

WOOLENWICK JUNIOR SCHOOL

PROGRESSION THROUGH CALCULATIONS FOR SUBTRACTION

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 **accurate** and **efficient** written method of calculation for subtraction, which they know they can rely on when mental methods are not appropriate.

MENTAL CALCULATIONS (ongoing)

To subtract successfully, children need to be able to:

Mental recall of addition and subtraction facts

$$\begin{array}{ll} 10 - 6 = 4 & 17 - \square = 11 \\ 20 - 17 = 3 & 10 - \square = 2 \end{array}$$

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

$$36 + 19 = 55 \qquad 19 + 36 = 55$$

$$55 - 19 = 36 \qquad 55 - 36 = 19$$

Partition numbers into multiples of one hundred, ten and one in different ways

$$74 \text{ into } 70 + 4 \text{ or } 60 + 14$$

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 subtraction.

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

PHASE 1: Practical Resources and Pictures (NNF - YR, P Levels)

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**, **cubes**, **counters** etc.

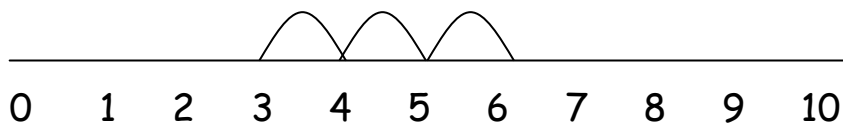


Vocabulary

take, take-away, leave, left, gone, less, fewer

PHASE 2: Numberlines - Count Back (NNF - Y1, Level 1)

The numberlines 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.

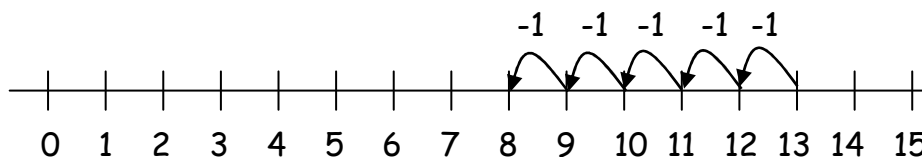


Vocabulary

subtract, difference, minus, half, halve,

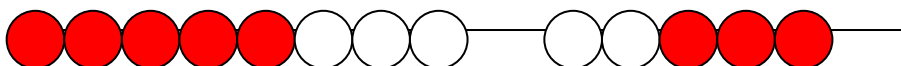
Children then begin to use **numbered lines** to support their own calculations - using a numbered line to count back in ones.

$$13 - 5 = 8$$



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

$$13 - 5 = 8$$

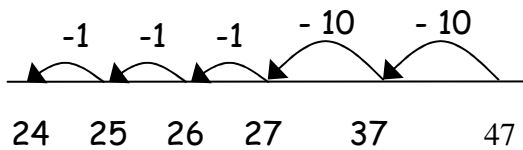


PHASE 3: Empty Numberline - Count Back (NNF - Y2, Level 2)

Children will begin to use empty number lines to support calculations. They should also be very familiar with the use of a **hundred numbers square**.

- ✓ First counting back in tens and ones.

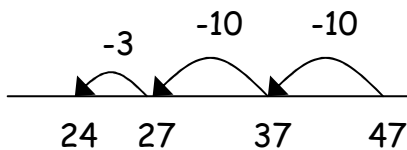
$$47 - 23 = 24$$



Vocabulary
subtraction, count back

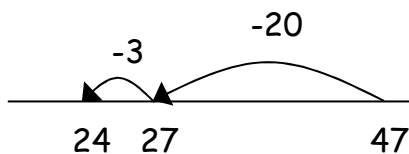
- ✓ Then helping children to become more efficient by subtracting the units in one jump (by using the known fact $7 - 3 = 4$).

$$47 - 23 = 24$$



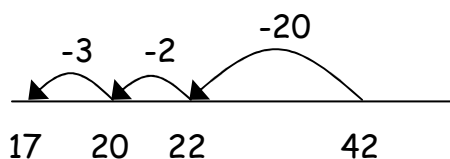
- ✓ Subtracting the tens in one jump and the units in one jump.

$$47 - 23 = 24$$



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

$$42 - 25 = 17$$

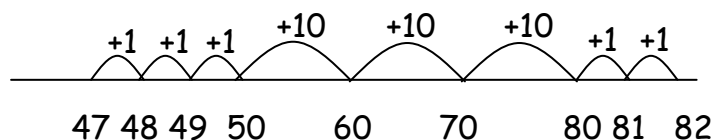


PHASE 4: Empty Numberline - Count On (NNF - Y2/3, Level 2)

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.

$$82 - 47 =$$



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.

PHASE 5: Partitioning with expanded lay-out (NNF - Y3/4, Level 3)

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

Note: When using base 10 materials, to solve the calculation $89 - 57$ children would need to count out only the 89. Therefore,

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

Vocabulary

partition, decrease, tens, hundreds, exchange, expand

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

From this the children will begin to exchange.

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

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

$$\text{Step 2} \quad \begin{array}{r} 60 + 11 \\ - 40 + 6 \\ \hline 20 + 5 = 25 \end{array}$$

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

The calculation should be read as e.g. "take 40 from 60"

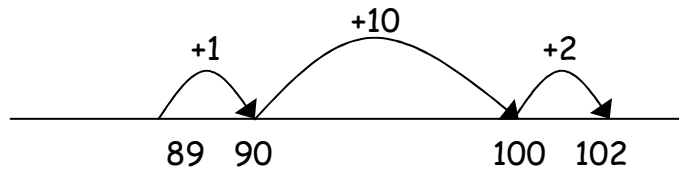
This would be recorded by the children as

$$\begin{array}{r} \overset{60}{\cancel{70}} + 1 \\ - 40 + 6 \\ \hline 20 + 5 = 25 \end{array}$$

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

Note: Where the numbers are involved in the calculation are close together or near to multiples of 10, 100 etc counting on using a number line should be used.

$$102 - 89 = 13$$



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

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

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

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

This would be recorded by the children as

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

PHASE 6: Decomposition – concise column method (NNF- Y4/5/6, Level 4)

$$\begin{array}{r}
 614\ 1 \\
 7\cancel{8}4 \\
 -\ 86 \\
 \hline
 668
 \end{array}$$

Vocabulary
*decomposition, columns,
 decimals, adjust*

Children should:

- ✓ be able to subtract numbers with different numbers of digits;
- ✓ begin to find the difference between two three-digit sums of money, with or without 'adjustment' from the pence to the pounds;
- ✓ 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.

For example:

$\pounds 8.95$	$=$	$8 + 0.9 + 0.05$	leading to
$-\pounds 4.38$	$-$	$\underline{4 + 0.3 + 0.08}$	
	$=$	$8 + 0.8 + 0.15$	$\overset{1}{8.85}$
		$- \underline{4 + 0.3 + 0.08}$	$\underline{- 4.38}$
		$4 + 0.5 + 0.07$	
		$= \pounds 4.57$	

(adjust from T to U)

Alternatively, children can set the amounts to whole numbers, i.e. $895 - 438$ and convert to pounds after the calculation.

Once a child has reached Phase 6 they will then continue this method through into years 5 and 6. They will not go back to using the expanded methods. By the end of year 6, 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.
- 2) they are not confident.

- Children should be encouraged to approximate their answers before calculating.
- Children should be encouraged to check their answers after calculation using an appropriate strategy.
- Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.