PROGRESSION THROUGH CALCULATIONS FOR ADDITION

We acknowledge Lancashire County Council as the main source for this document with some amendments from the Horwich and Blackrod Cluster.

It is imperative that children gain concrete experiences through play and manipulation before moving to any structured work or method. This is essential when any new concept is introduced.

- These standards are age-related expectations and therefore we expect the majority of children to achieve them.
- New learning is likely to be taught to groups rather than the whole class to acknowledge the different learning stages of the children.
- Children should understand that addition is commutative and therefore calculations can be rearranged, e.g. 4 + 13 = 17 is the same as 13 + 4 = 17.
- Ensure that children understand the = sign means is the same as, not makes, and that children see calculations where the equals sign is in a different position, e.g. 3 + 2 = 5 and 5 = 3 + 2.
- Children should be encouraged to approximate before calculating and check whether their answer is reasonable.

By the end of year 6, children will have a range of calculation methods, mental and written. Selection will depend upon the numbers involved.

Children should not be made to go onto the next stage if:

1) **they are not ready.**
2) **they are not confident.**

Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.

In developing a written method for addition, it is important that children understand the concept of addition, in that it is:
- Combining two or more groups to give a total or sum
- Increasing an amount

They also need to understand and work with certain principles, i.e. that it is:
- the inverse of subtraction
- commutative i.e. 5 + 3 = 3 + 5
- associative i.e. 5 + 3 + 7 = 5 + (3 + 7)

The fact that it is commutative and associative means that calculations can be rearranged, e.g. 4 + 13 = 17 is the same as 13 + 4 = 17.

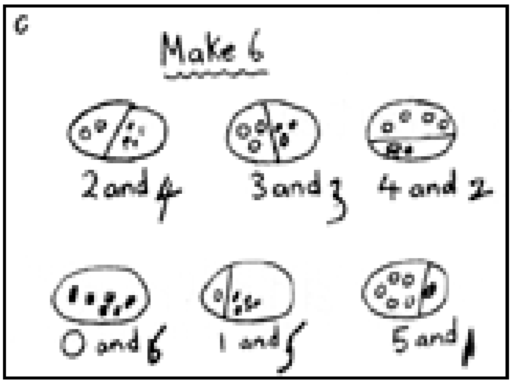
Units is the collective term for grams, Kg etc. Ones replaces unit within this policy to reflect the base 10 nature of our number system. Nine **ones** plus one equal 10 **(tens).** 10 lots of 10 equal 100 **(hundreds).**

RECEPTION

Early Learning Goal:
Using quantities and objects, children add two single-digit numbers and count on to find the answer.

Before a child embarks upon calculations they need to be secure at counting (Counting Policy tbc) *i e. learn number names, say number names in the correct order, count with 1:1 correspondence, conserve number, cardinality of number, represent numbers in different configurations on fingers (grow, know, throw- bunny ears)*

Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They should experience practical calculation opportunities using a wide variety of equipment, e.g. small world play, role play, counters, cubes etc. They develop ways of recording calculations using pictures, etc.

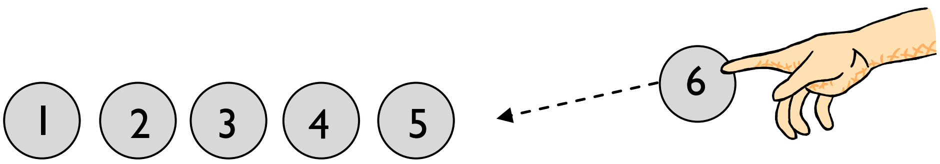


- Count all
- Count first
- Count on
- Count biggest
- Hide one number
- Hide both numbers

Children **who are ready** may record this as:
6 = 2 + 4   6 = 3 + 3   6 = 4 + 2   6 = 0 + 6   6 = 1 + 5   6 = 5 + 1

Counting all method
Children will begin to develop their ability to add by using practical equipment to count out the correct amount for each number in the calculation and then combine them to find the total. For example, when calculating 4 + 2, they are encouraged to count out four counters and count out two counters.

To find how many altogether, touch and drag them into a line one at a time whilst counting.



By touch counting and dragging in this way, it allows children to keep track of what they have already counted to ensure they don't count the same item twice.

