

Progression Towards a Written Method for Addition

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 $13 + 4 = 17$.

YR

Early Learning Goal:

Have a deep understanding of number to 10, including the composition of each number.

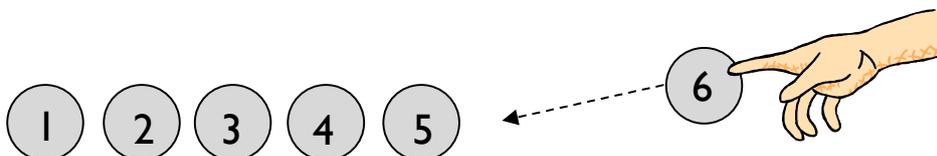
Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They should experience practical calculation opportunities using a wide variety of practical equipment, including small world play, role play, counters, cubes etc. By the end of the year children will be able to automatically recall (without reference to rhymes, counting or other aids) number bonds up to 5 (including subtraction facts) and some number bonds to 10, including double facts.

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.

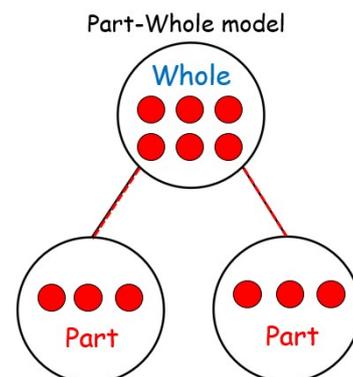


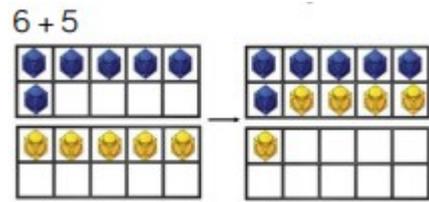
To find how many altogether, touch and drag them into a line one at a time whilst counting.



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.

Children to use practical equipment to combine two groups using the part whole model.

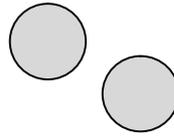
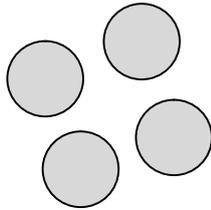




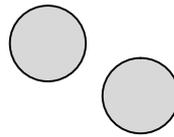
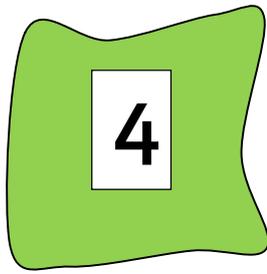
Regrouping to make 10; using ten frames and counters/cubes.

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.

Y1

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

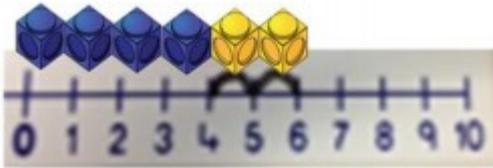
Children will continue to use practical equipment, combining groups of objects to find the total by counting all or counting on. Using their developing understanding of place value, they will move on to be able to use ten frames, part whole models, bar models and number lines.

For example,

| | |
|--|---|
| <p>Ten Frames</p> <p>$12 + 3 = 15$</p> | <p>Part Whole Model</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>$10 = 2 + 8$</p> </div> <div style="text-align: center;"> <p>$20 = 12 + 8$</p> </div> </div> |
|--|---|

