

Wallisdean Infant School

Calculation Policy





Wallisdean Infant School Mathematics Calculation Policy

Aims and Rationale

Children are introduced to the processes of calculation through the CPA approach (concrete, pictorial and abstract). As children begin to understand the underlying ideas, they develop ways of:-

- Recording to support their thinking and calculation methods
- Choosing the most efficient methods/strategies
- Interpreting and using the signs and symbols involved

As children's methods are strengthened and refined, so too are their informal written methods. These methods become more efficient and lead to efficient written methods that can be used more generally.

Early practical, pictorial, oral and mental work *must lay the foundations* by providing children with a good understanding of:-

- The number 10, including the composition of each number
- How to subitise
- How the four operations build on efficient counting strategies
- Place value
- Number bonds and number facts

The use of concrete (real objects), pictorial and abstract methods are all equally important in ensuring that children fully understand the process of calculations and what happens to the numbers and why. At the beginning, the children will begin by using concrete and oral methods. They will move towards using pictorial methods alongside these to consolidate their understanding, eventually moving towards abstract written methods. It is important that children go through this process of methods when learning any new topic in mathematics to ensure that they fully understand the process of the calculation. Once the children are familiar with a new topic it is important that the CPA approach is used in a non-linear way to consolidate their understanding. In one lesson you should see opportunities for children to use concrete resources, record pictorially and record in an abstract way.

Part-Whole Model

Benefits

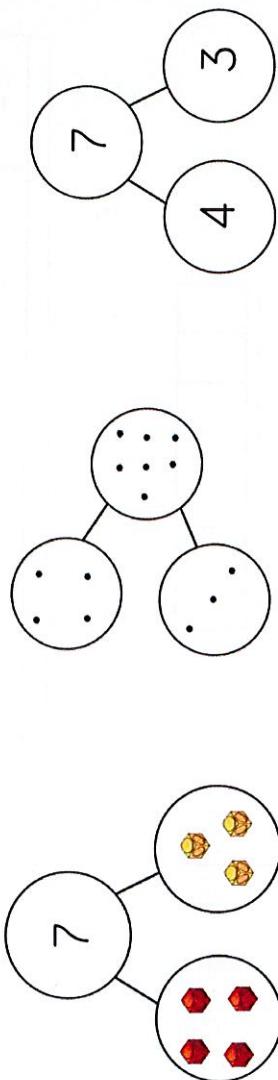
This part-whole model supports children in their understanding of aggregation and partitioning. Due to its shape, it can be referred to as a cherry part-whole model.

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

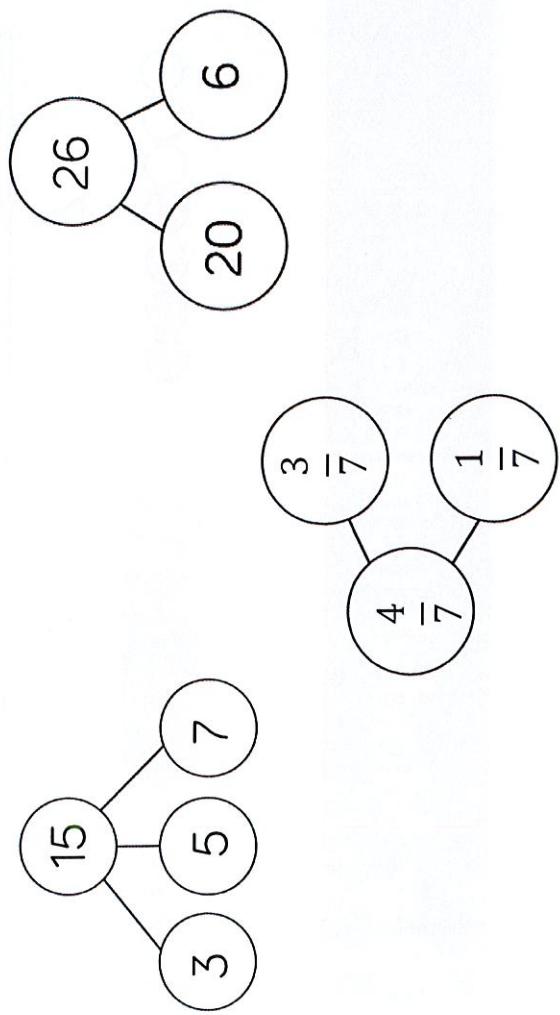
When the whole is complete and at least one of the parts is empty, children use partitioning (a form of subtraction) to find the missing part.

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.



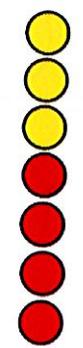
$$7 - 3 = 4$$
$$7 - 4 = 3$$



Bar Model (single)

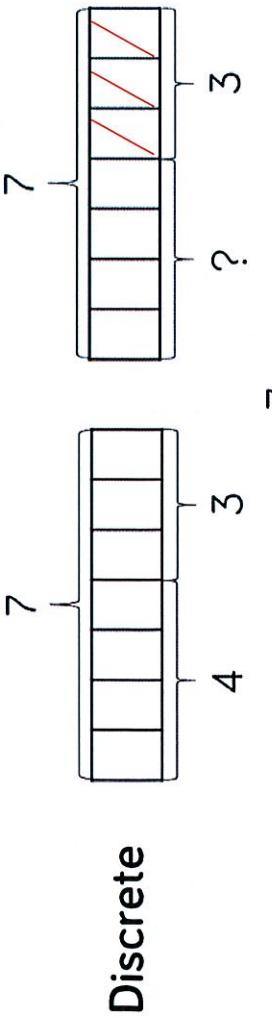


Concrete

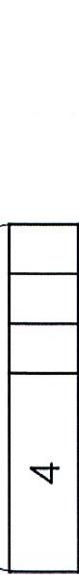


Benefits

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.



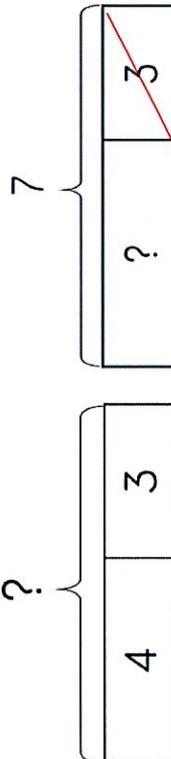
Cubes and counters can be used in a line as a concrete representation of the bar model.



Continuous

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.



477

5.3

283	194
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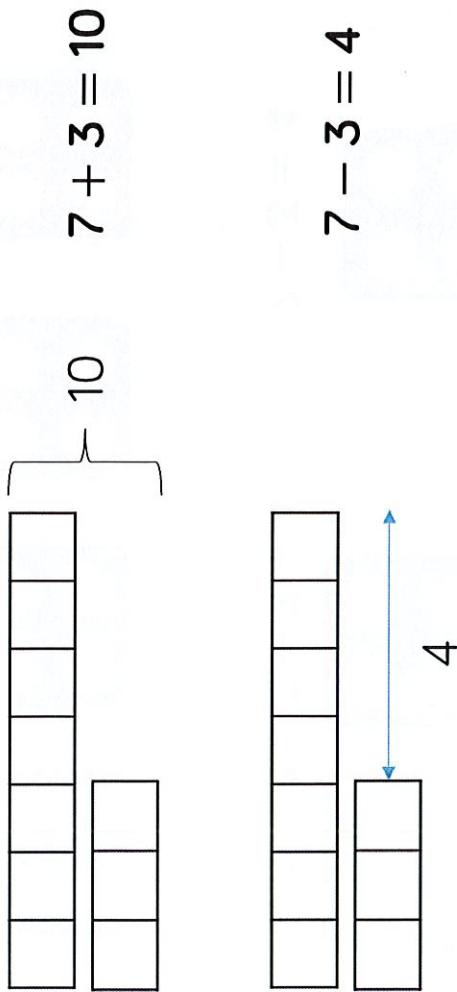
3.9	1.4
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Continuous bar models are useful for a range of values. Each rectangle represents a number. The question mark indicates the value to be found.

