

Progression in Written Calculations

The aim of this agreement is to ensure consistency and progression throughout the school in written methods of calculation and reflects a whole school agreement. It contains the key pencil and paper procedures that will be taught throughout the school. Our aim is that most children follow this progression successfully and with understanding. Other methods may be introduced for more able pupils to investigate and explore.

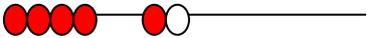
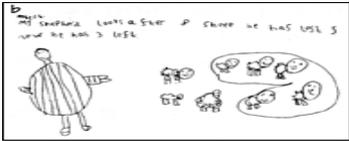
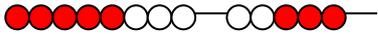
The aim for the school is that by the end of Y6, children will have been taught and be secure with a compact method for each operation. The children will have acquired their understanding through a wide range of models, representations, skills based developments and then embedded the knowledge through real life problems and contexts. Children will be encouraged to look at a calculation/problem/ investigation and then decide which calculation will best solve the problem. They will then select the most efficient method. The long-term aim is for children to be able to select the most efficient method of their choice (whether this be mental, written) that is appropriate for a given task.

Children should be guided towards increased efficiency and less dependence on informal jottings. Countries that are most successful at teaching number, avoid the premature teaching of standard written methods in order not to jeopardise the development of mental strategies.

Key points:

<u>Children should be encouraged to:</u>	<u>Points for teachers:</u>
Ask themselves, 'Can I do this calculation mentally?'	Refer to accompanying documents: Detailed Progression (Appendix 1) Progressive success criteria (Appendix 2 -5)
Approximate first	Continue to develop a range of mental strategies
Choose an efficient method appropriate for the numbers	Use appropriate numbers for child's ability
Apply knowledge of known facts	Present calculations in real life/problem solving contexts
Check results of calculations using the inverse	Make links between 4 operations
	Encourage children to share and discuss their methods
	Encourage a deeper conceptual understanding
	Use clear representations to support learning

Addition

<p>Stage A</p>	<p>Children are encouraged to develop a mental picture of the number system in their heads to use for calculation.</p> <p>They develop ways of recording calculations using pictures etc.</p>  <p>Bead strings or bead bars can be used to illustrate subtraction including bridging through ten by counting back 3 then counting back 2.</p>  <p style="text-align: right;">6-2=4</p> <p>They use numberlines and practical resources to support calculation. Teachers <i>demonstrate</i> the use of the numberline.</p>
<p>Stage B</p>	<p>using pictures</p>  <p>Bead strings or bead bars can be used to illustrate subtraction including bridging through ten by counting back 3 then counting back 2.</p>  <p style="text-align: right;">13-5=8</p> <p>Children then begin to use numbered lines to support their own calculations - using a numbered line to count back in ones. 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.</p> <p>Using symbols to stand for unknown numbers to complete equations using inverse operations and the - and = sign including bonds up to 10 and 20</p> <p>10 - 6 = <input type="text"/> 10 - <input type="text"/> = 3 20 - <input type="text"/> = 12</p>

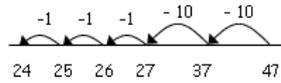
Stage C

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

Counting back:

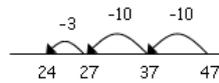
- ✓ First counting back in tens and ones.

$$47 - 23 = 24$$



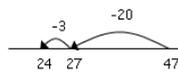
- ✓ Then helping children to become more efficient by subtracting the units in one jump (by using the known fact $7 - 3 = 4$).

$$47 - 23 = 24$$



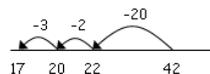
- ✓ Subtracting the tens in one jump and the units in one jump.

$$47 - 23 = 24$$



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

$$42 - 25 = 17$$

**Counting on:**

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'.

Stage D

Children will begin to use informal pencil and paper methods (jottings).

- ✓ **Partitioning and decomposition**

- Partitioning - demonstrated using arrow cards
- Decomposition - base 10 materials

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.

$$89 - 57$$

$$80 + 9$$

$$\underline{50 + 7}$$

$$30 + 2 = 32$$

✓ **Begin to exchange.**

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

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

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

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

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 use these informal written methods for subtraction using partitioning, for numbers up to 3 digits

Stage E

✓ **Partitioning and decomposition**

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

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

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

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

This would be recorded by the children as

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

✓ **Decomposition**

$$\begin{array}{r} 6141 \\ \cancel{754} \\ - 86 \\ \hline 668 \end{array}$$

Children should:

- ✓ *be able to subtract numbers with up to 4 digits digits;*
- ✓ *using this method, children should also begin to find the difference between two three-digit sums of money, with or without 'adjustment' from the pence to the pounds;*
- ✓ *know that decimal points should line up under each other.*

$$\begin{array}{r}
 \text{£}8.95 = 8 + 0.9 + 0.05 \\
 - \text{£}4.38 \quad - 4 + 0.3 + 0.08 \\
 \hline
 = 8 + 0.8 + 0.15 \quad (\text{adjust from T to U}) \\
 - 4 + 0.3 + 0.08 \\
 \hline
 4 + 0.5 + 0.07 \\
 \hline
 = \text{£}4.57
 \end{array}$$

leading to

$$\begin{array}{r}
 1 \\
 8.85 \\
 - 4.38 \\
 \hline
 \end{array}$$

Stage F Partitioning and decomposition

Step 1

$$\begin{array}{r}
 754 = 700 + 50 + 4 \\
 - 286 \quad - 200 + 80 + 6 \\
 \hline
 \end{array}$$

Step 2

$$\begin{array}{r}
 700 + 40 + 14 \quad (\text{adjust from T to U}) \\
 - 200 + 80 + 6 \\
 \hline
 \end{array}$$

Step 3

$$\begin{array}{r}
 600 + 140 + 14 \quad (\text{adjust from H to T}) \\
 - 200 + 80 + 6 \\
 \hline
 400 + 60 + 8 = 468
 \end{array}$$

This would be recorded by the children as

$$\begin{array}{r}
 \overset{600}{\cancel{700}} + \overset{140}{\cancel{50}} + 14 \\
 - 200 + 80 + 6 \\
 \hline
 400 + 60 + 8 = 468
 \end{array}$$

Decomposition

$$\begin{array}{r}
 6141 \\
 \cancel{754} \\
 - 286 \\
 \hline
 468
 \end{array}$$

Children should:

- ✓ *be able to subtract numbers with more than 4 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 6**Decomposition**

$$\begin{array}{r} 3131 \\ \cancel{0}467 \\ - \underline{2684} \\ 3783 \end{array}$$

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.*

There should be a greater focus in this year on using the subtraction method to solve multi-step problems in context.

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 consider if a mental calculation would be appropriate before using written methods.