

*St. Bernadette's Catholic Primary School,
Lancaster*

Written Calculations Policy

Introduction

This policy document is a statement of learning and teaching at St. Bernadette's Catholic Primary School.

Number is central to the learning of mathematics from Foundation to Year 6. During this period, children become familiar with the four operations of addition, subtraction, multiplication and division. They learn how to apply them to a range of problems arising out of real life situations.

It is important to lay firm foundations in maths and to build on these in a systematic manner. The curriculum for teaching mathematics states that *'In the early years of primary school the main emphasis should be on developing skills of mental calculation. The development of formal methods should follow a firm grounding in learning, understanding and using a range of mental calculation strategies.'*

The curriculum for maths puts considerable emphasis on mental calculations with annotations where appropriate.

- Up to the end of Year 3, the emphasis is on children working mentally with calculations recorded in horizontal number sentences and with some informal jottings for more challenging numbers
- In Year 4-6 children are taught more formalised written methods of calculation, starting with expanded methods and working gradually towards more compact standard methods by the end of year 6.

Aims

The aim of the policy is to take account of work within national and local policies and initiatives and the school's mission statement and curriculum policy. Through this we aim to establish consistent practice in school so that, as children move through school, they experience a carefully developed progression from mental calculation, jottings and informal written methods to standard written methods for each of the four operations.

We aim to ensure that by the end of year 6, as many children as possible will understand, and use successfully, compact written methods to carry out and record calculations they cannot do in their heads. This is in line with the objectives set in the maths curriculum 2014, and also reflects the stages of development through which children move.

Mental Calculation

Mental calculation skills are vital. They give children an understanding of numbers and number operations and a sense of autonomy in many practical situations. To use calculations sensibly, children need mental skills, particularly mental estimation, to check answers.

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Mental calculations with 2-digit numbers should be securely established before written methods are introduced.

Up to Year 3, the emphasis should be on children working mentally. Once written methods are introduced, mental skills must be kept sharp by continuing to develop and apply them to appropriate examples.

Years 2, 3 and 4 will have discrete daily times table lessons until all children are secure with 12 x 12 facts, quick recall out of sequence.

Children must be encouraged to always use mental methods as a first resort.

Written Calculations

The maths curriculum 2014 delays formal written methods until children are secure in mental work. Children need to understand written methods so they can use them accurately and reliably. The approach adopted by the maths Curriculum 2014, builds on children's experience of jottings and informal recordings in their mental work.

Children are introduced to formalised layouts, initially in expanded formats, which they can understand. These are gradually refined into more compact and efficient standard methods.

The maths curriculum and existing good practice have been used to set out a consistent and progressive approach for the teaching of written calculations.

Addition and Subtraction

Written recordings of addition and subtraction develop throughout Foundation, KS1 and KS2. These recordings take the form of:

- Jottings
- A record of mental strategy, written in a way that helps someone else to understand
- Extended methods of calculation that prepares the way for increasingly efficient written calculations that cannot easily be done mentally.

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Foundation Stage and Key Stage 1

The framework for teaching mathematics makes it clear that children are not expected to use formal pencil and paper procedures for addition and subtraction in early key stage 1. At this stage, their experience of these operations will be a mixture of practical, oral and mental work. They will, however, be making use of written forms to:

- Make a record in pictures, words or symbols of addition or subtraction activities that they have already carried out, and to construct number sentences;
- Explain to someone else what they have done;
- Interpret information that requires practical, oral or mental calculations;
- Begin to read recordings made by the teacher;
- Help work out steps in a calculation they will later do entirely mentally.

Much of young children's work, with addition and subtraction, will be oral arising out of practical activities. Children need to experience their own individual ways of recording addition and subtraction activities before they begin to record more formally.

Children should be encouraged to write about their work in their own way. When their understanding is sound, conventional labels and symbols can be introduced. It can be harder to start with symbols and then have to explain. It is easy to be misled by children who start to use standard forms of recording too early, in thinking that they necessarily understand what they have written.

Before children are ready to move onto using written strategies, they must be confident with mental strategies.

This checklist provides a guide for the teacher to decide whether a class or pupil is ready to move from informal methods of recording calculations to more refined formal written methods.

- Do children know addition and subtraction facts to 20?
- Do they understand place value and can they partition numbers into hundreds, tens and units?
- Do they use and apply the commutative and associative laws of addition?
- Can they add at least three 1-digit numbers mentally?
- Can they add and subtract any pair of 2-digit numbers mentally?
- Can they explain their mental strategies orally and record them using informal jottings?