Counting on method
To support children in moving from a counting all strategy to one involving counting on, children should still have two groups of objects but one should be covered so that it cannot be counted. For example, when calculating 4 + 2, count out the two groups of counters as before.

then cover up the larger group with a cloth.

For most children, it is beneficial to place the digit card on top of the cloth to remind the children of the number of counters underneath. They can then start their count at 4, and touch count 5 and 6 in the same way as before, rather than having to count all of the counters separately as before.

Those who are ready may record their own calculations.

Children need to know number bonds within 10 i.e bonds to 6,7,8,& 9

Resources: White Boards, ITPs, Counters, cubes, animals, cars, compare bears, camels, Numicon, straws, pennies, pegs, socks set rings, plates etc.

Key Vocabulary : more/less, biggest/smallest, add, altogether, makes, sum, calculation, 1 more, how many, is the same as

Y1

End of Year Objective:
Add one-digit and two-digit numbers to 20, including zero (using concrete objects and pictorial representations).

Children will initially use practical equipment and everyday situations to combine groups of objects to find the total. Use bundles of straws to make 11-20 with bundles of 10 and single straws e.g. 11= 1 bundle of 10 and 1 single straw. Ensure children know the difference between ‘ty’ and ‘teen’ numbers.

They will move on to the use of number tracks and Base 10 equipment to support their developing understanding of addition. If possible, use two different colours of base 10 equipment so that the initial amounts can still be seen. Learn to represent 2 digit numbers in pictorial form

The ones can then be combined to aid with seeing the final total, e.g. so 11 + 5 = 16.

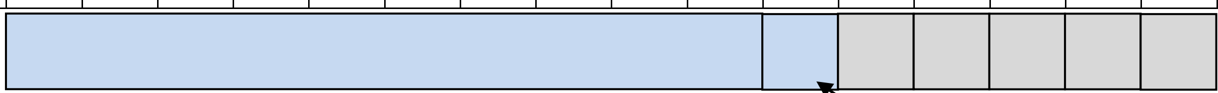
If possible, they should use two different colours of base 10 equipment so that the initial amounts can still be seen (11 in blue 5 in grey).

11 =

Add a 2 digit number to a single digit number eg.

11 + 5 =

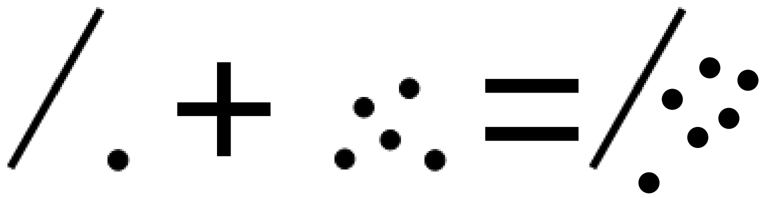
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17



11 + 5 = 16

Model of Base 10 equipment

This can also be represented as



Help children to reinforce their understanding using subitizing.

Resources ; White Boards, ITPs, Counters, cubes, animals, cars, compare bears, camels, straws, pennies, pegs, socks set rings, plates, base 10 equipment, number lines

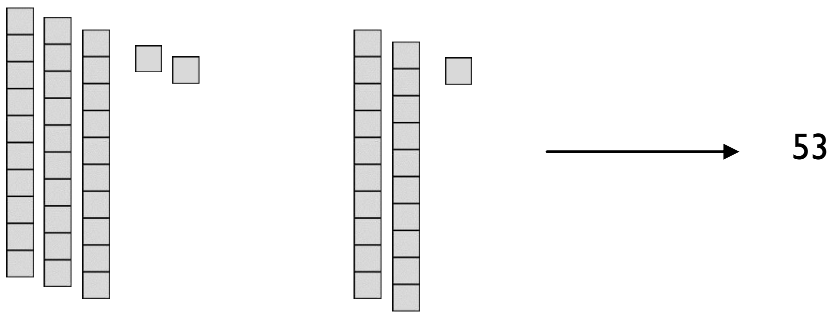
Key Vocabulary : more/less, biggest/smallest, add, altogether, makes, sum, calculation, 1 more, how many, total, score, addition, double, ten, distance between, tens and ones

Y2

End of Year Objective:
Add numbers using concrete objects, pictorial representations, and mentally, including: a two-digit number and ones; a two-digit number and tens; two, two-digit numbers; three one-digit numbers.

