate White Rose teacher guidance for EYFS)
Children need to have a secure knowledge of number in order to begin addition. Children are then introduced to the concept of addition through practical games and activities. Children act out addition sums to physically add two groups of objects together and use arm gestures to represent the signs + and =.
This is reinforced by opportunities provided in the outdoor area for the children to use addition e.g. adding together groups of building blocks, twigs etc. Children build on their previous knowledge of 'more' by learning that adding two groups of objects together gives them a larger number (more objects). Adults model addition vocabulary supported by age appropriate definition.



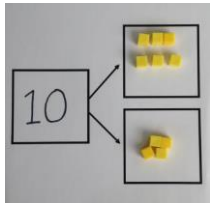
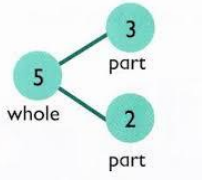
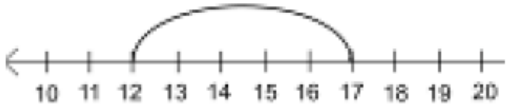
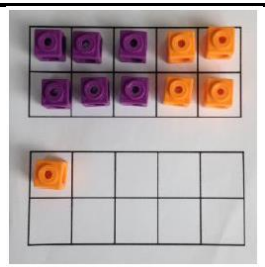
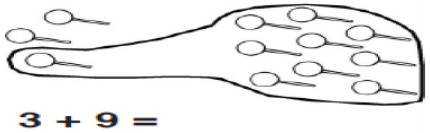
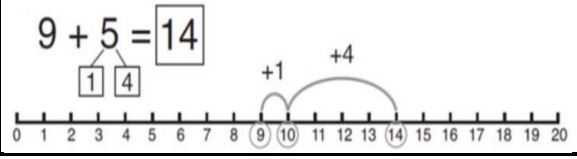






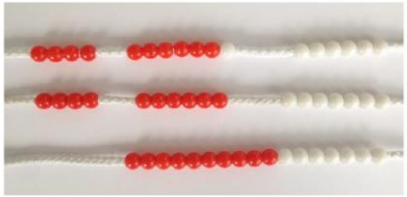


Addition

Strategies	Concrete	Pictorial	Abstract
Combining 2 groups to make a whole Counting sets of objects, combining then recounting using a 1:1 correspondence.	  	  3+2=5 	4 + 3 = 7 I have 4 apples and I pick 3 more, how many have I got altogether?
Counting on Pupils should be taught to start at the biggest number and count on, using this as an opportunity to Introduce the commutativity of addition.	 		5 + 12 = 17 Reinforce starting from the largest number. 7 + 3 = 10 Encourage recall of known number facts to develop fluency in mental calculations. .
Regrouping to make 10 To move on from the previous strategy, rather than counting on, children use their number bond knowledge and bridge to 10 e.g. if 4 + 6 = 10, so 4 + 7 must equal 11.	 6+5=11 Start with the bigger number and use the smaller number to make 10.	 	7p+4p=11p I have 7p, how much more do I need to make 10p. How much more do I add on now? If you know 10=7+3, what else do you know?

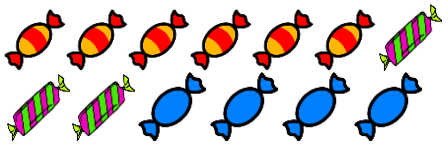
Adding 3 single digits

Use this method as an opportunity to develop fluent recall and application of known number facts including bonds and doubles.

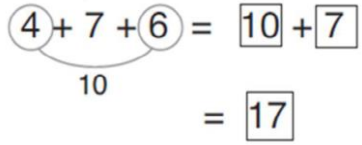




Following on from making 10, make 10 with 2 of the digits (if possible) then add on the third digit.



6 + 3 + 4 = 13

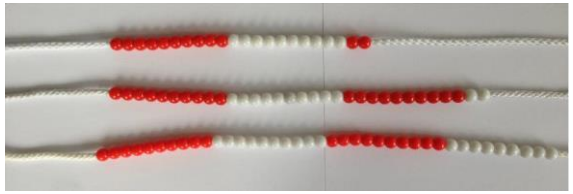


Partitioning to add

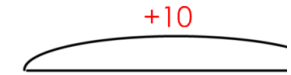
The emphasis for this strategy in KS1 is to develop a deep understanding of place value.