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

Bar Model (multiple)

Discrete



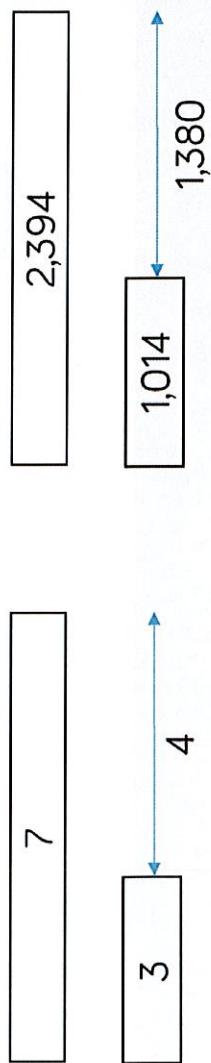
Benefits

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.



$$2,394 - 1,014 = 1,380$$
$$7 - 3 = 4$$

Number Shapes

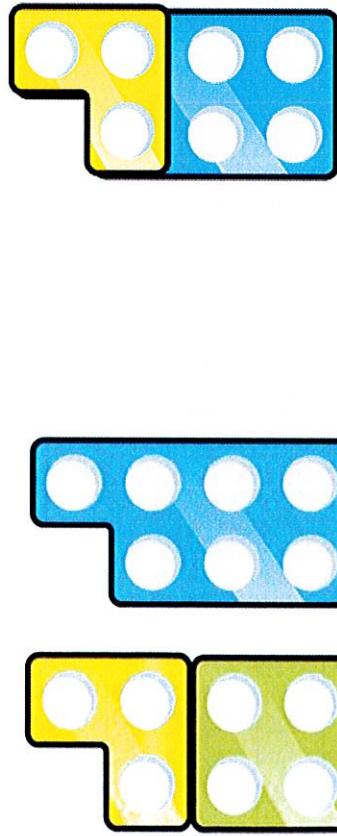
Benefits

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

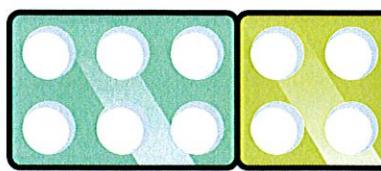
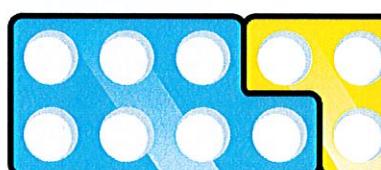
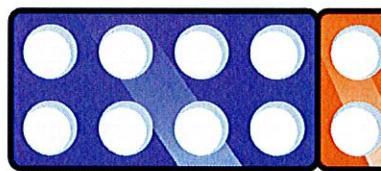
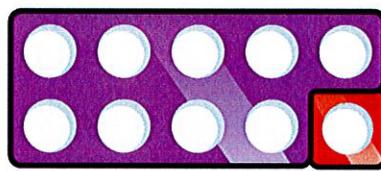
When adding numbers, children can see how the parts come together making a whole. As children use number shapes more often, they can start to subitise the total due to their familiarity with the shape of each number.

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.



$$7 = 4 + 3 \quad 7 = 3 + 4 \quad 7 - 3 = 4$$



9+1
8+2
7+3
6+4

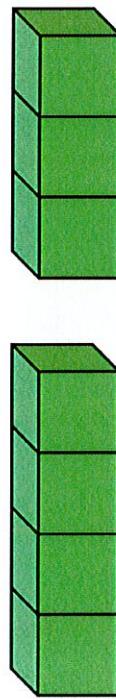
Cubes



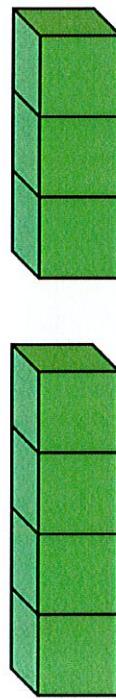
$$7 = 4 + 3$$



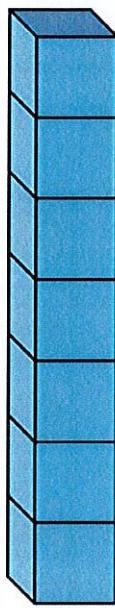
$$7 = 3 + 4$$



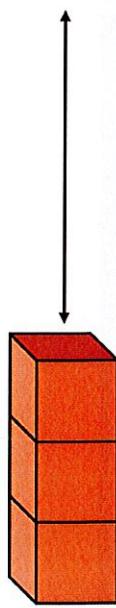
$$7 - 3 = 4$$



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.



$$7 - 3 = 4$$



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.

Benefits

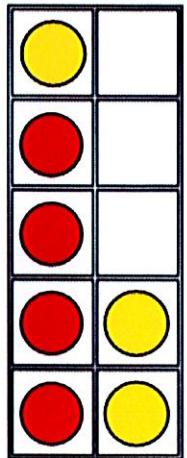
Cubes can be useful to support children with the addition and subtraction of one-digit numbers.

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.

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)

$$\begin{array}{lll} 4 + 3 = 7 & 4 \text{ is a part.} \\ 3 + 4 = 7 & 3 \text{ is a part.} \\ 7 - 3 = 4 & 7 \text{ is the whole.} \\ 7 - 4 = 3 & \end{array}$$



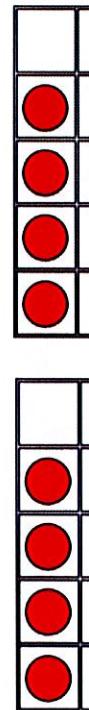
Benefits

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

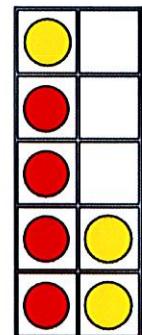
Using the language of parts and wholes represented by objects on the ten frame introduces children to aggregation and partitioning.

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.

First

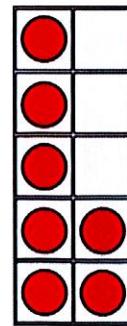


Then

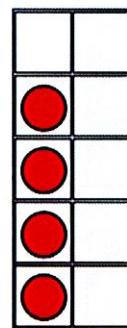


$$4 + 3 = 7$$

First



Now



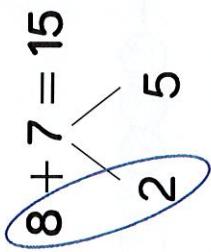
$$7 - 3 = 4$$

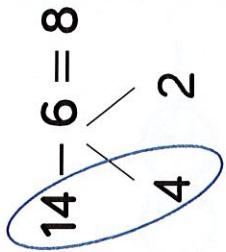
Children can also use ten frames to look at augmentation (increasing a number) and take-away (decreasing a number). This can be introduced through a first, then, now structure which shows the change in the number in the ‘then’ stage. This can be put into a story structure to help children understand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

Ten Frames (within 20)

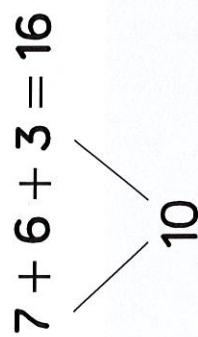
Benefits

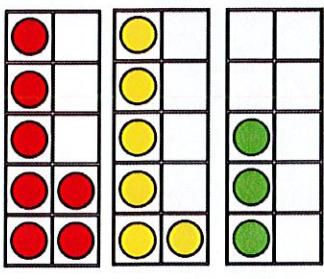
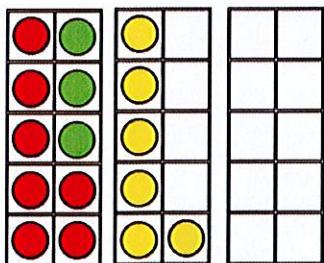
When adding two single digits, children can make each number on separate ten frames before moving part of one number to make 10 on one of the ten frames. This supports children to see how they have partitioned one of the numbers to make 10, and makes links to effective mental methods of addition.

$$8 + 7 = 15$$


$$14 - 6 = 8$$


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.

