Introduction

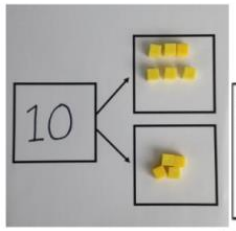
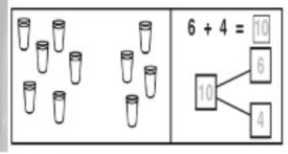
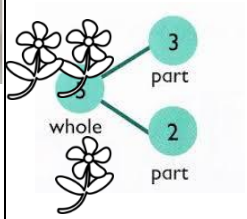
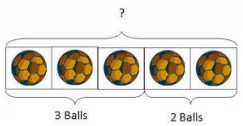
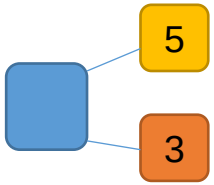
Children are introduced to the processes of calculation by building a sequence following a C-P-A approach. The C-P-A approach stands for Concrete - Pictorial – Abstract. This means that throughout the school, we see children using concrete equipment and pictures to support their understanding of more abstract concepts. Over time children learn how to use models and images, such as Dienes, place value counters, bar models and tens frames, to support their mental and informal written methods of calculation. As children's mental methods are strengthened and refined, so too are their informal written methods. These methods become more efficient and succinct and lead to efficient written methods that can be used more generally. By the end of Year 6 children are equipped with mental and written methods that they understand and can use correctly.

When faced with a calculation, children are able to decide which method is most appropriate and have strategies to check its accuracy. They will do this by asking themselves:

- Can I do this in my head?
- Can I do this in my head using drawing or jottings?
- Do I need to use a pencil and paper procedure? At whatever stage in their learning, and whatever method is being used, it must still be underpinned by a secure and appropriate knowledge of number facts, along with those mental skills that are needed to carry out the process and judge if it was successful.

The overall aim is that when children leave primary school they:

- Have a secure knowledge of number facts and a good understanding of the four operations;
- Are able to use this knowledge and understanding to carry out calculations mentally and to apply general strategies when using one-digit and twodigit numbers and particular strategies to special cases involving bigger numbers;
- Make use of diagrams and informal notes to help record steps and part answers when using mental methods that generate more information than can be kept in their heads;
- Have an efficient and reliable written method of calculation for each operation that children can apply with confidence when undertaking calculations that they cannot carry out mentally; which leads to a formal written method..

Objective and Strategies	Concrete	Pictorial	Abstract
Early Years Combining two parts to make a whole: part-whole model Joining two groups and then recounting all objects using one-to-one correspondence **Early Learning Goals** Children count reliably with numbers from 1 to 20, place them in order and say which number is one more or one less than a given number. Using quantities and objects, they add and subtract two single-digit numbers and count on or back to find the answer.	   10 = 6 + 4 10 − 6 = 4 10 − 4 = 6 10 = 4 + 6 	  Use pictures to add two numbers together as a group or in a bar.   Use the part-part whole diagram as shown above to move into the abstract.	4 + 3 = 7 10 = 6 + 4

Year 1

Starting at the bigger number and counting on

As a strategy, this should be limited to adding small quantities only (1, 2 or 3) with pupils understanding that counting on from the greater is more efficient. Pupils should be encouraged to rely on number bonds knowledge as time goes on, rather than using counting on as their main strategy.

Read, write and interpret mathematical statements involving addition (+), subtraction (–) and equals (=) signs.

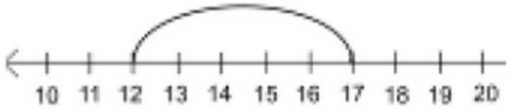
Represent and use number bonds and related subtraction facts within 20.

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 $7 = \square - 9$.

Start with the larger number on the bead string and then count on to the smaller number 1 by 1 to find the answer.

12 + 5 = 17



Start at the larger number on the number line and count on in ones or in one jump to find the answer.

Bar Model:

5 + 12 = 17

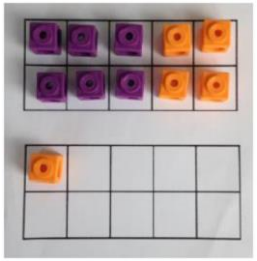
Place the larger number in your head and count on the smaller number to find your answer.