Children will continue to use the Base 10 equipment to support their calculations. They will record the calculations using their own drawings of the Base 10 equipment (as lines for the 10 rods and dots for the ones)

Children will continue to use the Base 10 equipment to support their calculations. For example, to calculate 32 + 21, they can make the individual amounts, counting the tens first and then count on the ones.

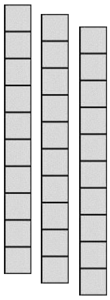


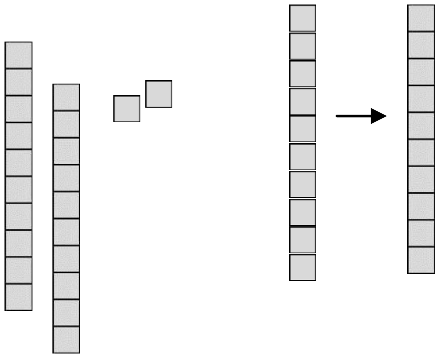
When the ones total more than 10, children should be encouraged to exchange 10 ones for 1 ten. This is the start of children understanding ‘carrying’ as part of exchanging in vertical addition.

For example, when calculating

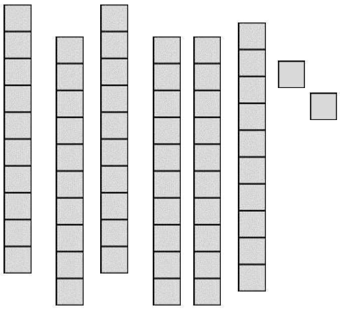
35 + 27, they can represent the amounts using Base 10 as shown:

Then, identifying the fact that there are enough ones to exchange for a ten, they can carry out this exchange:

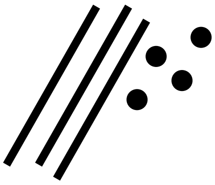


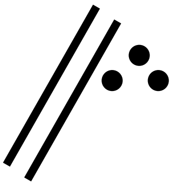


To leave:

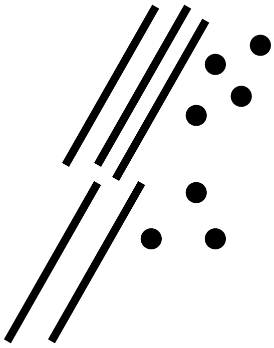


e.g. 34 + 23 =





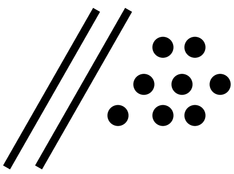
and vertically

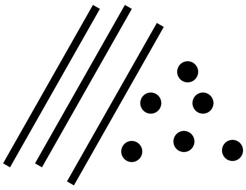


34 + 23 = 57

They would add the ones first and then count on the tens.

e.g. 28 + 36 =

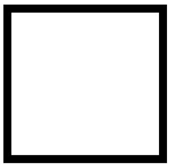




14, 24, 34, 44, 54, 64

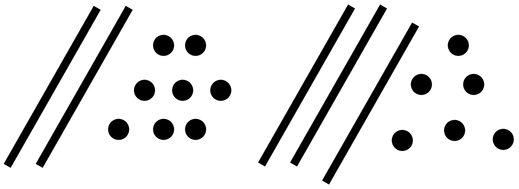
28 + 36 = 64

Introduce Base 10 hundred square as

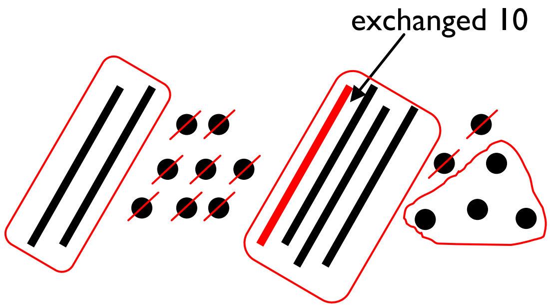


When the ones total more than 10, children should be encouraged to exchange 10 ones for 1 ten. This is the start of children understanding ‘carrying’ in vertical addition.