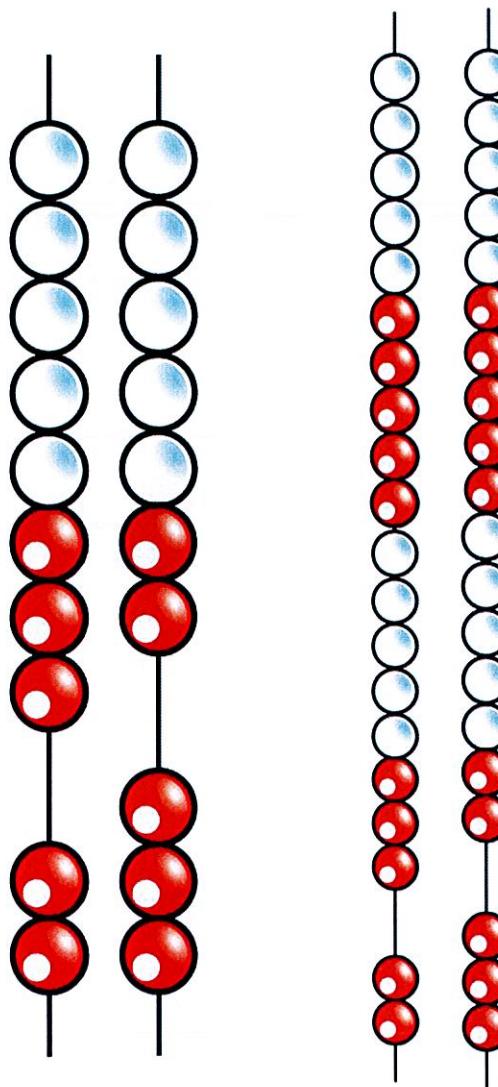
$$7 + 6 + 3 = 16$$




Bead Strings

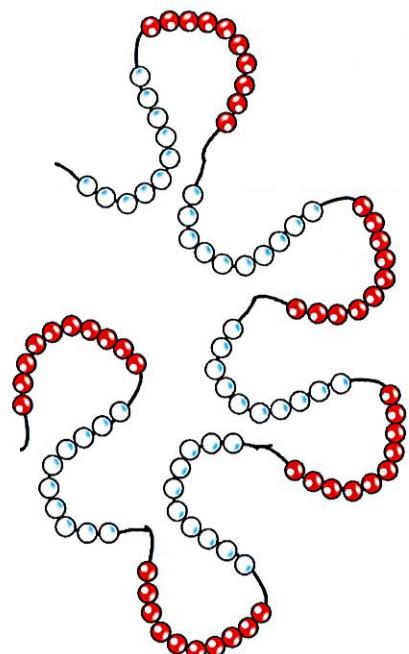
Benefits

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

$$5 + 3 = 8$$



1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	----

$$10 - 4 = 6$$



1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	----

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.

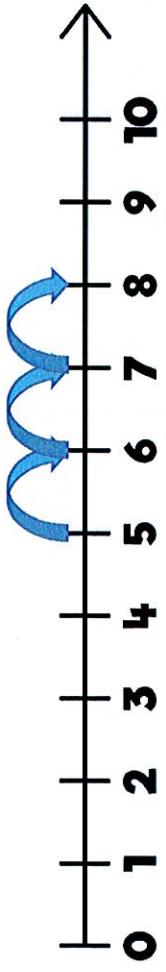
$$8 + 7 = 15$$



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----

Number Lines (labelled)

$$5 + 3 = 8$$

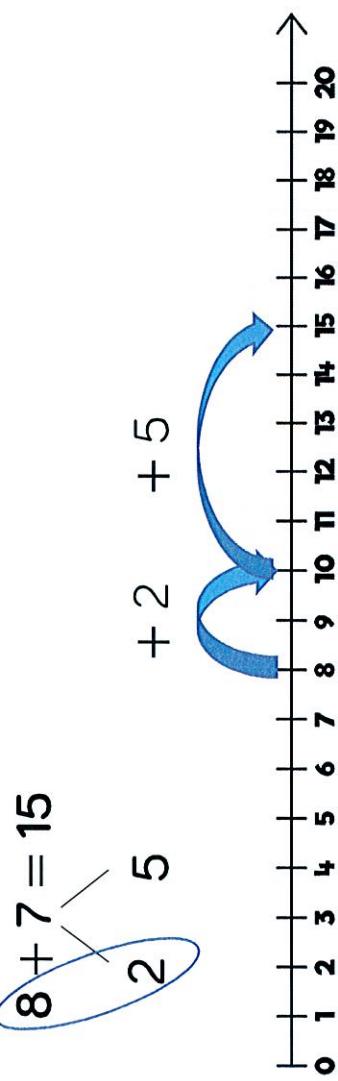


Benefits

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

$$8 + 7 = 15$$

2 5

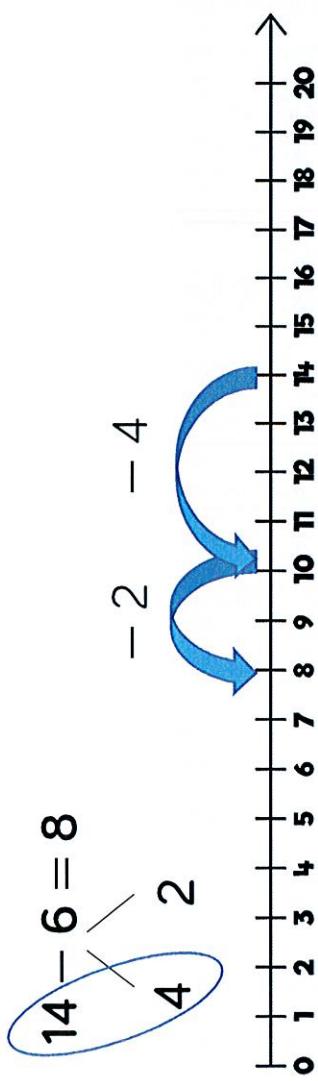


Children can start by counting on or back in ones, up or down the number line. This skill links directly to the use of the number track.

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.

$$14 - 6 = 8$$

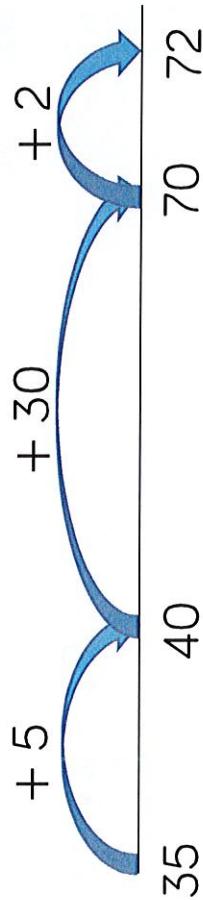
4 2



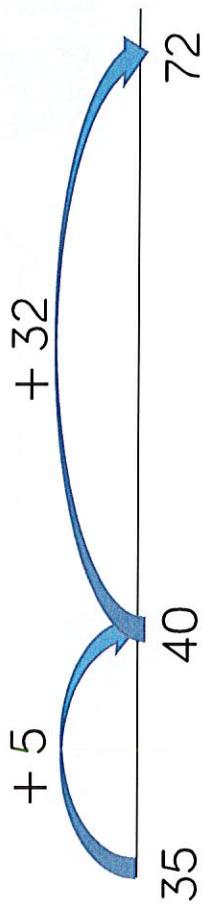
Children can subtract numbers by firstly jumping to the nearest 10. Again, this can be supported by ten frames so children can see how they partition the smaller number into the two separate jumps.