Regrouping to make 10.

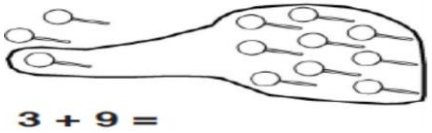
This is an essential skill that will support column addition later on

Chd should be able to link addition to making 10 first and then adding remaining amount.

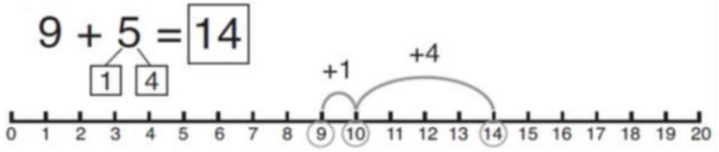
6 + 5 = 11



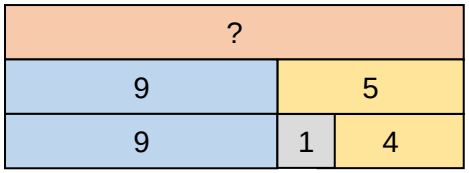
Start with the bigger number and use the smaller number to make 10.



Use pictures or a number line. Regroup or partition the smaller number to make 10.



Bar model:



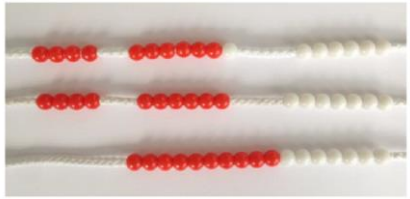
7 + 4= 11

If I am at seven, how many more do I need to make 10. How many more do I add on now?

Adding three single digits

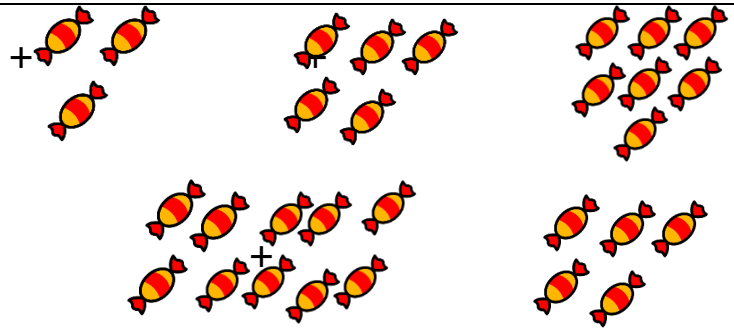
Here the emphasis should be on the language rather than the strategy.

4 + 7 + 6= 17
Put 4 and 6 together to make 10. Add on 7.

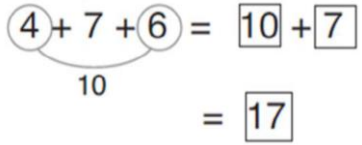


As pupils are using the bead string,
ensure that they are explaining using language such as; '1 more than 5 is equal to 6.'
'2 more than 5 is 7.'
'8 is 3 more than 5.'

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



Add together three groups of objects. Draw a picture to recombine the groups to make 10.



Combine the two numbers that make 10 and then add on the remainder.

Year 2

Column method- with grouping

Solve problems with addition and subtraction:
i. using concrete objects and pictorial representations, including those involving numbers, quantities and measures
ii. applying their increasing knowledge of mental and written methods.

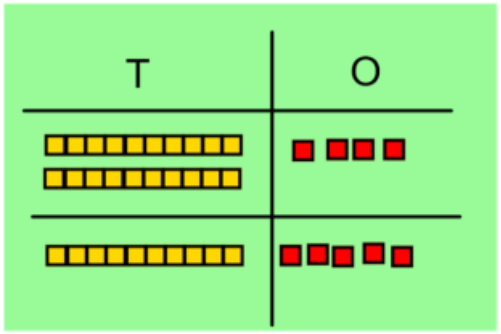
Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100.