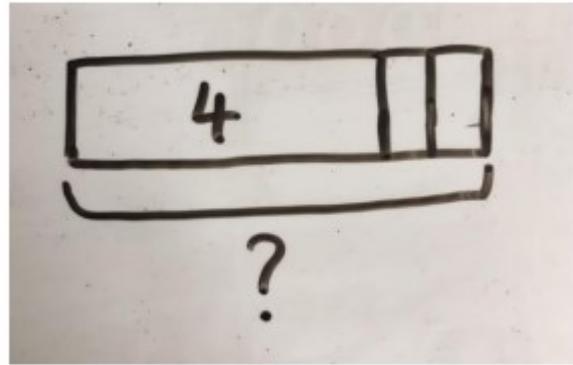
Number line

$4+2$



Bar Model

$4+2$

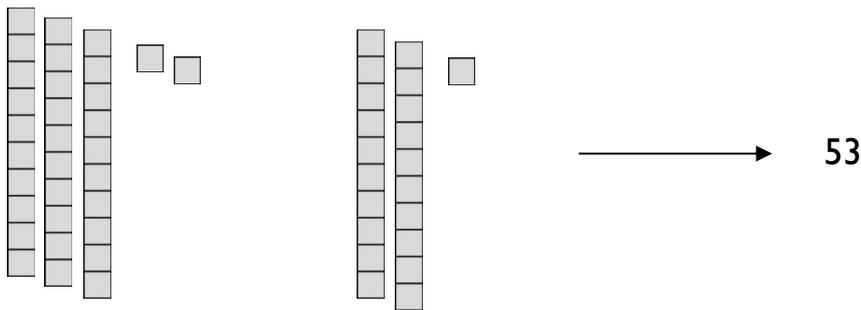


Y2

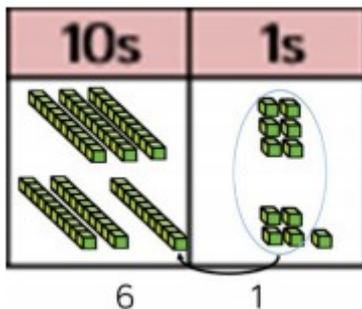
End of Year Objective:

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. For example, to calculate $32 + 21$, they can make the individual amounts, counting the tens first and then count on the units.

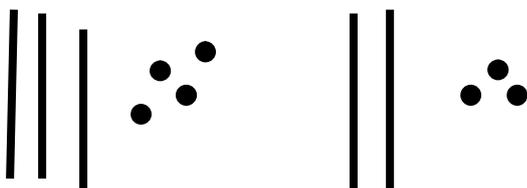


When the units total more than 10, children should be encouraged to exchange 10 units/ones for 1 ten. This is the start of children understanding 'carrying' in vertical addition. For example, when calculating $36 + 25$, they can represent the amounts using Base 10 as shown:

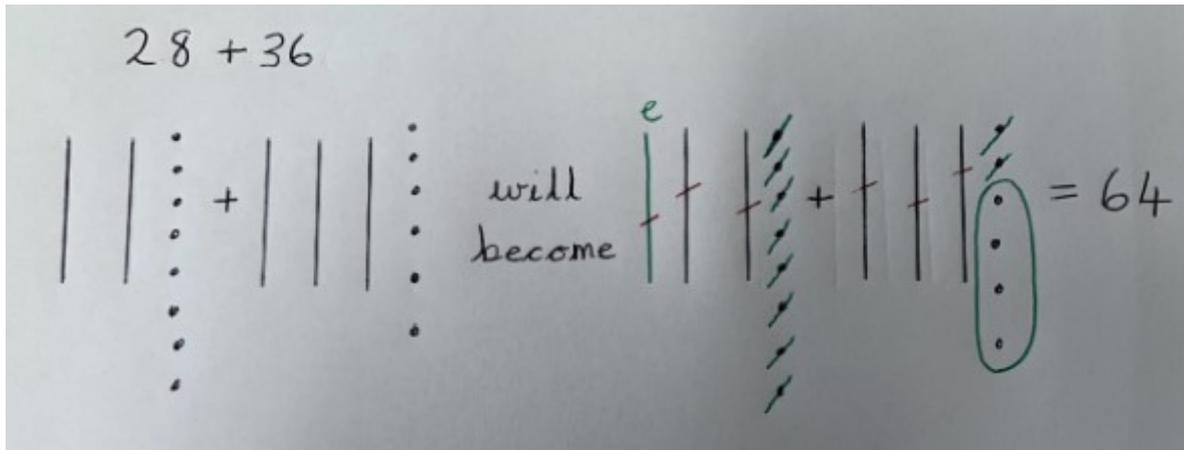


Then, identifying the fact that there are enough units/ones to exchange for a ten, they can carry out this exchange:

Children can also record the calculations using their own drawings of the Base 10 equipment.
e.g. $34 + 23 =$

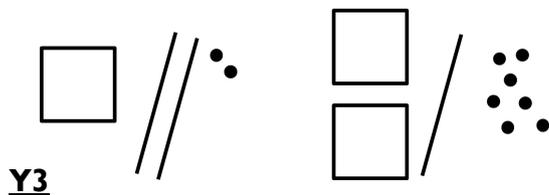


With exchange:
e.g. $28 + 36 =$



so $28 + 36 = 64$

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



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.