Number Lines (blank)

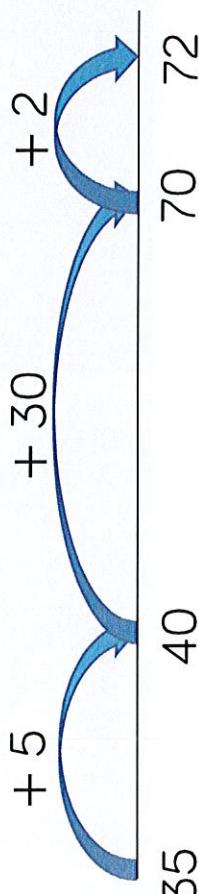
$$35 + 37 = 72$$



$$35 + 37 = 72$$



$$72 - 35 = 37$$



Benefits

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

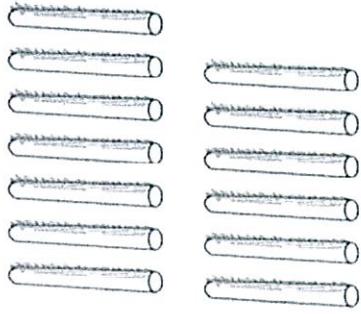
Developing from labelled number lines, children can add by jumping to the nearest 10 and then adding the rest of the number either as a whole or by adding the tens and ones separately.

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

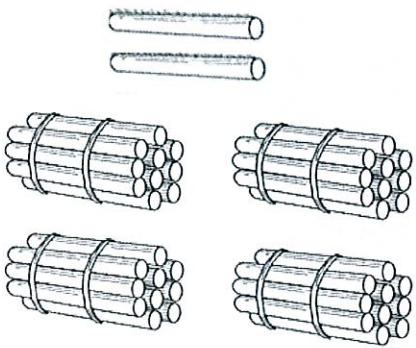
$$7 + 6 = 13$$



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.

$$42 - 17 = 25$$



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)

Benefits

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

Tens	Ones
1 1 1	1 1 1
1 1 1	1 1 1

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

Hundreds	Tens	Ones
1 1	1 1 1 1	1 1 1 1
1 1	1 1 1 1	1 1 1 1

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.

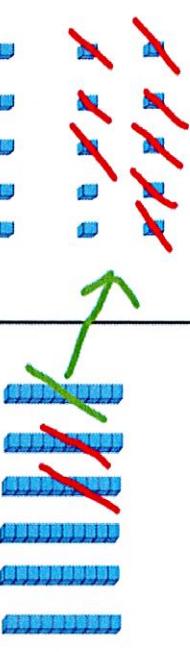
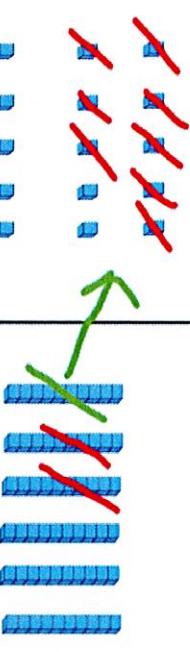
Children should first add without an exchange before moving on to addition with exchange.. The representation becomes less efficient with larger numbers due to the size of Base 10. In this case, place value counters may be the better model to use.

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.

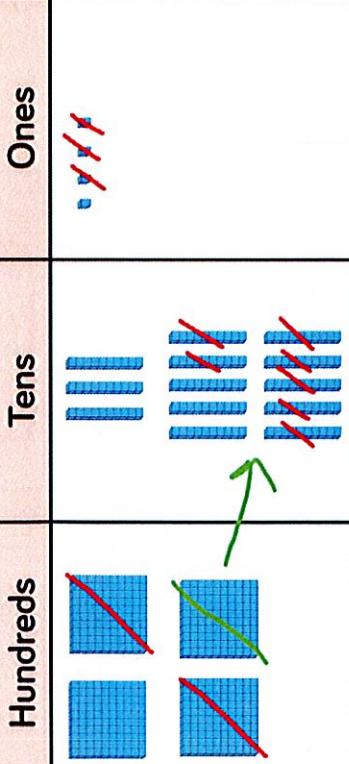
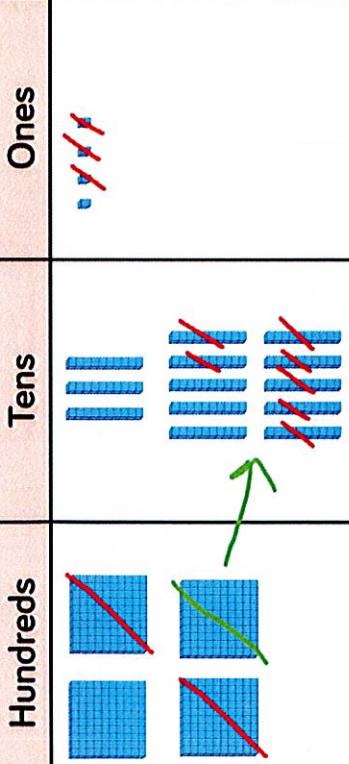
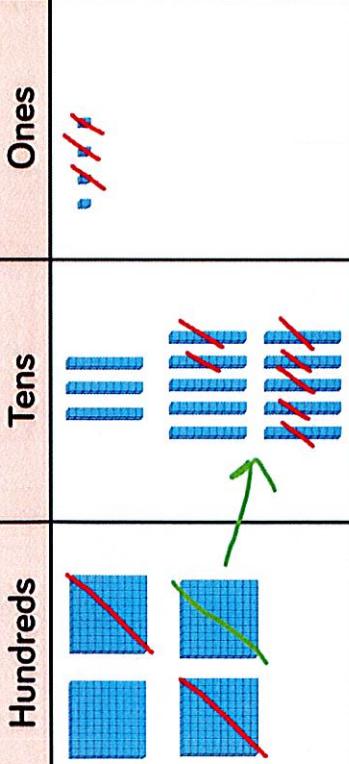
Base 10/Dienes (subtraction)

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.

Tens	Ones
	

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

Hundreds	Tens	Ones
		

$$\begin{array}{r} \cancel{3}4\cancel{3}5 \\ - 273 \\ \hline 162 \end{array}$$

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)

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.

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

Hundreds	Tens	Ones
100 100	10 10 10 10 10	1 1 1 1 1
100 100	10 10	1 1

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.

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

Ones	Tenths	Hundredths
1 1	0.1 0.1 0.1 0.1 0.1	0.01 0.01 0.01 0.01 0.01
1 1	0.1 0.1	0.01 0.01

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)

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.

$$\begin{array}{r} 651 \\ - 207 \\ \hline 445 \end{array}$$

Hundreds	Tens	Ones
3 0 0 0	0 0 0	0 0 0

A subtraction problem 651 minus 207 using place value counters. A green arrow points from the tens column of the minuend to the tens column of the subtrahend, indicating the exchange of one ten for ten ones.

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.

$$\begin{array}{r} 34357 \\ - 2735 \\ \hline 1622 \end{array}$$

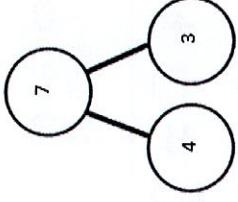
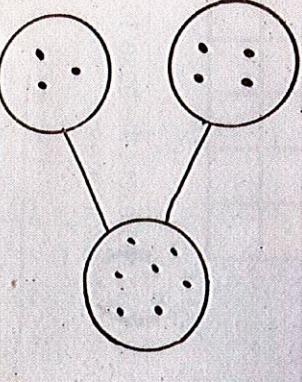
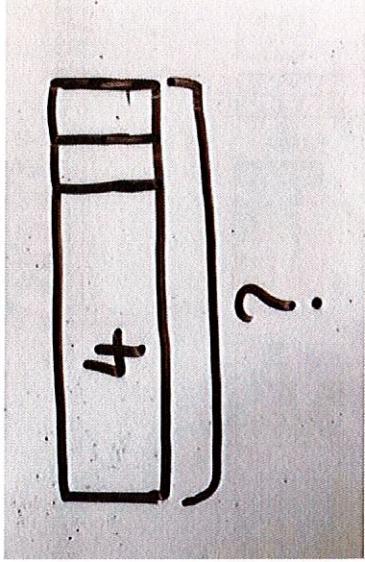
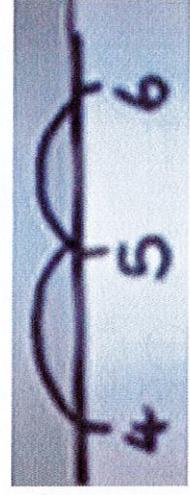
Thousands	Hundreds	Tens	Ones
1 0 0 0	1 0 0	1 0	7