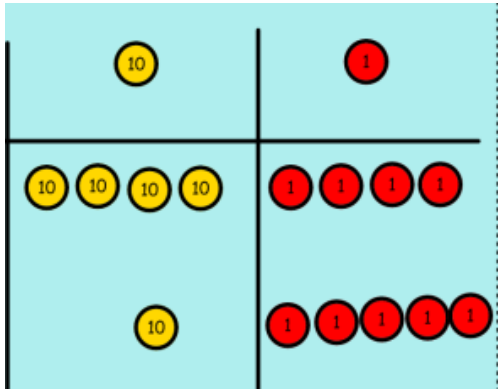
Add and subtract numbers using concrete objects, pictorial representations, and mentally, including:
i. a two-digit number and ones
ii. a two-digit number and tens
iii. two two-digit numbers
iv. adding three one-digit numbers.

Show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot.

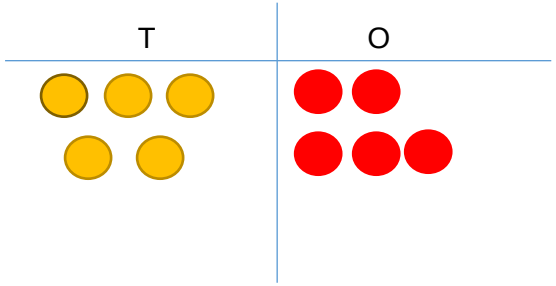
Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.

24 + 15=
Add together the ones first then add the tens. Use the Base 10 blocks first before moving onto place value counters.





After practically using the base 10 blocks and place value counters, children can draw the counters to help them to solve additions.



Calculations

21 + 42 =

21
+ 42

Year 3

Column method- regrouping with up to 3 digits and carrying

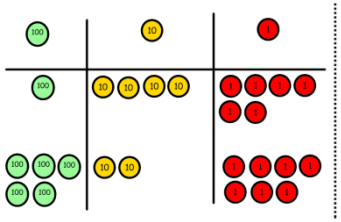
Add and subtract numbers mentally, including:
i. a three-digit number and ones
ii. a three-digit number and tens
iii. a three-digit number and hundreds.

Add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction.

Estimate the answer to a calculation and use inverse operations to check answers.

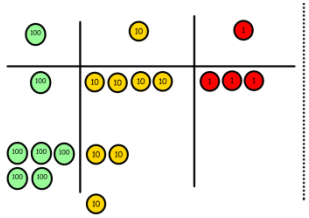
Solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction.

Make both numbers on a place value grid.



146
+ 527

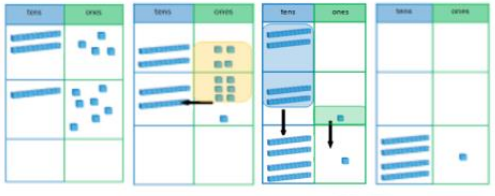
Add up the units and exchange 10 ones for one 10.

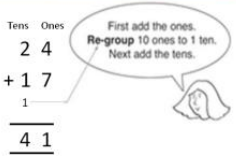


146
+ 527

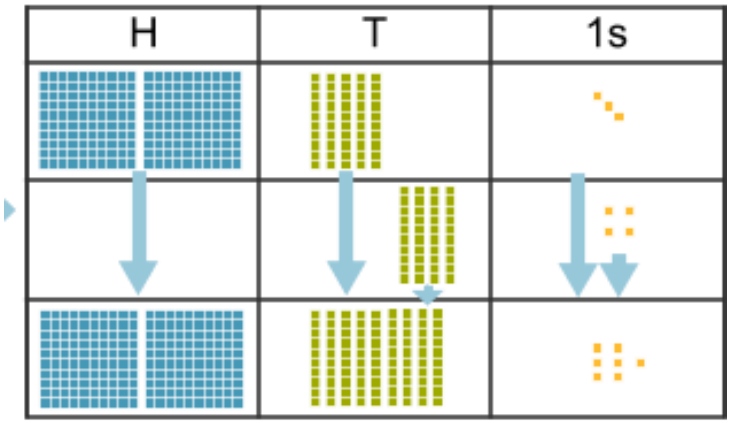
Add up the rest of the columns, exchanging the 10 counters from one column for the next place value column until every column has been added.
This can also be done with Base 10 to help children clearly see that 10 ones equal 1 ten and 10 tens equal 100.