With exchange:
e.g. 28 + 36 =



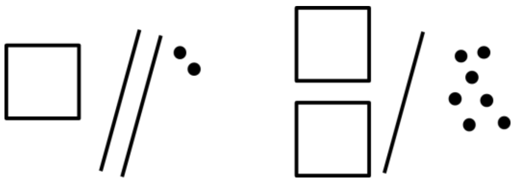
will become



so 28 + 36 = 64

It is important that children circle the remaining tens and ones after exchange to identify the amount remaining.

This method can also be used with adding three digit numbers, e.g. 122 + 217 using a square as the representation of 100.



Resources ; White Boards, ITPs, Counters, cubes, animals, cars, compare bears, camels, straws, pennies, pegs, socks set rings, plates, base 10 equipment including 100 square, place value charts

Key Vocabulary : more/less, biggest/smallest, add, altogether, makes, sum, calculation, 1 more, how many, total, score, addition, double, ten, distance between, 100, 2 more, 10 more

Y3

End of Year Objective:
Add numbers with up to three digits, using formal written method of columnar addition.*

**Although the objective suggests that children should be using formal written methods, the National Curriculum document states "The programmes of study for mathematics are set out year-by-year for key stages 1 and 2. Schools are, however, only required to teach the relevant programme of study by the end of the key stage. Within each key stage, schools therefore have the flexibility to introduce content earlier or later than set out in the programme of study." p4*

It is more beneficial for children's understanding to go through the expanded methods of calculation as steps of development towards a formal written method.

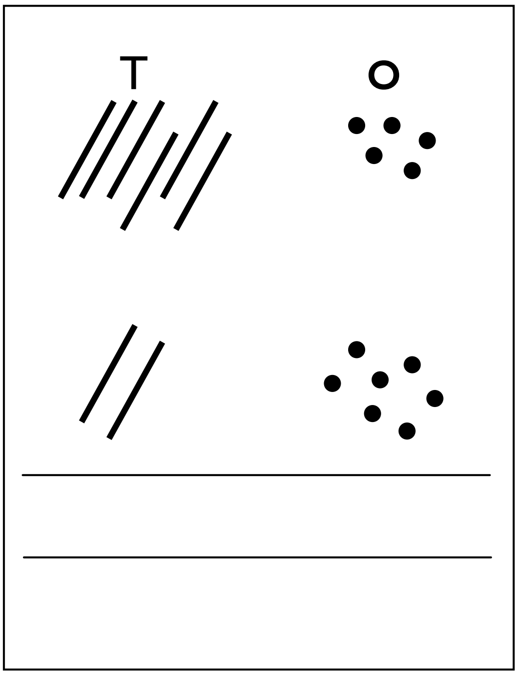
Children should learn how to round to the nearest 10.

Children will build on their knowledge of using Base 10 equipment from Y2 and continue to use this to support them with the transition into a vertical method. Only use vertical method when children are ready.

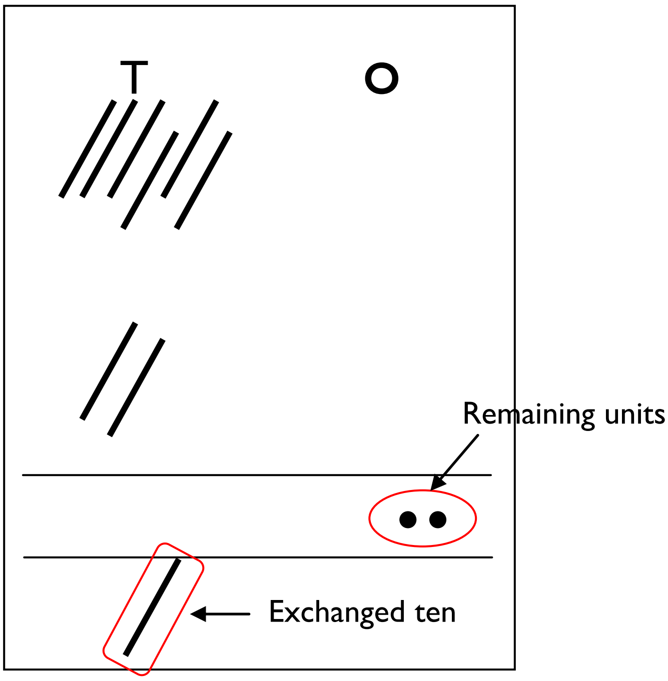
Children should add the **least significant digits** first (i.e. start with the ones), and in an identical method to that from year 2, should identify whether there are more than ten ones which can be exchanged for one ten.