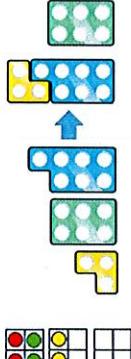
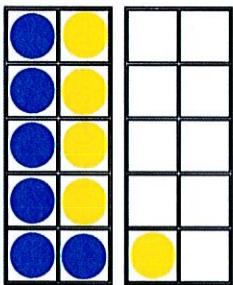
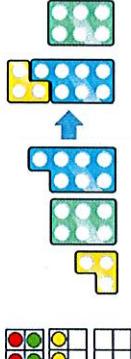
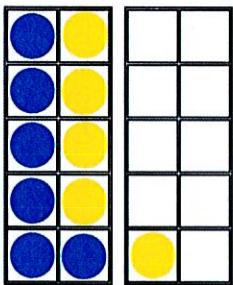
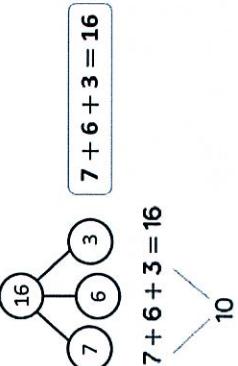
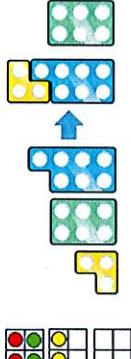
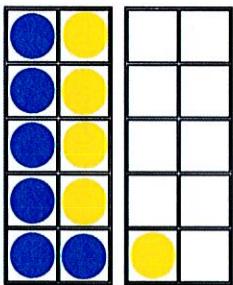
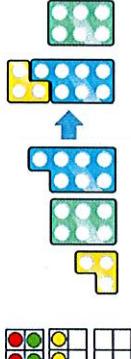
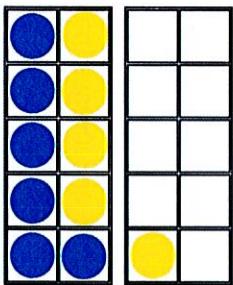
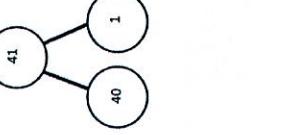
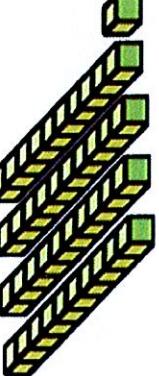
A subtraction problem 34357 minus 2735 using place value counters. A green arrow points from the hundreds column of the minuend to the hundreds column of the subtrahend, indicating the exchange of one hundred for ten tens.

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.

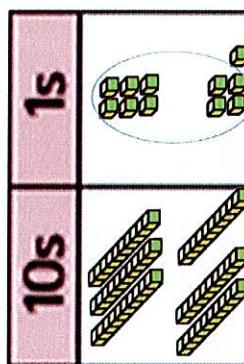
Calculation policy: Addition

Key language: sum, total, parts and wholes, plus, add, altogether, more, 'is equal to' 'is the same as'.

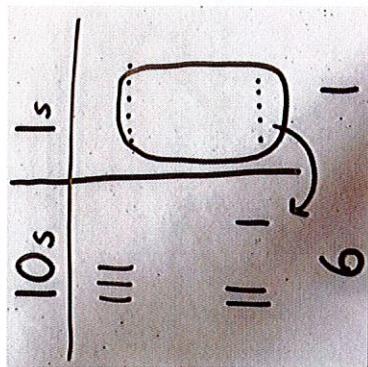
Concrete	Pictorial	Abstract
Combining two parts to make a whole (use other resources too e.g. eggs, shells, teddy bears, cars).	Children to represent the cubes using dots or crosses. They could put each part on a part whole model too.  	$4 + 3 = 7$ Four is a part, 3 is a part and the whole is seven.
Counting on using number lines using cubes or Numicon.	A bar model which encourages the children to count on, rather than count all. 	The abstract number line: What is 2 more than 4? What is the sum of 2 and 4? What is the total of 4 and 2? $4 + 2$ 

<p>Adding three 1-digit number; using part-part whole models, numicon, or tens frames.</p>  	<p>Children to draw the tens frames, numicon or part-part whole models and counters.</p>  	<p>Children to record numbers and number sentences.</p> 
<p>Regrouping to make 10; using ten frames and counters/cubes or using Numicon.</p> <p>$6 + 5 = 11$</p>  	<p>Children to draw the ten frame and counters/cubes.</p>  	<p>Children to develop an understanding of equality e.g.</p> <p>$6 + \square = 11$</p> <p>$6 + 5 = 5 + \square$</p> <p>$6 + 5 = \square + 4$</p> <p>$41 + 8 = 49$</p> 
<p>T0 + 0 using base 10. Continue to develop understanding of partitioning and place value.</p> <p>$41 + 8 = 49$</p>	<p>Children to represent the base 10 e.g. lines for tens and dot/crosses for ones.</p> <p>$10s$</p> <p>$1s$</p> <p>$\overline{1\ 1\ 1\ .\ \dots\ 9}$</p>	 

TO + TO using base 10. Continue to develop understanding of partitioning and place value.
 $36 + 25$



Children to represent the base 10 in a place value chart.

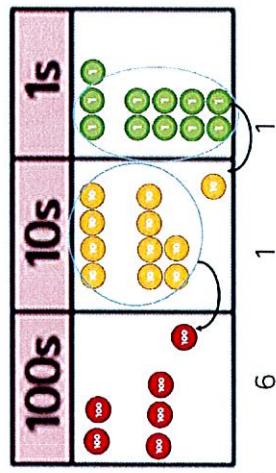


Looking for ways to make 10.

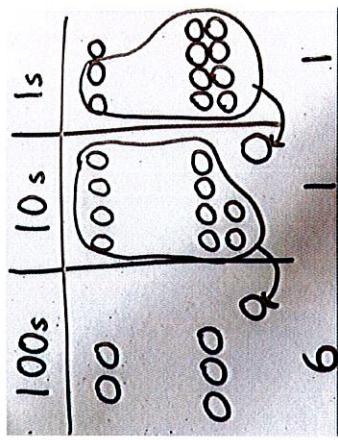
$$36 + 25 = \begin{array}{r} 30 + 20 = 50 \\ 5 + 5 = 10 \\ \hline 50 + 10 + 1 = 61 \end{array}$$

1 5

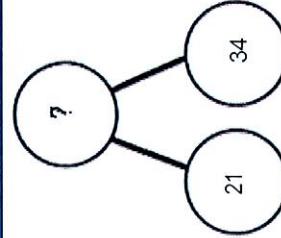
Use of place value counters to add HTO + TO, HTO + HTO etc. When there are 10 ones in the 1s column- we exchange for 1 ten, when there are 10 tens in the 10s column- we exchange for 1 hundred.



Children to represent the counters in a place value chart, circling when they make an exchange.



Conceptual variation; different ways to ask children to solve $21 + 34$



Word problems:

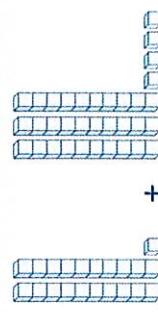
In year 3, there are 21 children and in year 4, there are 34 children. How many children in total?

$$21 + 34 = 55. \text{ Prove it}$$

$$\begin{array}{r} 21 \\ + 34 \\ \hline \end{array}$$

$$\boxed{\quad} = 21 + 34$$

Calculate the sum of twenty-one and thirty-four.



