

Benfieldside Primary School - Written Calculation policy
November 2022



Introduction

In order to ensure that every child in our school achieves their maximum potential in numeracy this Policy for written calculation sets out the school's ethos on the teaching and benefits of written calculations as well as highlighting the strategies to be taught.

From year two onwards, children in our school will be introduced to the process of written calculation. These techniques will build on the mental techniques taught from reception onwards and will require pupils to apply their knowledge of place value, number bonds and times tables. Initially, physical resources will be used to aid the introduction of written calculations, this will lead to the use of efficient and formal written calculations for all four number operations by the end of Key Stage 2.

The overall aim is that when children leave our school they:

- can efficiently use standard written methods for all four number operations
- are able to apply this knowledge and understanding to carry out written calculations for all four operations when **solving real life problems** including those involving money and units of measure.

Rationale

The purpose of this policy is to outline the progression of written calculation strategies as taught in our school from Year 2 to Year 6. The national curriculum states that formal written calculations should be introduced from year 3 onwards but we feel that the pupils at Benfieldside benefit from the introduction of written addition and subtraction from year 2 onwards

Written calculations are taught in line with the school's long term planning but they are regularly revisited during the Flashback 4 sessions taught 4 days a week in KS2.

We aim to establish a secure understanding of written calculation techniques appropriate to each child's age and stage of mathematical development.

Following key stage and whole school meetings, the staff at Benfieldside Primary have identified strategies and techniques from The National Curriculum for Mathematics, White Rose documents and NCETM materials, which we believe provides a structured and systematic approach to teaching written calculations.

Progression in Written calculations

This policy highlights the agreed strategies to be used within school and across year groups. Strategies show natural progression but are not necessarily age specific. Although teachers need to use long term planning to ensure suitable age related coverage, teachers have to use their own assessments and professional judgment to ensure techniques used are appropriate for the individual needs and abilities of their students. Therefore, sometimes teachers will need to look at the previous or subsequent strategies as opposed to solely using age related strategies or techniques.

Monitoring of Written Calculations

The use of written calculations will be monitored by the numeracy co-ordinator and SMT in a variety of ways at different points in the year, including: monitoring of plans; pupil interviews; lesson observations and where appropriate question level analysis of formal assessments.

Assessing the use of written calculations

Formal termly arithmetic assessments will take place in years 1 to 6 using version 3 of White Rose assessments. These assessments will highlight areas of written calculations that teachers need to revisit during review sessions or Flashback 4 activities. Individuals identified as being in the bottom 20% of each cohort will also have access to targeted activities within subsequent numeracy and intervention sessions.

Written addition

- Initial addition will require a physical aid such as base 10. When a child is capable of completing calculations efficiently, the physical aid can be removed
- Initial calculations will be two, 2 digit numbers without carry overs
- This will progress to two, 2 digit numbers with carry overs
- This will progress to carry overs that break the 100 boundary
- This will progress to adding more than two, 2 digit numbers
- This will progress to 3 or more digit numbers with carry overs and differing numbers of place value places i.e. 3 digit add 2 digits
- This will progress to calculations involving decimal numbers and money

Examples:

$$\begin{array}{r} \text{H T O} \\ 147 \\ + 238 \\ \hline 385 \end{array}$$

In the ones column $7 + 8 = 15$
15 ones are the same as 1 ten and 5 ones,
so you put a 5 in the ones column and the
1 ten goes into the tens column.

$$\begin{array}{r} \text{H T O ths} \\ 357.6 \\ + 22.5 \\ \hline 380.1 \end{array}$$

When dealing with numbers with a
different number of digits you need to
ensure the numbers are in the correct
columns

Written subtraction

- Initial subtraction will require a physical aid such as base 10. When a child is capable of completing calculations efficiently, the physical aid can be removed
- Initial calculations will be two, 2 digit numbers without exchanges
- This will progress to two, 2 digit numbers with an exchange
- This will progress to two, 3 digit numbers with an exchange
- This will progress to calculations with different numbers of digits
- This will progress to calculations which require exchanging from a zero
- This will progress to larger numbers
- This will progress to calculations involving decimal numbers and money

Examples:

$$\begin{array}{r} \text{H T O} \\ \overset{5}{\cancel{2}} \overset{1}{2} 7 \\ - \underline{284} \\ \underline{343} \end{array}$$

In Tens column $2 - 8 = -6$
so take a hundred which
is the same as 10 tens
and put it in the tens
column to leave $12 - 8 = 4$

$$\begin{array}{r} \text{H T O} \\ \overset{4}{\cancel{5}} \overset{9}{\cancel{0}} 3 \\ - \underline{265} \\ \underline{238} \end{array}$$

If exchanging and the digit to the left is a zero, you can't exchange from it so you take one from the next digit to the left and change the zero to a ten, which can then be exchanged from leaving a 9.

$$\begin{array}{r} \text{H T O ths hths} \\ \overset{3}{\cancel{2}} \overset{1}{2} 7 . \overset{1}{\cancel{4}} 0 \\ - \underline{122.28} \\ \underline{125.12} \end{array}$$

e.g. $247.4 - 122.28$

When dealing with numbers with a different number of digits you need to ensure the numbers are in the correct columns and that you **add a zero to empty columns** after the decimal point

Compensation

$$10000 - 4257 = 9999 - 4256$$

$$28 - 5.79 = 27.99 - 5.78$$

$$£100 - £74.23 = £99.99 - £74.22$$

If questions will involve multiple exchanges from zeros (example 1) or adding multiple zeroes in columns (examples 2 and 3) then use compensation and subtract 1 (in the appropriate column) from each number to get a simpler column subtraction that gives the same answer