They can use a place value grid to practically begin to set the calculation out vertically and to support their knowledge of exchange between columns (as in Step 1below).
e.g. 65 + 27

Step 1



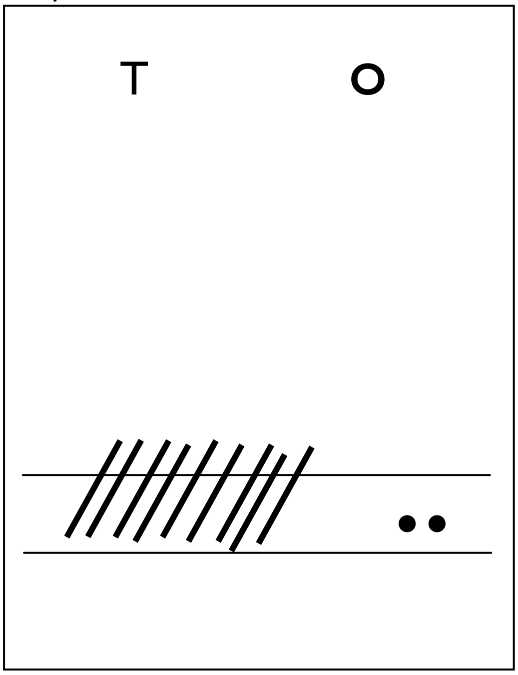
Step 2



Children would exchange ten ones for a ten, placing the exchanged ten below the equals sign. Clarify the equal sign in this different representation. Any remaining ones that cannot be exchanged for a ten move into the equals sign as they are the ones part of the answer (as in Step 2 above).

If there are any tens that can be exchanged for a hundred, this can be done next. If not, the tens move into the equals sign as they are the tens part of the answer (as in Step 3 below).

Step 3



Written method

Step 1

	T	O
	6	5
+	2	7

Step 2

	T	O
	6	5
+	2	7
		2
	1	

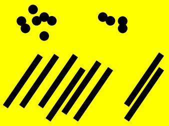
Step 3

	T	O
	6	5
+	2	7
	9	2
	1	

Children should utilise this practical method to link their understanding of exchange to how the column method is set out. Teachers should model the written method alongside this practical method initially.

Children should record the practical method and written method alongside one another until their understanding is secure and they can reason the written method and represent it back independently. Eventually children will utilise only the written method.

By the end of year 3, children should also extend this method for three digit numbers.

TO (Tens and Ones)			**HTO**	
67			267	
+ 24			+ 85	
1 1	*(7 + 4)*		12	*(7 + 5)*
80	*(60 + 20)*		140	*(60 + 80)*
9 1			200	
			352	

Teacher to model crossing boundaries using equipment.

In mental methods children will also learn that 60 +7 = 67 and 60 + 20 = 80, showing understanding through partitioning, jottings and number lines

NB The highlighted calculations are for modelling by the teacher to support understanding but should not be written by pupil in their answer.

Resources ; White Boards, ITPs, Counters, cubes, animals, cars, compare bears, camels, straws, pennies, pegs, socks set rings, plates, base 10 equipment including 100 square, place value charts

