

## 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  $13 + 4 = 17$ .

### RECEPTION

#### **Early Learning Goal:**

***Using quantities and objects, children add two single-digit numbers***

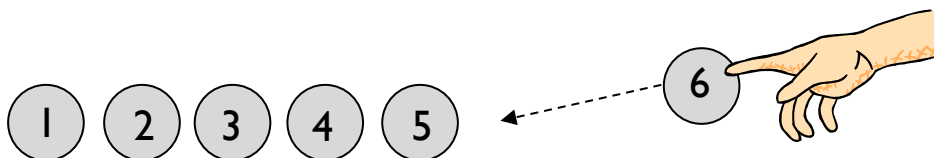
Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They should experience practical calculation opportunities using a wide variety of practical equipment, including small world play, role play, counters, cubes etc.

#### ***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.



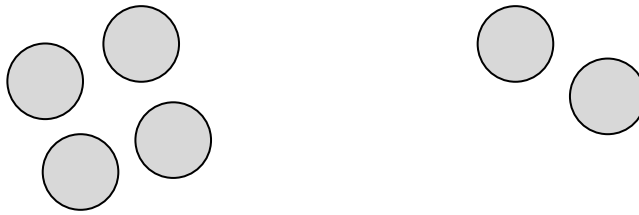
To find how many altogether, touch and drag them into a line one at a time whilst counting.



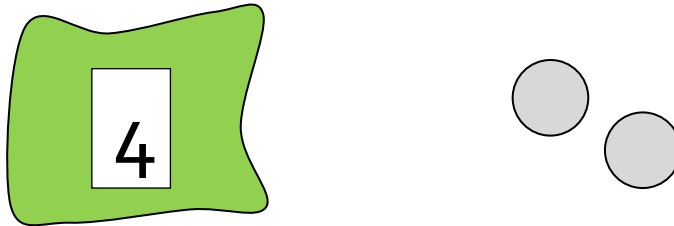
By touch counting and dragging in this way, it allows children to keep track of what they have already counted to ensure they don't count the same item twice.

### 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.

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**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 Base 10 equipment to make teens numbers using separate tens and units.

For example, when adding 11 and 5, they can make the 11 using a ten rod and a unit.



The units can then be combined to aid with seeing the final total, e.g.

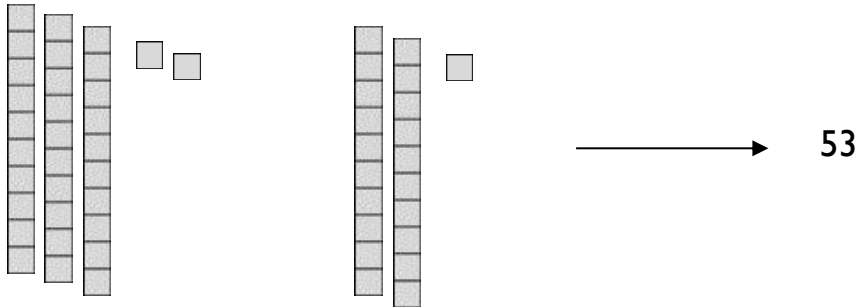


so  $11 + 5 = 16$ . If possible, they should use two different colours of base 10 equipment so that the initial amounts can still be seen.

**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. Add numbers with up to three digits, using formal written method of columnar addition (For those who are ready to record in this way.**

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.

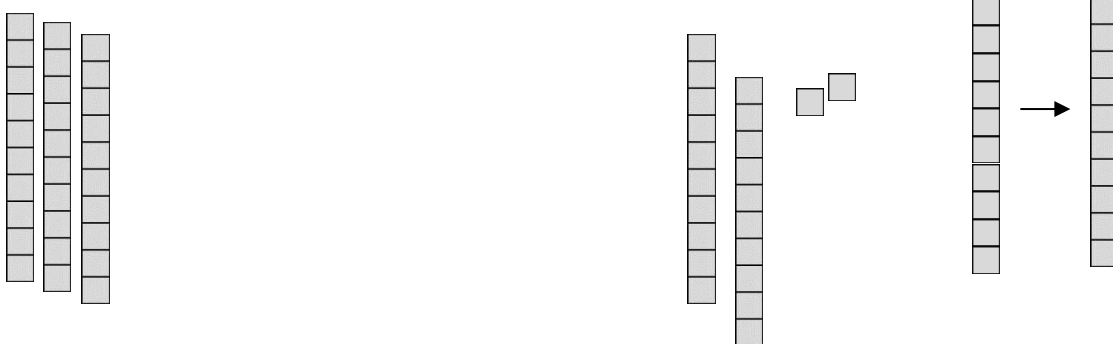


When the units total more than 10, children should be encouraged to **exchange** 10 units/ones for 1 ten. This is the start of children understanding 'carrying' in vertical addition. For example, when calculating

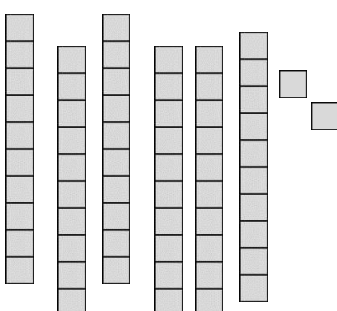
$35 + 27$ , they can represent the amounts using Base 10 as shown:



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



To leave:



Children will build on their knowledge of using Base 10 equipment from and continue to use the idea of exchange as they progress to the formal written method.

Written method

Step 1	Step 2	Step 3
$\begin{array}{r} \text{T} \quad \text{U} \\ 6 \quad 5 \\ + 2 \quad 7 \\ \hline \end{array}$	$\begin{array}{r} \text{T} \quad \text{U} \\ 6 \quad 5 \\ + 2 \quad 7 \\ \hline 2 \end{array}$	$\begin{array}{r} \text{T} \quad \text{U} \\ 6 \quad 5 \\ + 2 \quad 7 \\ \hline 9 \quad 2 \\ \hline \end{array}$

### Y3

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

Children will continue to use the formal written method.

Step 1	Step 2	Step 3
$\begin{array}{r} \text{T} \quad \text{U} \\ 6 \quad 5 \\ + 2 \quad 7 \\ \hline \end{array}$	$\begin{array}{r} \text{T} \quad \text{U} \\ 6 \quad 5 \\ + 2 \quad 7 \\ \hline 2 \end{array}$	$\begin{array}{r} \text{T} \quad \text{U} \\ 6 \quad 5 \\ + 2 \quad 7 \\ \hline 9 \quad 2 \\ \hline \end{array}$

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

$$\begin{array}{r} \text{H} \quad \text{T} \quad \text{U} \\ 3 \quad 6 \quad 5 \\ + 2 \quad 4 \quad 7 \\ \hline \\ \hline \end{array}$$

## 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 continue to use the formal written method:

$$\begin{array}{r} \text{H T U} \\ 365 \\ + 247 \\ \hline \phantom{36}2 \\ \hline | \end{array}$$

$$\begin{array}{r} \text{H T U} \\ 365 \\ + 247 \\ \hline \phantom{36}12 \\ \hline | | \end{array}$$

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:

$$\begin{array}{r} 3364 \\ + 247 \\ \hline 3611 \\ \hline | | \end{array}$$

$$\begin{array}{r} 3121 \\ \phantom{31}37 \\ + \phantom{31}148 \\ \hline 3306 \\ \hline | | \end{array}$$

$$\begin{array}{r} 3.56 \\ + 2.47 \\ \hline 6.03 \\ \hline | \end{array}$$

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

## Y6

### End of Year Objective:

**Add whole numbers and decimals using formal written methods (columnar addition).**

Children should extend the carrying method and use it to add whole numbers and decimals with any number of digits.

$$\begin{array}{r} \phantom{+} \phantom{4} \phantom{6} \phantom{8} \phantom{1} \\ \phantom{+} \phantom{6} \phantom{4} \phantom{3} \phantom{2} \\ \phantom{+} \phantom{7} \phantom{8} \phantom{6} \\ \phantom{+} \phantom{3} \\ + \phantom{4} \phantom{6} \phantom{8} \phantom{1} \\ \hline 1 \phantom{1} \phantom{9} \phantom{4} \phantom{4} \\ \hline 1 \phantom{1} \phantom{2} \phantom{1} \end{array}$$

$$\begin{array}{r} \phantom{+} \phantom{4} \phantom{0} \phantom{1} \phantom{.} \phantom{2} \phantom{0} \\ \phantom{+} \phantom{2} \phantom{6} \phantom{.} \phantom{8} \phantom{5} \\ + \phantom{0} \phantom{.} \phantom{7} \phantom{1} \\ \hline 4 \phantom{2} \phantom{8} \phantom{.} \phantom{7} \phantom{6} \\ \hline 1 \end{array}$$

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. This is known as a place holder.

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.