

PROGRESSION THROUGH CALCULATIONS FOR ADDITION

MENTAL CALCULATIONS

(ongoing)

These are a **selection** of mental calculation strategies:

Mental recall of number bonds

$$6 + 4 = 10$$

$$\square + 3 = 10$$

$$25 + 75 = 100$$

$$19 + \square = 20$$

Children should know number bonds for all multiplies of 10

Use doubles and near doubles of small numbers

$$6 + 7 = \text{double } 6 + 1 = 13$$

Addition using partitioning and recombining

$$34 + 45 = (30 + 40) + (4 + 5) = 79$$

Counting on or back in repeated steps of 1, 10, 100, 1000

$$86 + 57 = 143 \text{ (by counting on in tens and then in ones)}$$

$$460 - 300 = 160 \text{ (by counting back in hundreds)}$$

Add the nearest multiple of 10, 100 and 1000 and adjust

$$24 + 19 = 24 + 20 - 1 = 43$$

$$458 + 71 = 458 + 70 + 1 = 529$$

Use the relationship between addition and subtraction

$$36 + 19 = 55$$

$$19 + 36 = 55$$

$$55 - 19 = 36$$

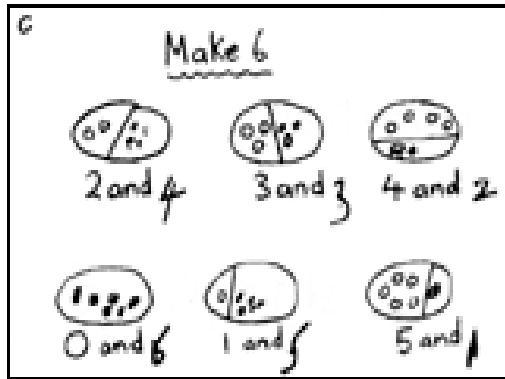
$$55 - 36 = 19$$

MANY MENTAL CALCULATION STRATEGIES WILL CONTINUE TO BE USED. THEY ARE NOT REPLACED BY WRITTEN METHODS.

THE FOLLOWING ARE METHODS THAT WE EXPECT THE MAJORITY OF CHILDREN TO BE ABLE TO ACHIEVE.

Stage 1

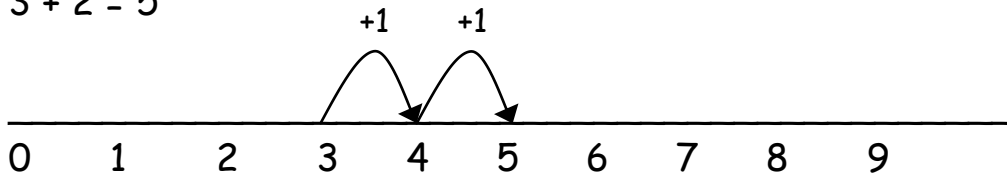
Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They develop ways of recording calculations using pictures, rhymes, songs etc.



Stage 2

They use number lines and practical resources to support calculation and teachers demonstrate the use of the numberline.

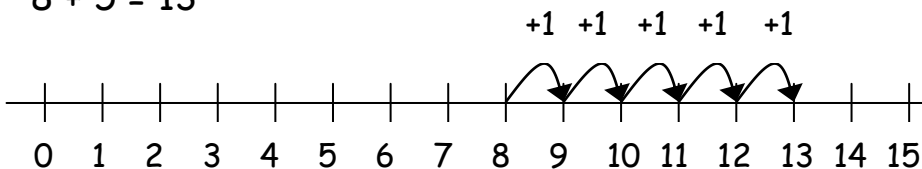
$$3 + 2 = 5$$



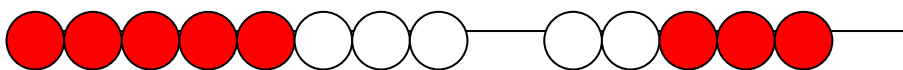
This stage could also be support with a number grid/100 square

Children then begin to use numbered lines to support their own calculations using a numbered line to count on in ones.

$$8 + 5 = 13$$



Bead strings or bead bars can be used to illustrate addition including bridging through ten by counting on 2 then counting on 3.

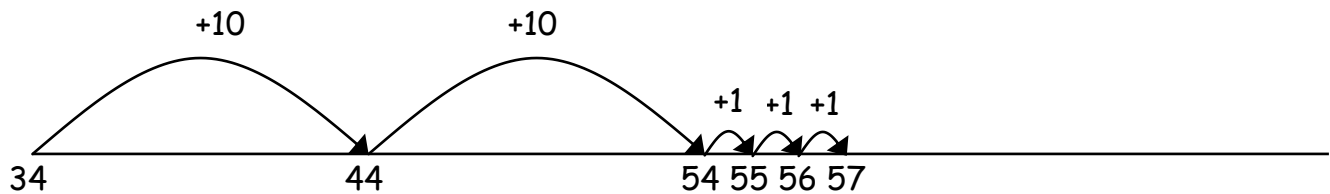


Stage 3

Children will begin to use 'empty number lines' themselves starting with the larger number and counting on.