Missing digit problems:

10s	1s
3	7
2	9
5	?
?	5

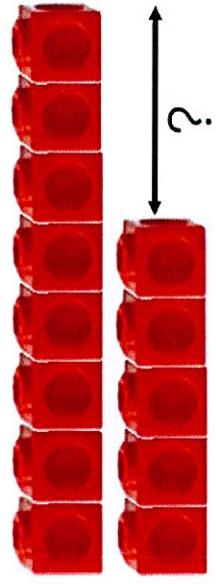
Calculation policy: Subtraction

Key language: take away, less than, the difference, subtract, minus, fewer, decrease.

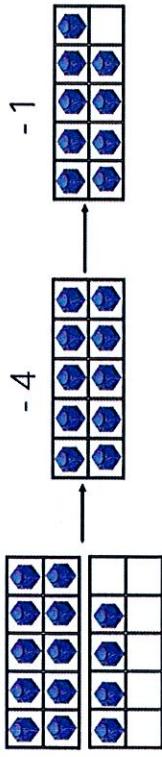
Concrete	Pictorial	Abstract
<p>Physically taking away and removing objects from a whole (ten frames, Numicon, cubes and other items such as beanbags could be used).</p> <p>$4 - 3 = 1$</p>	<p>Children to draw the concrete resources they are using and cross out the correct amount. The bar model can also be used.</p> <p>$4 - 3 = 1$</p> <p>$\square \square \square \quad ?$</p>	<p>$4 - 3 = 1$</p> <p>$\square \square \quad ?$</p>
<p>$4 - 3 = 1$</p>	<p>Children to represent what they see pictorially e.g.</p>	<p>Children to represent the calculation on a number line or number track and show their jumps. Encourage children to use an empty number line</p>
<p>$6 - 2 = 4$</p>	<p>Counting back (using number lines or number tracks) Children start with 6 and count back 2.</p> <p>$6 - 2 = 4$</p>	

Finding the difference (using cubes, Numicon or Cuisenaire rods, other objects can also be used).

Calculate the difference between 8 and 5.



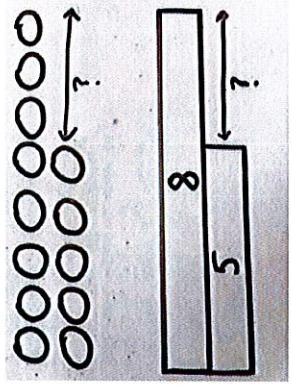
Making 10 using ten frames.
 $14 - 5$



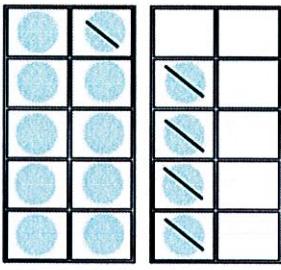
Children to draw the cubes/other concrete objects which they have used or use the bar model to illustrate what they need to calculate.

Find the difference between 8 and 5.
 $8 - 5$, the difference is

Children to explore why
 $9 - 6 = 8 - 5 = 7 - 4$ have the same difference.



Children to present the ten frame pictorially and discuss what they did to make 10.



Children to show how they can make 10 by partitioning the subtrahend.

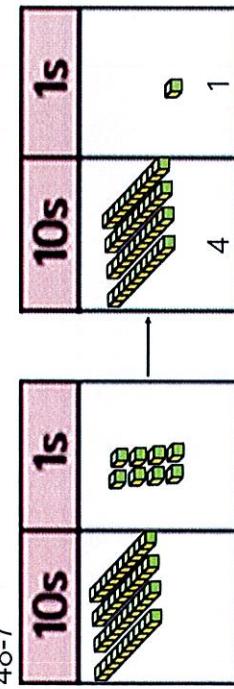
$$14 - 5 = 9$$

4 1

$$14 - 4 = 10$$

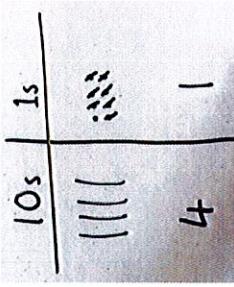
$$10 - 1 = 9$$

Children to represent the base 10 pictorially.



Column method using base 10.

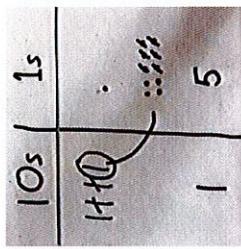
48-7



Column method using base 10 and having to exchange.

		1s		5
	10s			1
1				

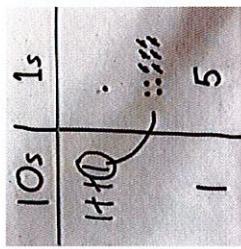
Represent the base 10 pictorially, remembering to show the exchange.



Column method using base 10 and having to exchange.

		1s		5
	10s			1
1				

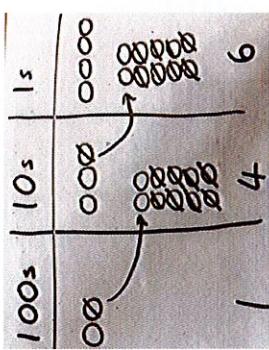
Represent the base 10 pictorially, remembering to show the exchange.



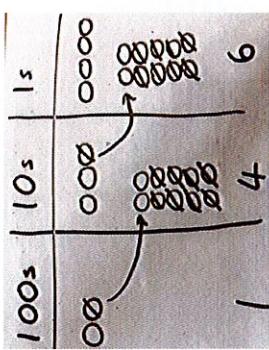
Column method using place value counters.

100s	10s	1s	
1			

Represent the place value counters pictorially; remembering to show what has been exchanged.



Represent the place value counters pictorially; remembering to show what has been exchanged.



Conceptual variation; different ways to ask children to solve 391 - 186

Raj spent £391, Timmy spent £186.
How much more did Raj spend?

Calculate the difference between 391 and 186.

$$\boxed{ } = 391 - 186$$

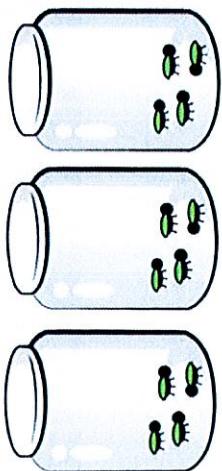
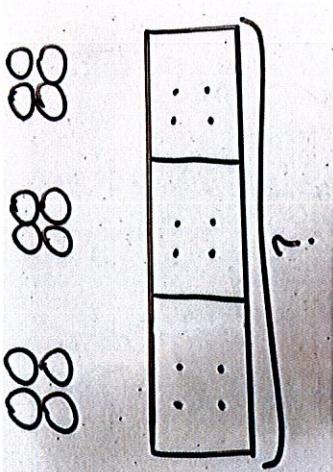
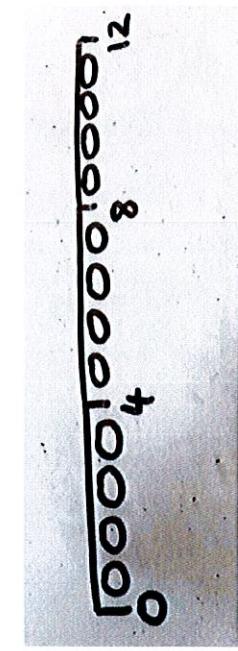
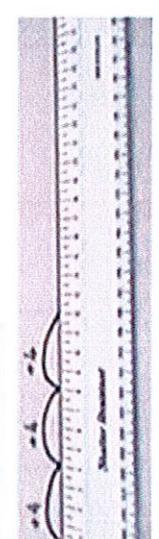
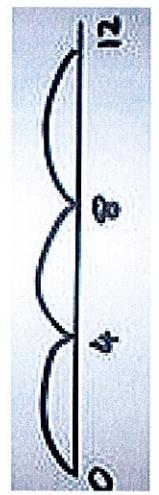
Missing digit calculations

$$\begin{array}{r}
 & 9 & \boxed{} \\
 3 & 9 & 6 \\
 - & \boxed{} & \boxed{} \\
 \hline
 & 0 & 5
 \end{array}$$

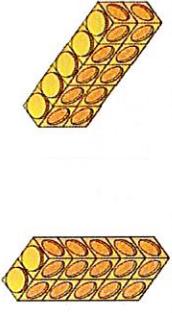
What is 186 less than 391?