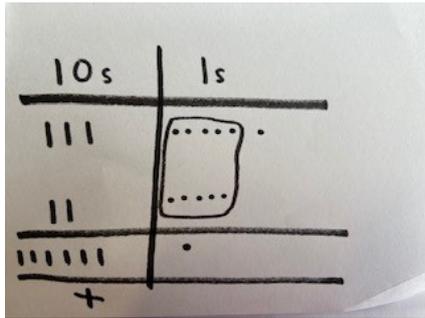
Children will build on their knowledge of using Base 10 equipment from Y2 and continue to use the idea of exchange.

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 greater than ten units which can be exchanged for one ten.

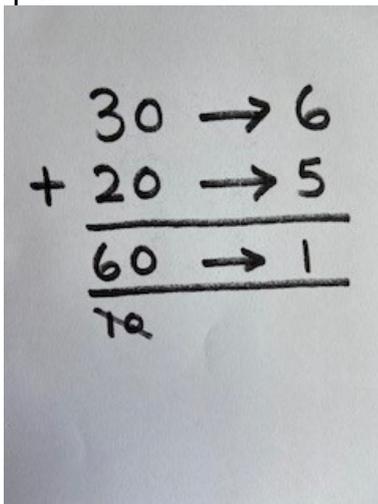
Children to represent the base 10 in a place value grid. They can use a place value grid to begin to set the calculation out vertically and to support their knowledge of exchange between columns. Then use an expanded format and look for ways to make 10. Then progress to a formal method.

e.g. $36 + 25$

Step 1



Step 2



Step 3

$$\begin{array}{r} 36 \\ +25 \\ \hline 61 \\ \hline 1 \end{array}$$

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. This should progress to children utilising the written and practical methods alongside each other and finally, and when they are ready, to children utilising just the written method.

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

Y4

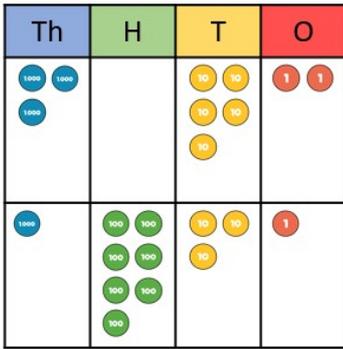
End of Year Objective:

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

Children will move to year 4 using whichever method they were using as they transitioned from year 3. They will use four digit numbers.

Step 1: No exchange

$$1,731 + 3,052 = 4,783$$



+

| Th | H | T | O |
|----|---|---|---|
| 3 | 0 | 5 | 2 |
| 1 | 7 | 3 | 1 |
| 4 | 7 | 8 | 3 |

Step 2: With exchange

Dexter scores 1,351 points in a game. 
 Rosie scores 2,263 points.
 How many points do they score altogether?

| | | | |
|----|---|---|---|
| Th | H | T | O |
| 2 | 2 | 6 | 3 |
| + | 1 | 3 | 5 |
| | | | |

| Th | H | T | O |
|---|--|---|--|
|   |   |       |    |
|  |    |      |  |
| | | | |

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| | | | |
|----|---|---|---|
| Th | H | T | O |
| 2 | 2 | 6 | 3 |
| + | 1 | 3 | 5 |
| | 6 | 1 | 4 |
| | 1 | | |

| Th | H | T | O |
|---|--|---|---|
|   |   | |    |
|  |    |  |  |
| 3 | 6 | 1 | 4 |
| |  | | |

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.*

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 continue to use the carrying method to solve calculations such as:

