

Written methods for addition of whole numbers

The aim is that children use mental methods when appropriate, but for calculations that they cannot do in their heads they use an efficient written method accurately and with confidence. Children are entitled to be taught and to acquire secure mental methods of calculation and one efficient written method of calculation for addition which they know they can rely on when mental methods are not appropriate. These notes show the stages in building up to using an efficient written method for addition of whole numbers by the end of Year 4.

To add successfully, children need to be able to:

- recall all addition pairs to $9 + 9$ and complements in 10;
- add mentally a series of one-digit numbers, such as $5 + 8 + 4$;
- add multiples of 10 (such as $60 + 70$) or of 100 (such as $600 + 700$) using the related addition fact, $6 + 7$, and their knowledge of place value;
- partition two-digit and three-digit numbers into multiples of 100, 10 and 1 in different ways.

Note: It is important that children's mental methods of calculation are practised and secured alongside their learning and use of an efficient written method for addition.

Method	Example
<p>Stage 1: The empty number line</p>	
<p>The mental methods that lead to column addition generally involve partitioning, e.g. adding the tens and ones separately, often starting with the tens. Children need to be able to partition numbers in ways other than into tens and ones to help them make multiples of ten by adding in steps.</p> <p>The empty number line helps to record the steps on the way to calculating the total.</p>	<p>Steps in addition can be recorded on a number line. The steps often bridge through a multiple of 10.</p> <p>$8 + 7 = 15$</p>  <p>$48 + 36 = 84$</p>  <p>or:</p> 
<p>Stage 2: Partitioning</p>	
<p>The next stage is to record mental methods using partitioning. Add the tens and then the ones to form partial sums and then add these partial sums.</p>	<p>Record steps in addition using partitioning:</p> <p>$47 + 76 = 47 + 70 + 6 = 117 + 6 = 123$</p> <p>$47 + 76 = 40 + 70 + 7 + 6 = 110 + 13 = 123$</p>

Method	Example
<p>Partitioning both numbers into tens and ones mirrors the column method where ones are placed under ones and tens under tens. This also links to mental methods.</p>	<p>Partitioned numbers are then written under one another:</p> $\begin{array}{r} 47 = 40 + 7 \\ + 76 \quad 70 + 6 \\ \hline 110 + 13 = 123 \end{array}$
Stage 3: Expanded method in columns	
<p>Move on to a layout showing the addition of the tens to the tens and the ones to the ones separately. To find the partial sums either the tens or the ones can be added first, and the total of the partial sums can be found by adding them in any order. As children gain confidence, ask them to start by adding the ones digits first always.</p> <p>The addition of the tens in the calculation $47 + 76$ is described in the words 'forty plus seventy equals one hundred and ten', stressing the link to the related fact 'four plus seven equals eleven'.</p> <p>The expanded method leads children to the more compact method so that they understand its structure and efficiency. The amount of time that should be spent teaching and practising the expanded method will depend on how secure the children are in their recall of number facts and in their understanding of place value.</p>	<p>Write the numbers in columns.</p> <p>Adding the tens first:</p> $\begin{array}{r} 47 \\ + 76 \\ \hline 110 \\ 13 \\ \hline 123 \end{array}$ <p>Adding the ones first:</p> $\begin{array}{r} 47 \\ + 76 \\ \hline 13 \\ 110 \\ \hline 123 \end{array}$ <p>Discuss how adding the ones first gives the same answer as adding the tens first. Refine over time to adding the ones digits first consistently.</p>
Stage 4: Column method	
<p>In this method, recording is reduced further. Carry digits are recorded below the line, using the words 'carry ten' or 'carry one hundred', not 'carry one'.</p> <p>Later, extend to adding three two-digit numbers, two three-digit numbers and numbers with different numbers of digits.</p>	$\begin{array}{r} 47 \\ + 76 \\ \hline 123 \\ 11 \end{array} \quad \begin{array}{r} 258 \\ + 87 \\ \hline 345 \\ 11 \end{array} \quad \begin{array}{r} 366 \\ + 458 \\ \hline 824 \\ 11 \end{array}$ <p>Column addition remains efficient when used with larger whole numbers and decimals. Once learned, the method is quick and reliable.</p>