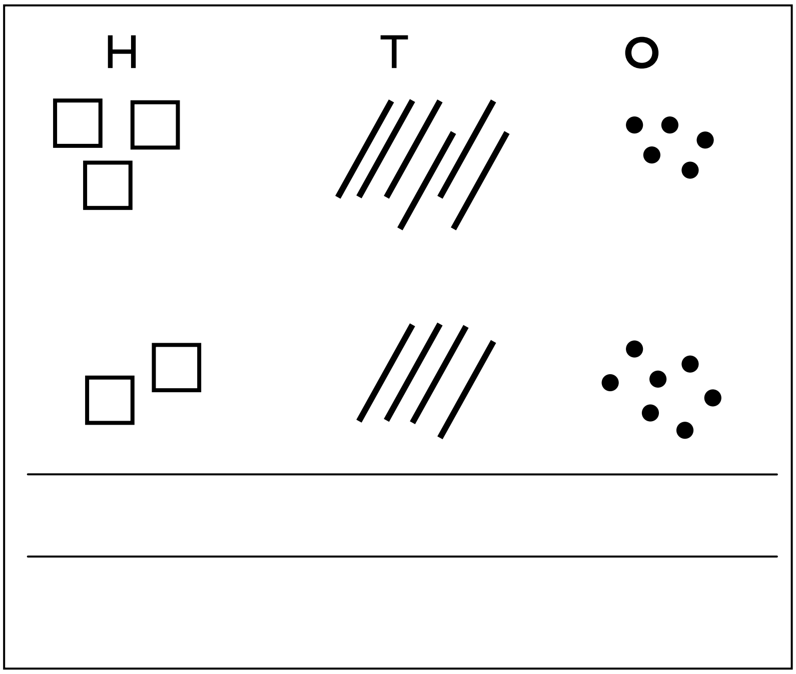
Key Vocabulary : more/less, biggest/smallest, add, altogether, makes, sum, calculation, 1 more, how many, total, score, addition, double, ten, distance between, place value, 100s, 10s, 0nes, 2 more, 10 more, exchange, carry, vertical method

Y4

End of Year Objective:
Add numbers with up to 4 digits *and decimals with one decimal place* using the formal written method of columnar addition where appropriate.

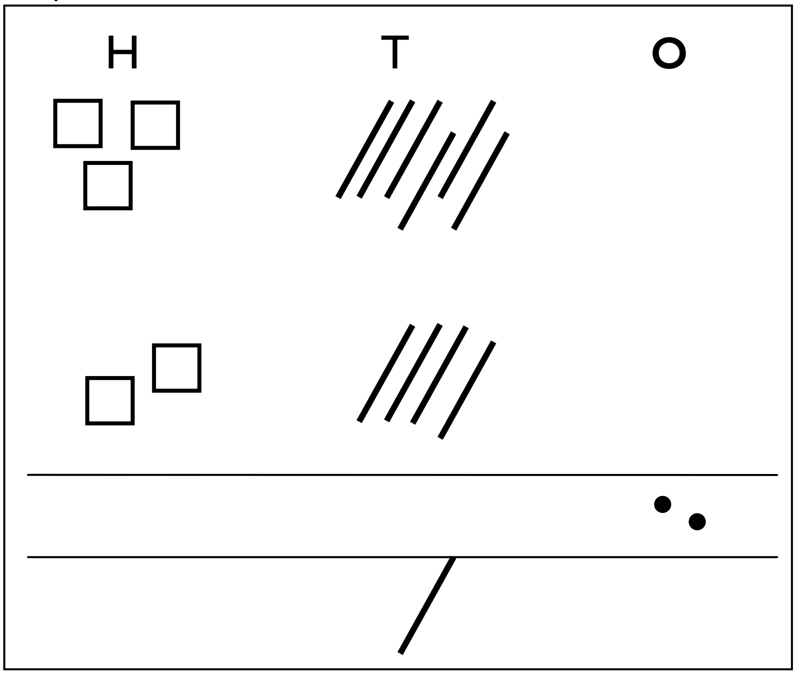
Children should learn how to round to the nearest 10s and 100s
Children will move to year 4 using whichever method they were using as they transitioned from year 3.