In year 2, recording addition and subtraction informally in columns supports place value and prepares for formal written methods with larger numbers later on in KS2. Ensure that when moving into any form of column the ones are calculated first.



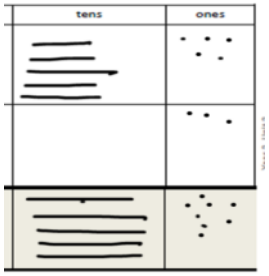


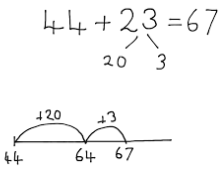
22+17=39

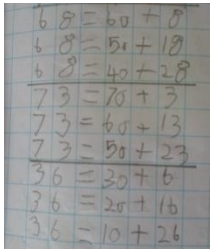


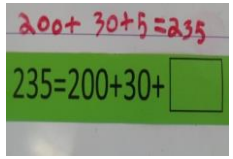
22+17=39

Begin with jumps of tens and ones then progress to jumps of all the tens and all the ones as children become more fluent.









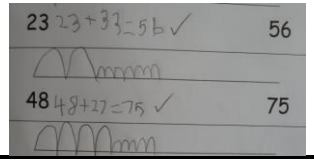
5

40 + 8

60 + 13 = 73

25+48=73

Informal recording in columns



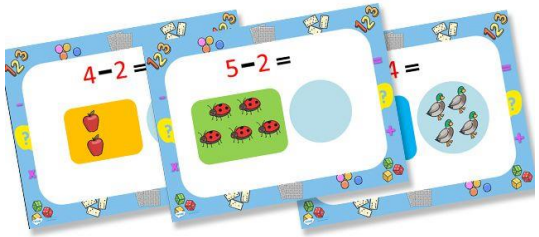
Counting on in tens and ones to solve missing number problems

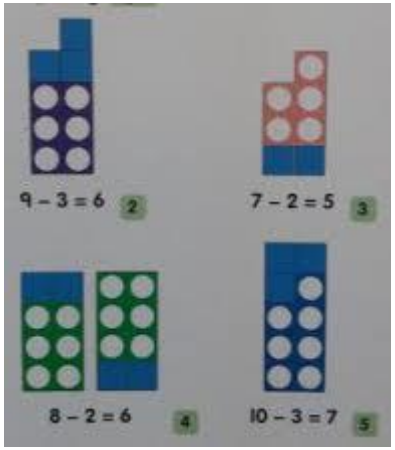
Subtraction

Reception (Please also see separate White Rose teacher guidance for EYFS)

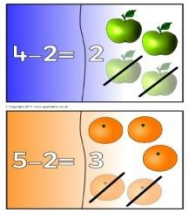
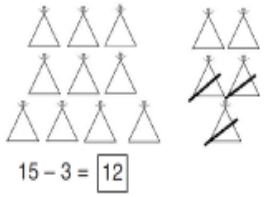
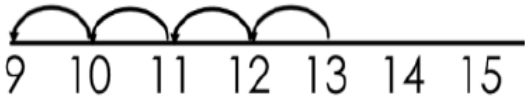
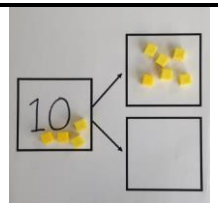
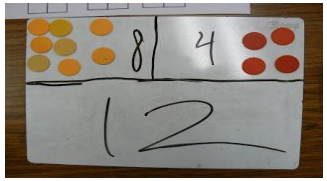
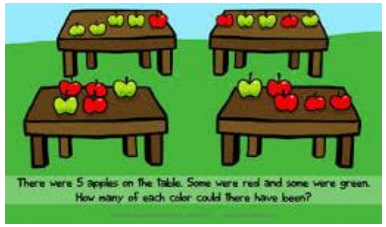
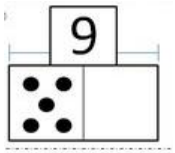
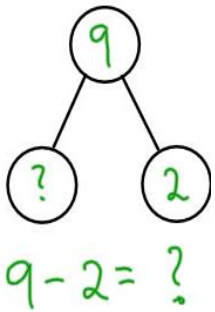
Children need to have a secure knowledge of number in order to begin subtraction. Children are then introduced to the concept of subtraction through practical games and activities. Children act out subtractions to physically subtract a number of objects from a group. This is reinforced by opportunities provided in the outdoor area for the children to count e.g. counting building blocks, twigs etc. Children build on their previous knowledge of 'fewer' by learning that subtracting means taking away a certain number of objects from a group (leaving them with fewer objects). Adults model subtraction vocabulary supported by age appropriate definition.