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Addition

Stage 1

Mental method using partitioning:

$$47 + 76 = (40 + 70) + (7 + 6) = 110 + 13 = 123$$

Stage 2 (May be used to illustrate but not necessarily taught as a step)

1. Demonstrate the expanded vertical layout of a calculation adding the most significant digit first:

$$\begin{array}{r} 47 \\ + 76 \\ \hline 110 \\ \quad 13 \\ \hline 123 \end{array}$$

2. Discuss how adding the least significant digits first still gives the same answer.

$$\begin{array}{r} 47 \\ + 76 \\ \hline 13 \\ \quad 110 \\ \hline 123 \end{array}$$

For further examples refer to Progression through Written Calculations Booklet

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Stage 3 *(May be used to illustrate but not necessarily taught as a step)*

Extend to larger numbers.

Emphasise to the children that this vertical method is simply a more organised way of writing their mental calculations:

$\begin{array}{r} 368 \\ + 493 \\ \hline 700 \\ 150 \\ \underline{11} \\ 861 \end{array}$	$\begin{array}{r} 368 \\ + 493 \\ \hline 11 \\ 150 \\ \underline{700} \\ 861 \end{array}$
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Because addition is commutative, the order does not matter at this stage. Encourage the children to estimate first.

(E.g. $368 + 493$. Estimate $370 + 500 = 870$)

Ask them to check if their answer is sensible.

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Stage 4

Show the children the correct layout alongside the expanded format.
In the compact layout the children should add the 'least significant' digit first.

'One Carry'

1. $\begin{array}{r} 47 \\ + 26 \\ \hline 13 \\ 60 \\ \hline 73 \end{array}$	$\begin{array}{r} 47 \\ + 26 \\ \hline 73 \\ 1 \end{array}$	2. $\begin{array}{r} 368 \\ + 423 \\ \hline 11 \\ 80 \\ \hline 700 \\ 791 \end{array}$	$\begin{array}{r} 368 \\ + 423 \\ \hline 791 \\ 1 \end{array}$
3. $\begin{array}{r} 368 \\ + 491 \\ \hline 9 \\ 150 \\ \hline 700 \\ 859 \end{array}$	$\begin{array}{r} 368 \\ + 491 \\ \hline 859 \\ 1 \end{array}$		

'Two Carries'

1. $\begin{array}{r} 47 \\ + 76 \\ \hline 13 \\ 110 \\ \hline 123 \end{array}$	$\begin{array}{r} 47 \\ + 76 \\ \hline 123 \\ 11 \end{array}$	2. $\begin{array}{r} 368 \\ + 493 \\ \hline 11 \\ 150 \\ \hline 861 \end{array}$	$\begin{array}{r} 368 \\ + 493 \\ \hline 861 \\ 11 \end{array}$
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Start with calculations the children can do mentally, so that they can easily follow the procedure and how it works. Introduce calculations which involve 'one carry' and then move to two or more.

Still encourage them to estimate first.

Stage 5

Use the methods taught with larger numbers, more than two numbers, numbers with different numbers of digits and decimals, including money.

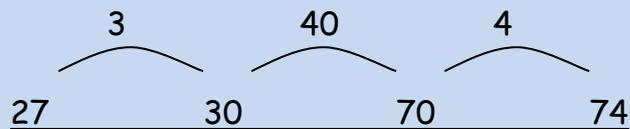
Children may need to revert to more expanded methods initially.

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Subtraction

Stage 1

i) Counting on from the smallest to largest number. Use of number lines and bead bars is important.

e.g. $74 - 27$



Stage 2

Use the numberline method taught with larger numbers, more than two numbers, numbers with different numbers of digits and decimals, including money and time. Do NOT move to stage 2 until the children are secure with decimals and using and applying.

Stage 3

Develop an efficient standard method that can be applied.

Children may be shown the compact layout alongside the expanded format.

i) $81 - 57$ becomes

$$\begin{array}{r} 81 \\ - 57 \\ \hline \end{array} \quad \begin{array}{r} 78 \ 11 \\ - - \ 57 \\ \hline 24 \end{array}$$

Stage 4

Use the methods taught with larger numbers, more than two numbers, numbers with different numbers of digits and decimals, including money.