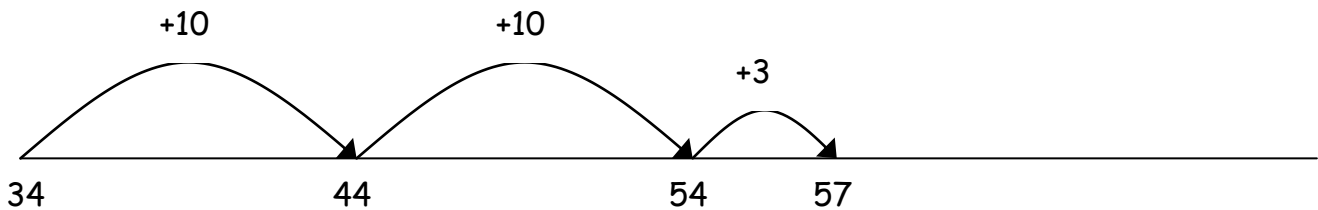
- ✓ First counting on in tens and ones.

$$34 + 23 = 57$$



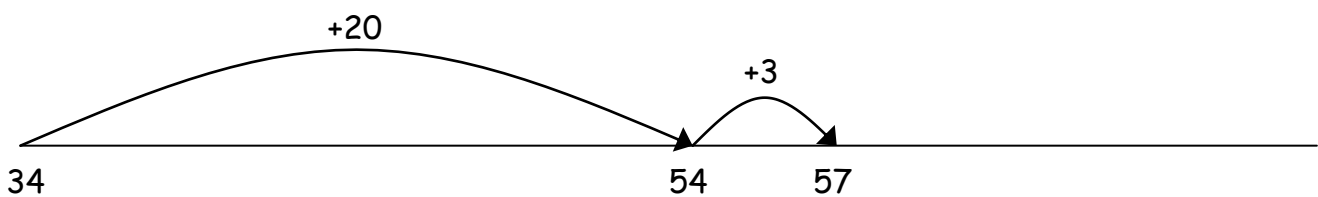
- ✓ Then helping children to become more efficient by adding the units in one jump (by using the known fact $4 + 3 = 7$).

$$34 + 23 = 57$$



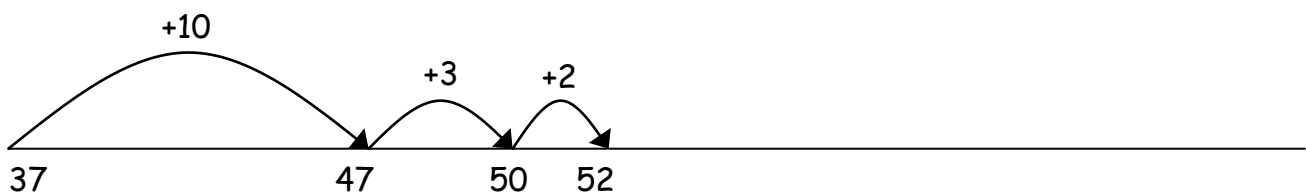
- ✓ Followed by adding the tens in one jump and the units in one jump.

$$34 + 23 = 57$$



- ✓ Bridging through ten can help children become more efficient.

$$37 + 15 = 52$$

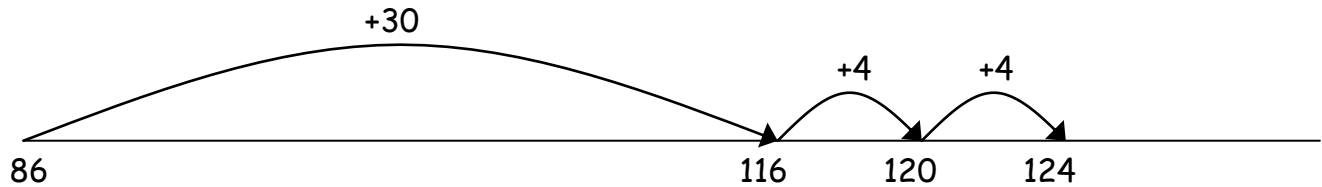


Stage 4

Children will continue to use empty number lines with increasingly large numbers, including compensation where appropriate.