Calculation policy: Multiplication

Key language: double, times, multiplied by, the product of, groups of, lots of, equal groups.

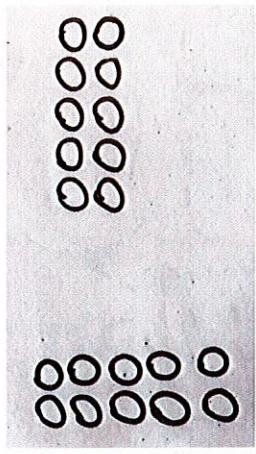
Concrete	Pictorial	Abstract
Repeated grouping/repeated addition 3×4 $4 + 4 + 4$ There are 3 equal groups, with 4 in each group. 	Children to represent the practical resources in a picture and use a bar model. 	$3 \times 4 = 12$ $4 + 4 + 4 = 12$
Number lines to show repeated groups 3×4 	Represent this pictorially alongside a number line e.g.: 	Abstract number line showing three jumps of four. $3 \times 4 = 12$ 
		Cuisenaire rods can be used too. 

Use arrays to illustrate commutativity counters and other objects can also be used.
 $2 \times 5 = 5 \times 2$



2 lots of 5 5 lots of 2

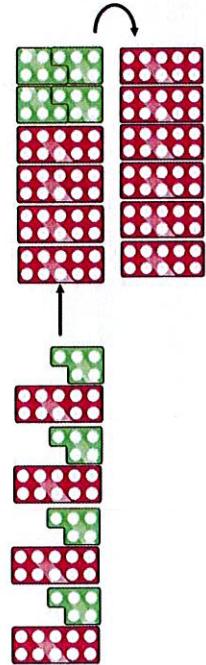
Children to represent the arrays pictorially.



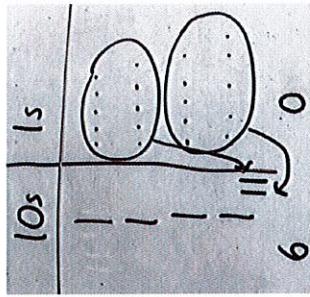
Children to be able to use an array to write a range of calculations e.g.

$$\begin{aligned} 10 &= 2 \times 5 \\ 5 \times 2 &= 10 \\ 2 + 2 + 2 + 2 + 2 &= 10 \\ 10 &= 5 + 5 \end{aligned}$$

Partition to multiply using Numicon, base 10 or Cuisenaire rods.
 4×15



Children to represent the concrete manipulatives pictorially.

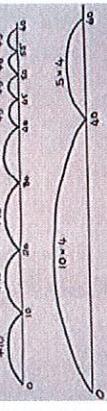


Children to be encouraged to show the steps they have taken.

$$\begin{array}{r} 4 \times 15 \\ \hline 10 & 5 \end{array}$$

$$\begin{array}{r} 10 \times 4 = 40 \\ 5 \times 4 = 20 \\ 40 + 20 = 60 \end{array}$$

A number line can also be used



Formal column method with place value counters
(base 10 can also be used.) 3×23

10s	1s	6	9
0	0	0	0
0	0	0	0
0	0	6	9

Children to represent the counters pictorially.

10s	1s	6	9
0	0	0	0
0	0	0	0
0	0	6	9

Formal column method with place value counters.
 6×23

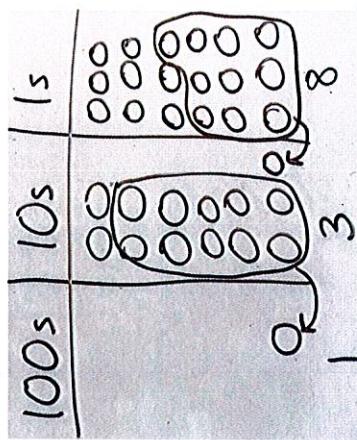
100s	10s	1s
	10	6

100s	10s	1s
	2	3

When children start to multiply $3d \times 3d$ and $4d \times 2d$ etc., they should be confident with the abstract:

To get 744 children have solved 6×124 .
 To get 2480 they have solved 20×124 .

Children to represent the counters/base 10, pictorially
 e.g. the image below.



$$\begin{array}{r}
 & 1 & 2 & 4 \\
 \times & 2 & 6 \\
 \hline
 & 7 & 4 & 4 \\
 2 & 4 & 8 & 0 \\
 \hline
 3 & 2 & 2 & 4 \\
 \hline
 1 & 1
 \end{array}$$

Answer: 3224

Conceptual variation; different ways to ask children to solve 6×23

23	23	23	23	23	23
?					

Find the product of 6 and 23

Mai had to swim 23 lengths, 6 times a week.
 How many lengths did she swim in one week?

$$\boxed{ } = 6 \times 23$$

What is the calculation?
 What is the product?

100s	10s	1s
	6	23

$$\begin{array}{r}
 & 1 & 2 & 4 \\
 \times & 2 & 6 \\
 \hline
 & 7 & 4 & 4 \\
 2 & 4 & 8 & 0 \\
 \hline
 3 & 2 & 2 & 4 \\
 \hline
 1 & 1
 \end{array}$$

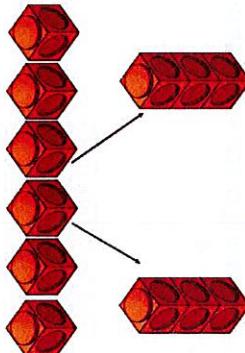
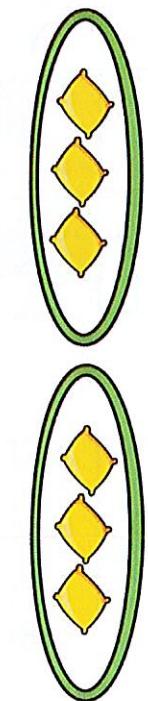
With the counters, prove that $6 \times 23 = 138$

Calculation policy: Division

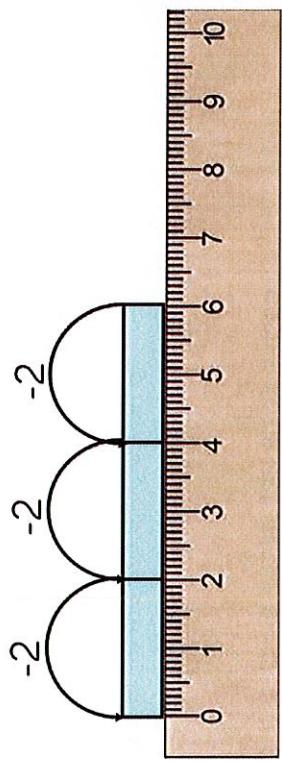
Key language: share, group, divide, divided by, half.

Concrete

Sharing using a range of objects.
 $6 \div 2$



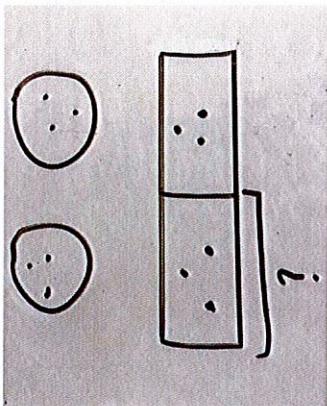
Repeated subtraction using Cuisenaire rods above a ruler.
 $6 \div 2$



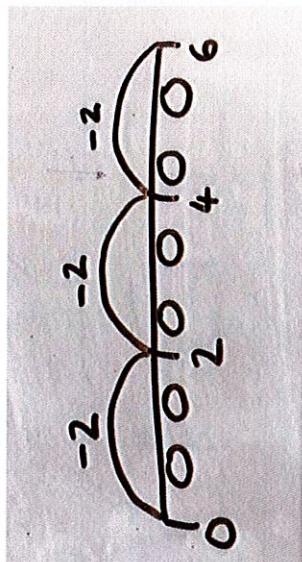
3 groups of 2

Pictorial

Represent the sharing pictorially.