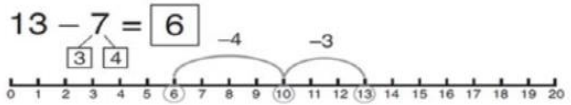
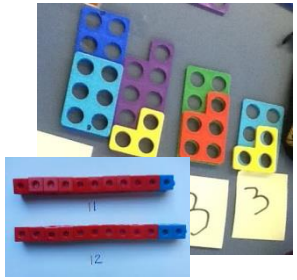
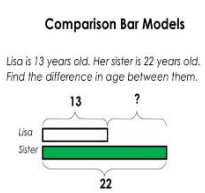
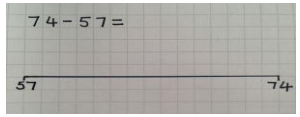
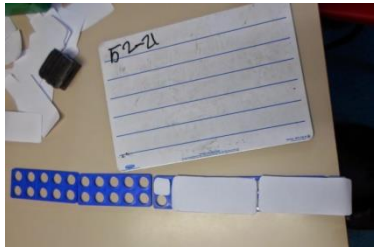
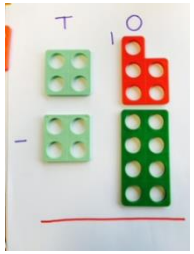
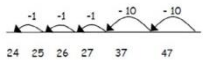






Subtraction

Strategies	Concrete	Pictorial	Abstract
Taking away ones Use physical objects to demonstrate how something can be taken away. Move on to crossing out drawn representations. This can be developed by representing a group of ten with a line and ones with dots.	    23 - 1 = 12	 	18 -3= 15 8 – 2 = 6 There are 15 cakes in the shop. One cake is eaten; how many are left?
Counting back As with the previous, this strategy is used for subtracting small numbers from larger numbers and provides a good foundation for the concept of subtraction	 Use counters or objects and move away from the group as they are counted.	 13-4=9	Hold 17 in your head, count back 5. What number are you at? Use your fingers to help.
Part, part, whole model This model develops knowledge of the inverse relationship between addition and subtraction and is used to find the answer to missing number problems.	 If 10 is the whole and 6 is one of the parts. What is the other part? 	  Children should be taught the skills to approach problems in a systematic way.	 I made 9 buns for the cake sale and I only had 2 left at the end. How many did I sell? 

Make 10 Use this strategy to subtract a single digit number from a 2-digit number. Pupils identify how many need to be taken away to make ten first. Then they take away the rest to reach the answer.	 14-5=9 Make 14 on the ten frame or with different coloured cubes to represent the ten and the ones. Take away the four first to make 10 and then takeaway one more so you have taken away 5. You are left with the answer of 9.		15 – 7= How many do we subtract to reach the next 10? How many do we have left to subtract?
Find the difference Pupils should develop a good understanding of the meaning of 'difference', exploring the inverse relationship with addition by counting back and counting up.	 Practical resources to visualise 'difference' and recognise inverse relationships e.g. 12-1=11 and 11+1=12	  Use a blank number line to count back and count up between 2 numbers.	Lexie has 5 more strawberries than Jake. Jake has 11 cherries. How many does Lexie have? Look at the graph. Fewer children have green eyes than blue. What is the difference?
Partitioning to subtract The emphasis for this strategy in KS1 is to develop a deep understanding of place value. When not regrouping, partitioning should be developed as a mental strategy rather than formal recording in columns.	  	34-13=21 Subtract the ones first and then the tens to prepare for formal methods later  47 - 23 = 24 Partition the second number and subtract it in tens and units, as below:  Move towards more efficient jumps block, as below: 	There are 35 children in the class and 12 are boys. How many are girls? 35-12=

Multiplication

Reception (Please also see separate White Rose teacher guidance for EYFS)
By the end of Reception, children are expected to understand the concept of doubling and to be able to double a number up to 10. Before doubling can be introduced, children need to have a secure knowledge of counting, number facts and addition in order to double. Children are then introduced to the concept of doubling through practical games and activities, including the use of the outdoor areas. Children act out 'doubling' by physically add two equal groups together to find out the 'doubles' answer.

