

# PROGRESSION THROUGH CALCULATIONS FOR SUBTRACTION

## MENTAL CALCULATIONS

(ongoing)

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

### Mental recall of addition and subtraction facts

$$10 - 6 = 4$$

$$17 - \square = 11$$

$$20 - 17 = 3$$

$$10 - \square = 2$$

### Find a small difference by counting up

$$82 - 79 = 3$$

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

$$86 - 52 = 34 \text{ (by counting back in tens and then in ones)}$$

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

### Subtract the nearest multiple of 10, 100 and 1000 and adjust

$$24 - 19 = 24 - 20 + 1 = 5$$

$$458 - 71 = 458 - 70 - 1 = 387$$

### 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

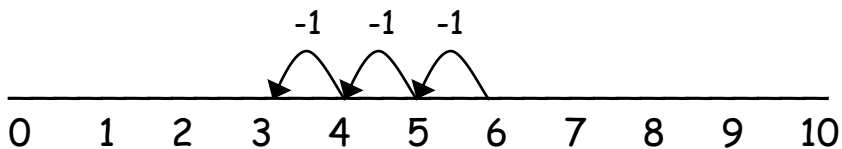
Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They develop ways of recording calculations using pictures etc.



### Stage 2

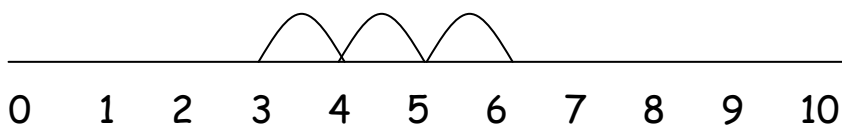
They use number lines and practical resources to support calculation. Teachers *demonstrate* the use of the numberline.

$$6 - 3 = 3$$



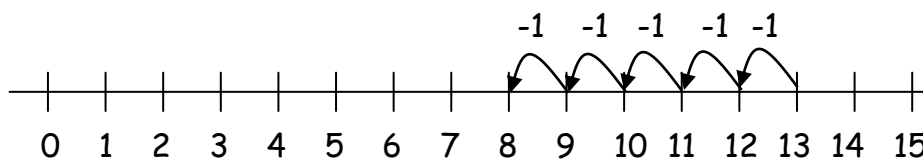
This stage could also be supported with a number grid/100 square

The numberline should also be used to show that  $6 - 3$  means the 'difference between 6 and 3' or 'the difference between 3 and 6' and how many jumps they are apart.



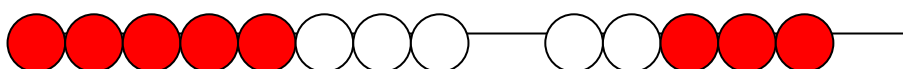
Children then begin to use numbered lines to support their own calculations - using a numbered line to count back in ones.

$$13 - 5 = 8$$



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

$$13 - 5 = 8$$



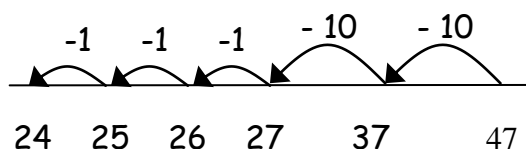
### Stage 3

Children will begin to use empty number lines to support calculations.

#### Counting back

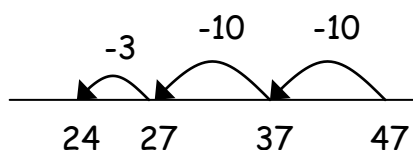
- ✓ First counting back in tens and ones.

$$47 - 23 = 24$$



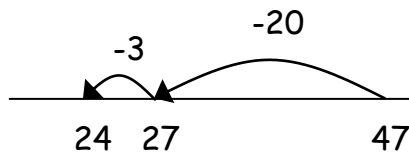
- ✓ Then helping children to become more efficient by subtracting the units in one jump (by using the known fact  $7 - 3 = 4$ ).

$$47 - 23 = 24$$



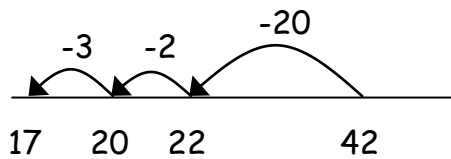
- ✓ Subtracting the tens in one jump and the units in one jump.

$$47 - 23 = 24$$



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

$$42 - 25 = 17$$



## Stage 4

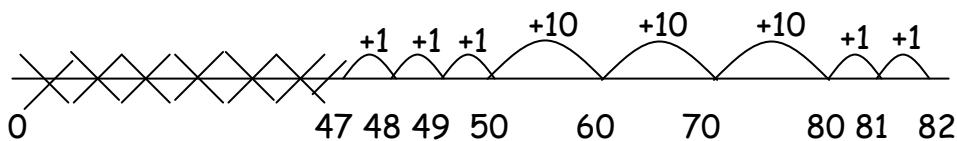
### Counting on - difference between the numbers

If the numbers involved in the calculation are close together or near to multiples of 10, 100 etc, it can be more efficient to count on.

Count up from 47 to 82 in jumps of 10 and jumps of 1.