Written multiplication

- Initial multiplication may require a physical aid such as base 10 and / or access to a times tables sheet. When a child is capable of completing calculations independently the resources can be removed.
- Initial calculations will be 2 digit multiplied by 1 digit
- This will progress to 2 digit multiplied by 2 digit
- This will progress to 4 digit multiplied by 2 digit
- This will progress to questions involving decimal points / money

Examples:

$$\begin{array}{r} \text{T O} \\ 36 \\ \times 4 \\ \hline 144 \end{array}$$

In the ones column $6 \times 4 = 24$,
24 is the same as 2 tens and 4 ones,
so the 4 goes in the ones column in the answer
and the 2 is carried over to the tens column.
In the Tens column $3 \times 4 = 12$, plus the two that
had been passed over makes 14.

$$\begin{array}{r} \text{T O} \\ 36 \\ \times 24 \\ \hline 144 \\ 720 \\ \hline 864 \end{array}$$

$36 \times 4 = 144$
 36×20 , ($20 = 2 \times 10$),
apply place value knowledge and put a zero
at the end of the 2nd line then do 36×2

Written division

- Initial short division may require a physical aid such as base 10 and / or access to a times tables sheet. When a child is capable of completing calculations independently the resources can be removed
 - Initial short division calculations will be a 2 digit number which is exactly divisible by a 1 digit number (greater than 12 times the one digit number)
 - This will progress to a 3 digit number which is exactly divisible by a 1 digit number
 - This will progress to a 2 digit + number which isn't exactly divisible by a 1 digit number (a remainder will be left)
 - This will progress onto questions involving decimals and money
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- Initial long division (chunking) may require a physical aid such as base 10 and / or access to a times tables sheet. When a child is capable of completing calculations independently the resources can be removed
 - Initial long division calculations will be 3 digit numbers which are exactly divisible by a 2 digit number
 - This will progress onto 4 digit + numbers which are exactly divisible by a 2 digit number
 - This will progress onto 3 digit + numbers which aren't exactly divisible by a 2 digit number (a remainder will be left to be interpreted)

Examples:

$$7 \overline{) 856} \begin{array}{r} 122 \\ \underline{856} \\ r2 \end{array}$$

There is 1 seven in eight with one left over.
The one is carried to the next column to make 15 (because 1 hundred is the same as 10 tens).
There are 2 sevens in fifteen with one left over etc.
The 2 that is left at the end is called a remainder or is represented as a fraction

$$8 \overline{) \pounds 86.75} \begin{array}{r} \pounds 10.75 \\ \underline{\pounds 86.00} \\ 00 \end{array}$$

£86 ÷ 8 (not exactly divisible so becomes £86.00 ÷ 8)

There is 1 eight in eight with none left over.
There are 0 eights in six so all six are carried over.
There are 7 eights in 60 with 4 left over etc

With money there can't be a fraction as part of the answer.

$$1564 \div 34 = 46$$

$$\begin{array}{r} 1564 \\ - 1360 \quad (40 \times 34) \\ \hline 204 \\ - 170 \quad (5 \times 34) \\ \hline 34 \\ - 34 \quad (1 \times 34) \\ \hline 0 \end{array}$$

the number of 'chunks' you subtract is the answer.

Always start by applying knowledge of multiplying by ten and doubling and halving to generate the following 4 chunks to start.

$$\begin{array}{ll} 5 \times 34 = 170 & \text{(half)} \\ 10 \times 34 = 340 & \text{(x 10)} \\ 20 \times 34 = 680 & \text{(double 10 x 34)} \\ 40 \times 34 = 1360 & \text{(double 20 x 34)} \end{array}$$

Place value can then be used to get smaller and bigger chunks.

Remember – you should NEVER take off two chunks of the same size.

Success Steps for column addition.

- * Are the numbers in the correct columns?
- * Remember you can only put a single digit in each column of your answer, the other digit has to be passed over.
- * Have you added on any numbers that have been passed over?
- * If needed, have you put the decimal point in your answer?

Success Steps for column subtraction

- * Are the numbers in the correct columns?
- * Have you put the decimal point in if you need one?
- * Remember the number on top can't be smaller.
- * Remember you can only transfer from the next column to the left.
- * If you're exchanging and the next column is a zero, you need to change the zero to a ten and take one from the column to the left of the zero.
- * If the numbers have a different number of decimals places, have you added zero's in the gap?

Success Steps for written multiplication $TO \times O$

- * Are your numbers in columns?
- * Remember to start with the digit furthest to the right.
- * Remember multiply all of the top number by the ones value in the bottom number.
- * Have you passed over numbers to the top line?
- * Have you added on any numbers you passed over?

Success steps for written multiplication $TO \times TO$

- * Are your numbers in columns?
- * Remember multiply all of the top number by the ones value in the bottom number.
- * Have you passed over numbers to the top line?
- * Have you added on any numbers you passed over?
- * Does your second row end in a zero?
- * in the 2nd line multiply **all** of the top number by the tens value in the bottom number.

Success steps for short division.

- * Remember you start at the **left** hand side.
- * You have to work out how many times does the number you're dividing by go into the **each** value of the starting number.
- * Remember you don't need to put a zero at the beginning of your answer.
- * Have you remembered to pass over any of the number that wasn't used?
- * If there is a number left to be passed over at the end, this is your remainder value (it has to be smaller than the number you're dividing by)
- * *remainders can be represented as fractions*
- * *remember to put .00 on the end if working with money*

Success steps for long division (chunking).

- * At the side/bottom multiply the number you're dividing by: 5, 10, 20 and 40 (start with 10 and using doubling and halving)
- * Have you taken off the largest chunk you can?
- * Remember to write down each chunk you take off.
- * Remember any remainder you have has to be **smaller** than the number you are dividing by.