Step 1



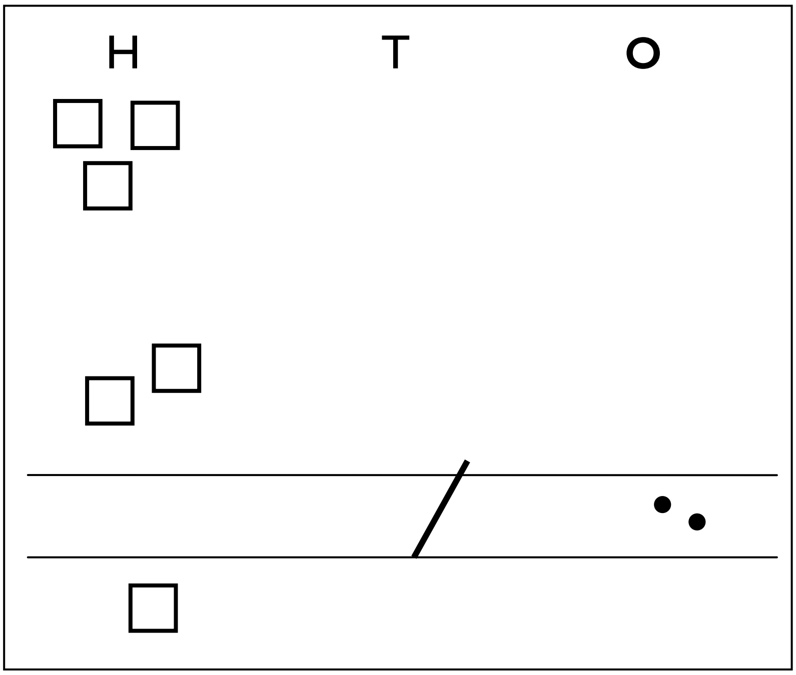
$$\begin{array}{cccc} & H & T & O \\ & 3 & 6 & 5 \\ + & 2 & 4 & 7 \\ \hline & & & \\ \hline \end{array}$$

Step 2



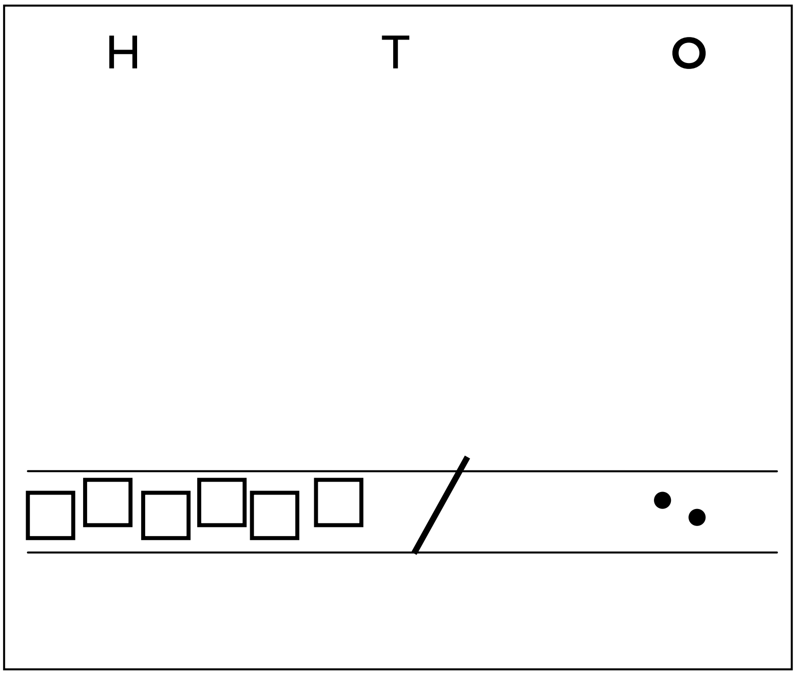
$$\begin{array}{cccc} & H & T & O \\ & 3 & 6 & 5 \\ + & 2 & 4 & 7 \\ \hline & & & 2 \\ \hline & & 1 & \end{array}$$

Step 3



	H	T	O
	3	6	5
+	2	4	7
		1	2
	1	1	

Step 4



	H	T	O
	3	6	5
+	2	4	7
	6	1	2
	1	1	

By the end of year 4, children should be using the written method confidently and with understanding. They will also be adding:

- several numbers with different numbers of digits, understanding the place value;
- *decimals with one decimal place, knowing that the decimal points line up under one another.*

Children need to be able to convert between any units of measure e.g. £ to p

Resources ; White Boards, ITPs, Counters, cubes, animals, cars, compare bears, camels, straws, pennies, pegs, socks set rings, plates, base 10 equipment, place value chart, 100 square.