The number line should still show 0 so children can cross out the section from 0 to the smallest number. They then associate this method with 'taking away'.

$$82 - 47$$



**Help children to become more efficient with counting on by:**

- ✓ Subtracting the units in one jump;
- ✓ Subtracting the tens in one jump and the units in one jump;
- ✓ Bridging through ten.

Children will continue to use empty number lines with increasingly large numbers.

## Stage 5

### Partitioning and decomposition

This process can be demonstrated using arrow cards to show the partitioning and base 10 materials to show the decomposition of the number.

**NOTE** When solving the calculation  $89 - 57$ , children should know that 57 **does NOT EXIST AS AN AMOUNT** it is what you are subtracting from the other number. Therefore, when using base 10 materials, children would need to count out only the 89.

$$\begin{array}{r} 89 \\ - 57 \\ \hline \end{array} = \begin{array}{r} 80 + 9 \\ 50 + 7 \\ \hline 30 + 2 = 32 \end{array}$$

*Initially, the children will be taught using examples that do not need the children to exchange.*

From this the children will begin to exchange.

$$\begin{array}{r} 71 \\ - 46 \\ \hline \end{array}$$

Step 1

$$\begin{array}{r} 70 + 1 \\ - 40 + 6 \\ \hline \end{array}$$

Step 2

$$\begin{array}{r} 60 + 11 \\ - 40 + 6 \\ \hline 20 + 5 = 25 \end{array}$$

The calculation should be read as e.g. take 6 from 1.

This would be recorded by the children as

$$\begin{array}{r} \overset{60}{\cancel{70}} + 11 \\ - 40 + 6 \\ \hline 20 + 5 = 25 \end{array}$$

*Children should know that units line up under units, tens under tens, and so on.*

## Stage 6

### Partitioning and decomposition H T U's

$$\begin{array}{r} 754 \\ - 86 \\ \hline \end{array} =$$

$$\text{Step 1} \quad \begin{array}{r} 700 + 50 + 4 \\ - \quad \quad 80 + 6 \\ \hline \end{array}$$

$$\text{Step 2} \quad \begin{array}{r} 700 + 40 + 14 \\ - \quad \quad 80 + 6 \\ \hline \end{array} \quad (\text{adjust from } T \text{ to } U)$$

$$\text{Step 3} \quad \begin{array}{r} 600 + 140 + 14 \\ - \quad \quad 80 + 6 \\ \hline 600 + 60 + 8 = 668 \end{array} \quad (\text{adjust from } H \text{ to } T)$$

This would be recorded by the children as

$$\begin{array}{r} \begin{array}{r} 600 \\ \cancel{700} \end{array} + \begin{array}{r} 140 \\ \cancel{50} \end{array} + 14 \\ - \quad \quad 80 + 6 \\ \hline 600 + 60 + 8 = 668 \end{array}$$

## Stage 7

### Decomposition - standard method

$$\begin{array}{r} 614 \text{ } 1 \\ \cancel{7} \cancel{5} 4 \\ - 286 \\ \hline 468 \end{array}$$

$$\begin{array}{r} 5 \text{ } 13 \text{ } 1 \\ \cancel{6} \cancel{4} 6 7 \\ - 2684 \\ \hline 3783 \end{array}$$

*Children should:*

- ✓ *be able to subtract numbers with different numbers of digits;*
- ✓ *to know that decimal points should line up under each other.*
- ✓ *be able to subtract with exchanges*

## Stage 8

### Partitioning and Decomposition – decimal numbers

- ✓ *using this method, children should also begin to find the difference between decimal numbers*
- ✓ *know that decimal points should line up under each other.*

*For example:*

$$\begin{array}{r} 89.5 \\ -43.8 \\ \hline \end{array} = \begin{array}{r} 80 + 9 + 0.5 \\ - 40 + 3 + 0.8 \\ \hline \end{array} \quad \text{leading to}$$
  
$$\begin{array}{r} 80 + 8 + 0.15 \\ - 40 + 3 + 0.8 \\ \hline 40 + 5 + 0.7 \\ \hline \end{array} \quad \text{(adjust from T to U)} \quad \begin{array}{r} 80.85 \\ - 40.38 \\ \hline \end{array}$$
  
$$= 40.57$$

*Children should:*

- ✓ *be able to subtract numbers with different numbers of digits;*
- ✓ *begin to find the difference between two decimal fractions with up to three digits and the same number of decimal places;*
- ✓ *know that decimal points should line up under each other.*

## Stage 9

***NB If children have reached the concise stage they will then continue with this method. They will not go back to using the expanded methods.***

**Decomposition - standard method (decimals)**

$$\begin{array}{r} \phantom{0}^5 \phantom{0}^{13} \phantom{0}^1 \\ 646.7 \\ - 268.4 \\ \hline 378.3 \end{array}$$

*Children should:*

- ✓ *be able to subtract numbers with different numbers of digits;*
- ✓ *be able to subtract two or more decimal fractions with up to three digits and either one or two decimal places;*
- ✓ *know that decimal points should line up under each other.*
- ✓ *Using this method, children should also begin to find the difference between two three-digit sums of money, with or without exchanges from the pence to the pounds*

*For example:*

$$\begin{array}{r} \pounds 8.85 \\ - \pounds 4.38 \\ \hline \pounds 4.57 \end{array}$$

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

**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