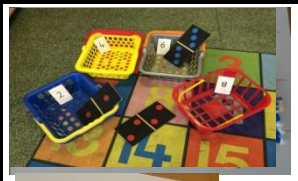
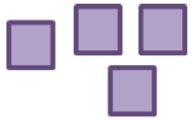
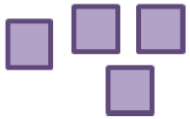
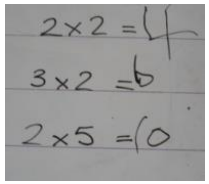
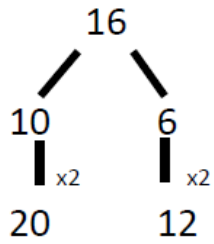
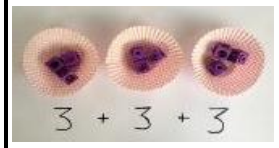
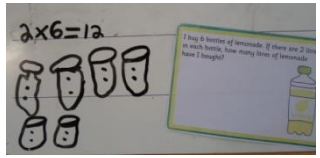
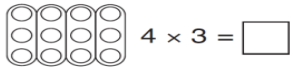


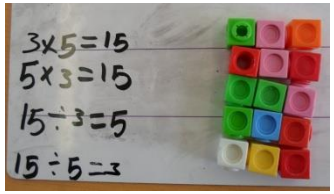
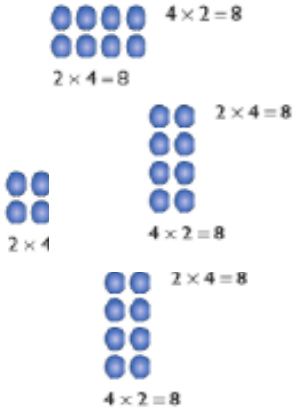






Multiplication

Strategies	Concrete	Pictorial	Abstract
Doubling Pupils should be encouraged to develop fluent mental recall of doubles and relate to the 2 x table.	 	Double 4 is 8  	  If I can see 10 wheels, how many bikes are there?
Counting in multiples Pupils can use their fingers as they are skip counting, to develop an understanding of 'groups of'. Children should become increasingly fluent as they practise.	  	Use a number line or pictures to continue support in counting in multiples.   0 5 10 15 20 25 30	Count in multiples of a number aloud. Write sequences with multiples of numbers and work out missing numbers in sequences both forward and backward. If I count in 2's will I get to the number 58?
Repeated addition Pupils should apply skip counting to help find the totals of repeated additions.	 5+5+5=15  3+3+3=9	 Pupils begin to recognise the relationship between repeated addition and multiplication.   4 × 3 = ☐	Write addition or multiplication sentences to describe objects and pictures.  2+2+2+2+2=10 2x5=10

Arrays showing commutative multiplication Pupils should understand that an array can represent different equations and that, as multiplication is commutative, the order of the multiplication does not affect the answer.	 	Draw arrays in different rotations to find **commutative** multiplication sentences.  	3 children go to the park to hunt for plne cones. They find 5 each, how many do they find altogether? 5 children eat the same number of cakes at a party. 15 cakes are eaten in total, how many did they each eat? 5+5+5=15 3x5=15 3+3+3+3+3=15 5x3=15

Division

Reception (Please also see separate White Rose teacher guidance for EYFS)
By the end of Reception, children are expected to understand the concept of halving and sharing. Before this can be introduced, children need to have a secure knowledge of counting backwards, number facts and subtraction in order to halve and share. Children are then introduced to the concept of halving and sharing through practical games and activities. They act out 'halving and sharing' through activities such as sharing food for their Teddy Bear's Picnic, sharing resources equally to play a game. This is reinforced by opportunities provided in the outdoor area for the children to halve and share out objects such as building blocks, twigs etc.