24 + 17





Draw representations of 3 digit column addition both with and without carry.



Start by partitioning the numbers before moving on to clearly show the exchange below the addition.

$$\begin{array}{rcrl} 20 & + & 5 & \\ 40 & + & 8 & \\ \hline 60 & + & 13 & = 73 \end{array}$$

$$\begin{array}{r} 536 \\ +\ 85 \\ \hline 621 \\ \hline 1\ 1 \end{array}$$

Year 4

Column method- regrouping with up to 4 digits and carrying

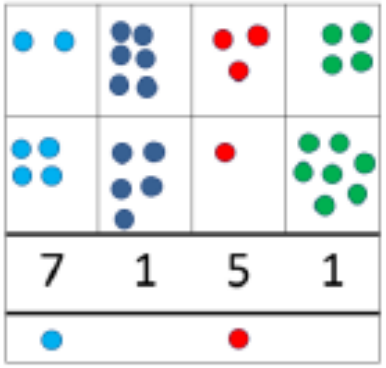
Add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate.

Estimate and use inverse operations to check answers to a calculation.

Solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why.

As year 3 but with up to 4 digit numbers and with carrying.

Children can draw a pictoral representation of the columns and place value counters to further support their learning and understanding.



Chd will be able to add any digit number with more than one carry if needed.

Th	H	T	O
2	3	1	4
+ 3	8	8	6
6	2	0	0
1	1	1	

Year 5 and 6

Column method with regrouping. Dealing with larger numbers and decimals numbers. Children should also be able to solve inverse problems related to the column method.

Add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction).

Add and subtract numbers mentally with increasingly large numbers.

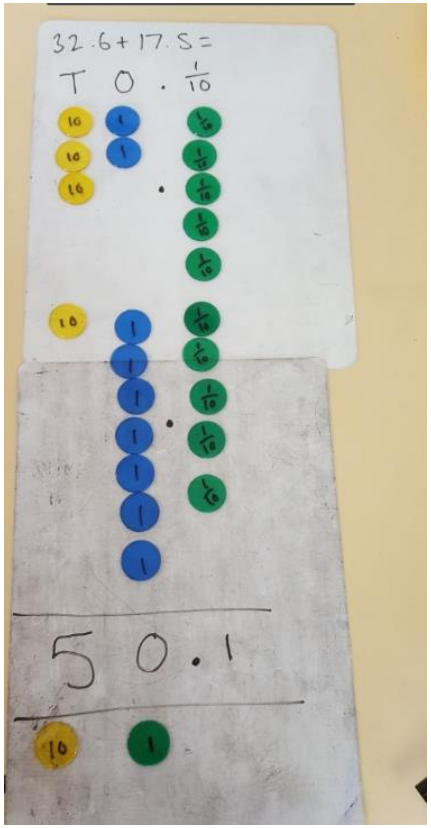
Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy.

Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.

Use their knowledge of the order of operations to carry out calculations involving the four operations.

Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why. Solve problems involving addition, subtraction, multiplication and division.

As children move on to decimals, money and decimal place value counters can be used to support learning.



As Year 4 if required based on decimal values.

As the children move on, introduce decimals with the same number of decimal places and different. Money can be used here.

$$\begin{array}{r} 72.8 \\ +\,54.6 \\ \hline 127.4 \\ \hline 1\ 1 \end{array}$$

$$\begin{array}{rrrrrr} & £ & 2 & 3 & . & 5\ 9 \\ + & £ & & 7 & . & 5\ 5 \\ \hline & £ & 3 & 1 & . & 1\ 4 \\ & & 1 & 1 & & 1 \end{array}$$

$$\begin{array}{rrrrrr} 2 & 3 & . & 3 & 6 & 1 \\ & 9 & . & 0 & 8 & \mathbf{0} \\ 5 & 9 & . & 7 & 7 & \mathbf{0} \\ + & 1 & . & 3 & \mathbf{0} & \mathbf{0} \\ \hline 9 & 3 & . & 5 & 1 & 1 \\ 2 & 1 & & 2 & & \end{array}$$

Use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.			