Children to represent repeated subtraction pictorially.



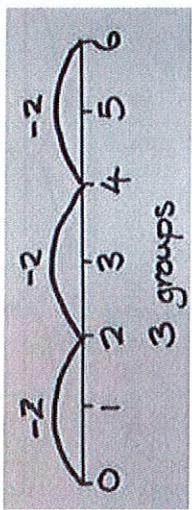
Abstract

$6 \div 2 = 3$



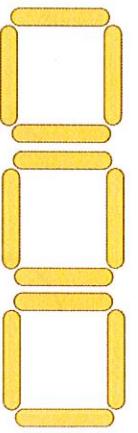
Children should also be encouraged to use their 2 times tables facts.

Abstract number line to represent the equal groups that have been subtracted.



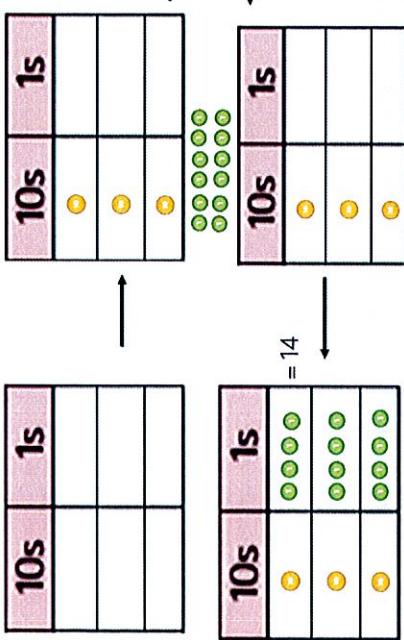
Year 2
2d ÷ 1d with remainders using lollipop sticks. Cuisenaire rods, above a ruler can also be used.
 $13 \div 4$

Use of lollipop sticks to form wholes- squares are made because we are dividing by 4.

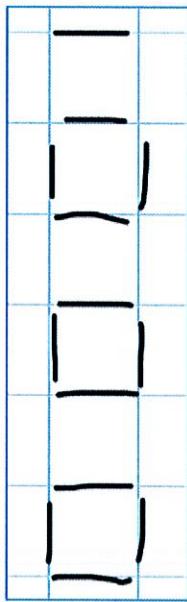


There are 3 whole squares, with 1 left over.

Sharing using place value counters.
 $42 \div 3 = 14$



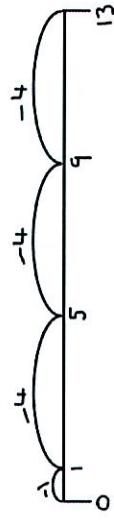
Children to represent the lollipop sticks pictorially.



$$13 \div 4 - 3 \text{ remainder } 1$$

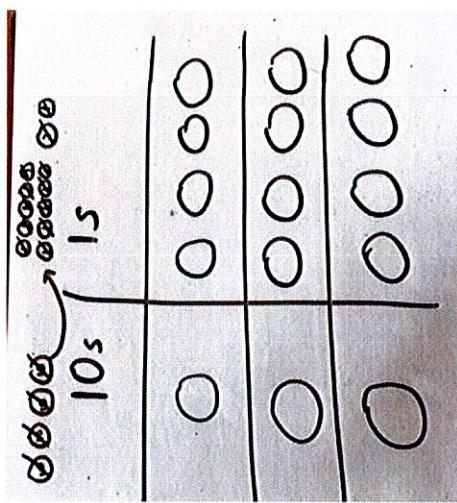
Children should be encouraged to use their times table facts; they could also represent repeated addition on a number line.

'3 groups of 4, with 1 left over'



There are 3 whole squares, with 1 left over.

Children to represent the place value counters pictorially.

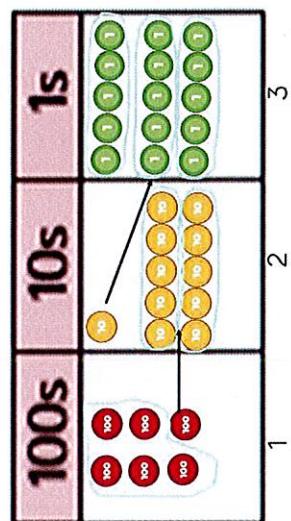


Children to be able to make sense of the place value counters and write calculations to show the process.

$$\begin{array}{r} 42 \div 3 \\ 42 = 30 + 12 \\ 30 \div 3 = 10 \\ 12 \div 3 = 4 \\ 10 + 4 = 14 \end{array}$$

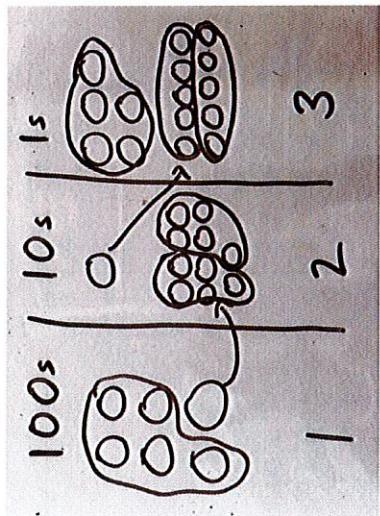
$$13 \div 4 - 3 \text{ remainder } 1$$

Short division using place value counters to group.
 $615 \div 5$



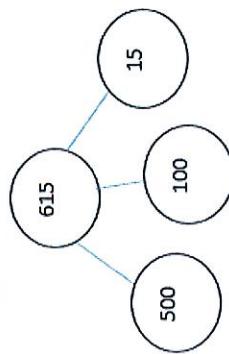
1. Make 615 with place value counters.
2. How many groups of 5 hundreds can you make with 6 hundred counters?
3. Exchange 1 hundred for 10 tens.
4. How many groups of 5 tens can you make with 11 ten counters?
5. Exchange 1 ten for 10 ones.
6. How many groups of 5 ones can you make with 15 ones?

Represent the place value counters pictorially.



Conceptual variation; different ways to ask children to solve $615 \div 5$

Using the part whole model below, how can you divide 615 by 5 without using short division?

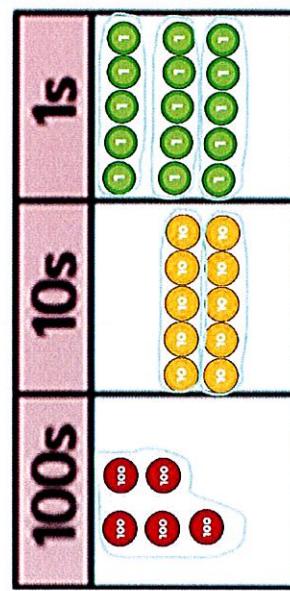


I have £615 and share it equally between 5 bank accounts. How much will be in each account?

$$615 \div 5 = \boxed{\quad} = 615 \div 5$$

615 pupils need to be put into 5 groups. How many will be in each group?

What is the calculation?
What is the answer?



Glossary

Addend - A number to be added to another.

Aggregation - combining two or more quantities or measures to find a total.

Augmentation - increasing a quantity or measure by another quantity.

Commutative - numbers can be added in any order.

Difference - the numerical difference between two numbers is found by comparing the quantity in each group.

Exchange - Change a number or expression for another of an equal value.

Equality - a symbolic expression of the fact that two quantities are equal.

Fact Family - a collection of related addition and subtraction facts, or multiplication and division facts, made from the same numbers.

Inverse - the word inverse refers to the opposite of another operation.

Partitioning - Splitting a number into its component parts.

Reduction - Subtraction as take away.

Subitise - Instantly recognise the number of objects in a small group without needing to count.

Subtrahend - a quantity or number to be subtracted from another.

Sum - The result of an addition.

Systematically - according to a fixed plan or system; methodically.

Total - The aggregate or the sum found by addition.