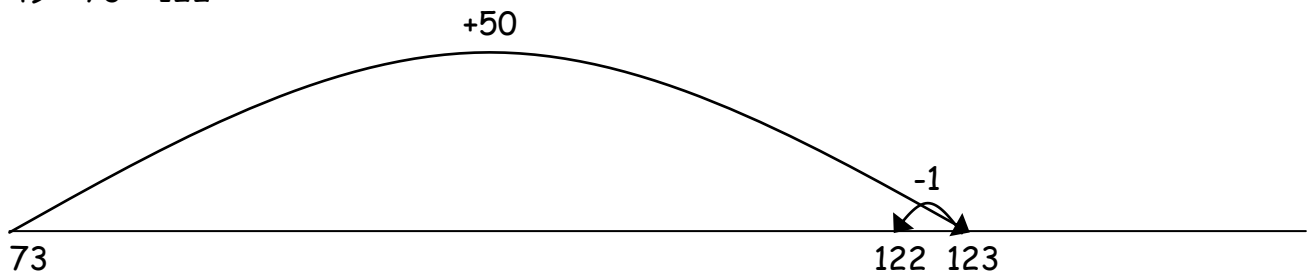
- ✓ Count on from the largest number irrespective of the order of the calculation.

$$38 + 86 = 124$$



- ✓ Compensation by rounding to the nearest 10 and take away the number they had added when rounding.

$$49 + 73 = 122$$



Stage 5

Formal Methods - Addition uses partitioning.

Option 1 - Adding most significant digits first then, moving to adding least significant digits.

$$\begin{array}{r} 67 \\ + 24 \\ \hline 80 \text{ (60 + 20)} \\ \underline{11} \text{ (7 + 4)} \\ 91 \end{array}$$

$$\begin{array}{r} 267 \\ + 85 \\ \hline 200 \\ 140 \text{ (60 + 80)} \\ \underline{12} \text{ (7 + 5)} \\ 352 \end{array}$$

Moving to adding the least significant digits first in preparation for 'carrying'.

$$\begin{array}{r} 67 \\ + 24 \\ \hline 11 \text{ (7 + 4)} \\ \underline{80} \text{ (60 + 20)} \\ 91 \end{array}$$

$$\begin{array}{r} 267 \\ + 85 \\ \hline 12 \text{ (7 + 5)} \\ 140 \text{ (60 + 80)} \\ \underline{200} \\ 352 \end{array}$$

Option 2 - Adding the least significant digits first

$$\begin{array}{r} 67 \\ + 24 \\ \hline 11 \text{ (7 + 4)} \\ \underline{80} \text{ (60 + 20)} \\ 91 \end{array}$$

$$\begin{array}{r} 267 \\ + 85 \\ \hline 12 \text{ (7 + 5)} \\ 140 \text{ (60 + 80)} \\ \underline{200} \\ 352 \end{array}$$

Option 1 can be useful for securing place value but if appropriate children can start at option 2

Stage 6

Addition using the standard method (short method)

From this, children will begin to carry below the line.

$$\begin{array}{r} 625 \\ + 48 \\ \hline 673 \\ \hline 1 \end{array}$$

$$\begin{array}{r} 783 \\ + 42 \\ \hline 825 \\ \hline 1 \end{array}$$

$$\begin{array}{r} 367 \\ + 85 \\ \hline 452 \\ \hline 11 \end{array}$$

Using similar methods, children will:

- ✓ *add several numbers with different numbers of digits;*
- ✓ *begin to add two or more three-digit sums of money, with or without adjustment from the pence to the pounds;*
- ✓ *know that the decimal points should line up under each other, particularly when adding mixed amounts, e.g. £3.59 + 78p.*

Stage 7

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

$$\begin{array}{r} 587 \\ + 475 \\ \hline 1062 \\ \hline 11 \end{array}$$

$$\begin{array}{r} 3587 \\ + 675 \\ \hline 4262 \\ \hline 111 \end{array}$$

Using similar methods, children will:

- ✓ *add several numbers with different numbers of digits;*
- ✓ *begin to add two or more decimal fractions with up to three digits and the same number of decimal places;*
- ✓ *know that decimal points should line up under each other, particularly when adding or subtracting mixed amounts, e.g. 3.2 m - 280 cm.*

Stage 8

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

$$\begin{array}{r} 7648 \\ + 1486 \\ \hline 9134 \\ 111 \end{array}$$

$$\begin{array}{r} 6584 \\ + 5848 \\ \hline 12432 \\ 111 \end{array}$$

$$\begin{array}{r} 42 \\ 6432 \\ 786 \\ 3 \\ + 4681 \\ \hline 11944 \\ 121 \end{array}$$

Using similar methods, children will

- ✓ *add several numbers with different numbers of digits;*
- ✓ *begin to add two or more decimal fractions with up to four digits and either one or two decimal places;*
- ✓ *know that decimal points should line up under each other, particularly when adding mixed amounts, e.g. $401.2 + 26.85 + 0.71$.*

When using mixed numbers children need to understand that place holders do not change the value of the number.

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

The children need to be aware that it does not change the value of the number, just supports with lining up the place value.

+ - + - + - + - + - + - +

By the end of all the stages, 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 i.e. lack of understanding of place value.
- 2) they are not confident with previous stages