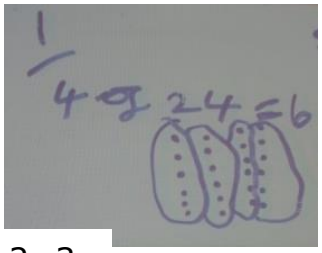
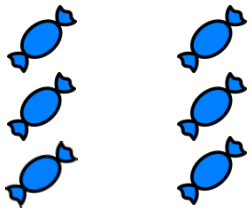
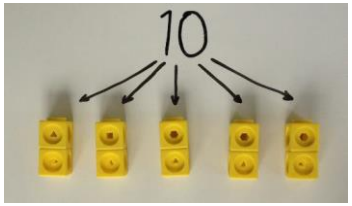
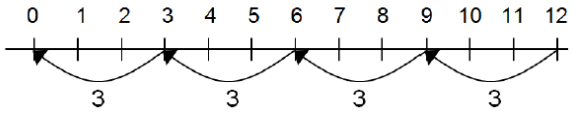
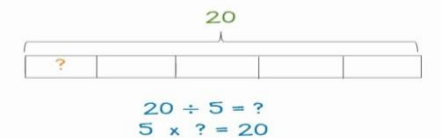
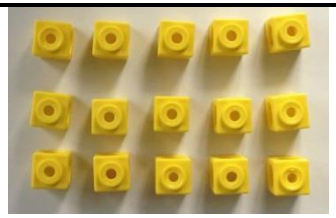
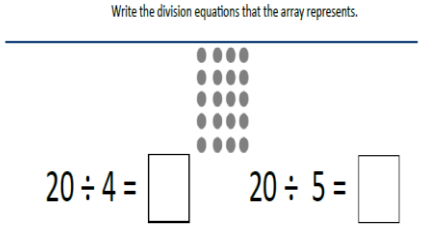






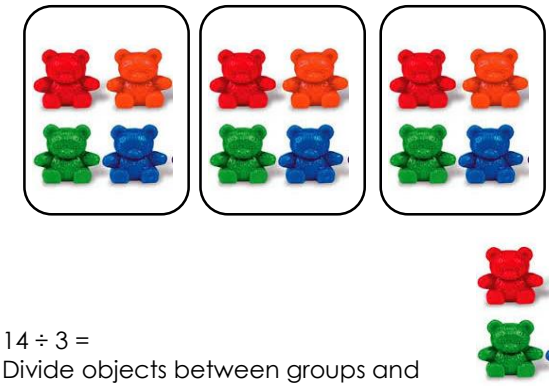


Division

Strategies	Concrete	Pictorial	Abstract
Sharing Here, division is shown as sharing. E.g. If we have 24 squares of chocolate and we share them between 3 people, each person will have 8 squares each.	 	  6÷2=3	Share 9 buns between three people. 9 ÷ 3 = 3 Can you make up your own 'sharing' story and record a matching equation?
Division as grouping Here, division is shown as grouping. If we have ten cubes and put them into groups of two, there are 5 groups. This is a good opportunity to demonstrate and reinforce the inverse relationship with multiplication.	 Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.	Show jumps in groups. The number of jumps equals the number of groups.   Think of the bar as a whole. Split it into the number of groups you are dividing by and work out how many would be within each group.	28 ÷ 7 = 4 Divide 28 into 7 groups. How many are in each group? Max is filling party bags with sweets. He has 20 sweets altogether and decides to put 5 in every bag. How many bags can he fill?
Division within arrays Use arrays of concrete manipulatives and images of familiar objects to find division equations. Begin to use dot arrays to develop a more abstract concept of division.		 Children can draw lines to divide their array	Find the inverse of multiplication and division sentences by creating four linking number sentences. 7 x 4 = 28 4 x 7 = 28 28 ÷ 7 = 4 28 ÷ 4 = 7

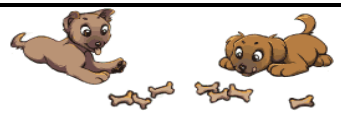
Division with a remainder

This strategy provides an opportunity to reinforce prior learning of odd and even and 'multiples' when exploring how numbers can and cannot be divided into different whole numbers.

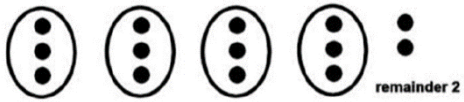


14 ÷ 3 =

Divide objects between groups and see how many are left over.



7 ÷ 2 = 3 R 1 ← Remainder



Complete written divisions and show the remainder using r.

29 ÷ 8 = 3 REMAINDER 5

dividend divisor quotient remainder