Key Vocabulary : more/less, biggest/smallest, add, altogether, makes, sum, calculation, 1 more, how many, total, score, addition, double, ten, distance between, place value, 1000s, 100s,10s , ones, 2 more, 10 more, exchange, carry, vertical method, increase, near double

Y5

End of Year Objective:
Add whole numbers with more than 4 digits *and decimals with two decimal places*, including formal written methods (columnar addition).

Children should learn how to round to the nearest 10s, 100s, 1000s and 1/10s.

Children should extend the carrying method to numbers with at least four digits.

$$\begin{array}{ccccc} & 3 & 3 & 6 & 4 \\ + & & 2 & 4 & 7 \\ \hline & 3 & 6 & 1 & 1 \\ \hline & & 1 & 1 & \end{array} \qquad \begin{array}{ccccc} & 3 & 1 & 2 & 1 \\ & & & 3 & 7 \\ + & & 1 & 4 & 8 \\ \hline & 3 & 3 & 0 & 6 \\ \hline & & 1 & 1 & \end{array} \qquad \begin{array}{ccccc} & 3 & . & 5 & 6 \\ + & 2 & . & 4 & 7 \\ \hline & 6 & . & 0 & 3 \\ \hline & & & 1 & \end{array}$$

They will also be adding:

- several numbers with different numbers of digits, understanding the place value;
- *decimals with up to two decimal places (with each number having the same number of decimal places), knowing that the decimal points line up under one another.*
- amounts of money and measures, including those where they have to initially convert from one unit to another

Resources ; White Boards, ITPs, Counters, cubes, animals, cars, compare bears, camels, straws, pennies, pegs, socks set rings, plates, base 10 equipment including 100 square.

Key Vocabulary : more/less, biggest/smallest, add, altogether, makes, sum, calculation, 1 more, how many, total, score, addition, double, ten, distance between, place value, 10,000s, 1000s, 100s, 10s, ones, 2 more, 10 more, exchange, carry, vertical method, increase, near double, decimal, tenths, hundredths.

Y6

End of Year Objective:
Add whole numbers and decimals using formal written methods (columnar addition).

Children should learn how to round to the nearest 10s, 100s, 1000s, 1/10s and 1/100s.

Children should extend the carrying method to numbers with any number of digits.

$$\begin{array}{r} 7648 \\ +\ 1486 \\ \hline 9134 \\ \hline {\scriptstyle 1\ 11\ } \end{array} \qquad \begin{array}{r} 6584 \\ +\ 5848 \\ \hline 12432 \\ \hline {\scriptstyle 1\ 1\ 1\ } \end{array} \qquad \begin{array}{r} 42 \\ 6432 \\ 786 \\ 3 \\ +\ 4681 \\ \hline 11944 \\ \hline {\scriptstyle 1\ 2\ \ 1\ } \end{array}$$

$$\begin{array}{r} 401.20 \\ 26.85 \\ 0.71 \\ \hline 428.76 \\ \hline 1\ \ \ \ \ \ \end{array}$$

When adding decimals with different numbers of decimal places, children should be taught and encouraged to make them the same through identification that 2 tenths is the same as 20 hundredths, therefore, 0.2 is the same value as 0.20.

They will also be adding:

- several numbers with different numbers of digits, understanding the place value;
- *decimals with up to two decimal places (with mixed numbers of decimal places), knowing that the decimal points line up under one another.*
- amounts of money and measures, including those where they have to initially convert from one unit to another e.g. kg to g
- *know that decimal points should line up under each other, particularly when adding or subtracting mixed amounts, and whole numbers e.g. 3 + 401.2 + 26.85 + 0.71.*

Resources ; White Boards, ITPs, Counters, cubes, animals, cars, compare bears, camels, straws, pennies, pegs, socks set rings, plates, base 10 equipment including 100 square.

Key Vocabulary : more/less, biggest/smallest, add, altogether, makes, sum, calculation, 1 more, how many, total, score, addition, double, ten, distance between, place value, 1000000s, 100000s, 10,000s, 1000s, 100s, 10s, ones, 2 more, 10 more, exchange, carry, vertical method, increase, near double, decimal, tenths, hundredths.