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Children may need to revert to more expanded methods initially. Children should understand that the numberline is still an important (efficient) method when subtracting larger numbers which require a lot of decomposition.

Eg. $5008 - 1399$

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Multiplication and Division

Multiplication and division are introduced whenever objects or numbers are combined or partitioned in equal groups. Although multiplication is usually associated with the idea of repeated addition, it can also have the idea of a 'multiplying factor', such as, when one set has 'four times as many' elements as another or is 'four times bigger' than another.

Division is associated with repeated subtraction or sharing equally – 'chunking'. Division calculations are often based on knowledge of multiplication facts and so it helps to know the two operations are linked.

Foundation and Key Stage 1

The idea of multiplication and division begins with counting patterns and contexts involving equal grouping and can be introduced wherever equal groupings are involved.

At first, the results will be recorded using patterns, and phrases such as 'lots of' or 'shared between'.

Rhymes and stories which involve counting in 1s, 2s or 5s etc., or counting forwards or backwards in different intervals from a given starting point, help to develop familiarity with number patterns and sequences, as do practical activities.

Early recordings of experiences will probably take the form of pictorial representations or written descriptions, leading to number sentences etc, but by Year 2, children should be introduced to the \times and \div symbols, and an appropriate extended vocabulary.

Written recording of multiplication and division starts in Key Stage 1 but is developed mainly in Key Stage 2. This recording takes the form of:

- Recorded patterns and sequences of numbers to learn facts and to devise new facts
- Jottings to support mental calculations
- Expanded written recordings to show stages in a calculation
- Efficient calculating and recording methods

Written recordings should include a range of appropriate words, phrases and symbols.

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Multiplication KS2

Stage 1

Short multiplication (TU x U)

Mental method using partitioning.

$$23 \times 8 = (20 \times 8) + (3 \times 8) = 160 + 24 = 184$$

Stage 2

Short multiplication (TU x U)

Introduce the grid method expanded working

i) 23×8

x	20	3		
8	160	24		=
				160
				<u>+24</u>
				184

Stage 3

Continue to use grid layout expanded working using larger numbers.

Stage 4

Long Multiplication (TU x TU, HTU x TU)

Continue to use the grid method.

i) 346×9

x	300	40	6	
9	2700	360	54	
				2700
				360
				<u>+ 54</u>
				= 3114

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ii) 72×38

x	70	2			2100
30	2100	60	=		60
8	560	16			560
					+ 16
					2736

iii) 172×38

x	100	70	2			3000
30	3000	2100	60	=		2100
8	800	560	16			60
						800
						560
						+ 16
						6536

Use the grid method taught with larger numbers and decimals, including money.

Stage 5

Develop an efficient standard method that can be applied.

i)	346		346
	<u>x 9</u>		<u>x 9</u>
	54	(6 × 9)	<u>3114</u>
	360	(40 × 9)	45
	<u>2700</u>	(300 × 9)	
	<u>3114</u>		

ii) Multiplying the *least significant* digit first:

72	
<u>x 38</u>	
576	(72 × 8)
<u>2160</u>	(72 × 30)
<u>2736</u>	

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Use the methods taught with large numbers and decimals, including money.

Children may need to revert to more expanded layouts initially.

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Division

Stage 1

Short division.

e.g. $96 \div 6 = 16$ (a number line can be used to illustrate this)

Stage 2

Short division – a compact method for dividing by a single digit

$$\begin{array}{r} 32 \text{ r } 4 \\ 6 \overline{) 196} \end{array}$$

Stage 3

Long division (HTU \div TU)

i)

$$\begin{array}{r} 15 \overline{) 432} \\ \underline{-300} \quad (15 \times 20) \\ 132 \\ \underline{-120} \quad (15 \times 8) \\ 12 \\ - \\ \text{Answer} = 28 \text{ r } 12 \\ - \end{array}$$

Stage 4

Use the methods taught for both short and long division with larger numbers and decimals, including money.

Children may need to revert to more expanded layouts initially.

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Summary of Written Calculations Policy

- Children should always estimate first
- Always check the answer, preferably using a different method eg. the inverse operation.
- Always decide first whether a mental method is appropriate.
- Pay attention to language - refer to the actual value of digits.
- Children who make persistent mistakes should return to the method that they can use accurately until ready to move on.
- Children need to know number and multiplication facts by heart.
- Discuss errors and diagnose problem and then work through problem step by step, do not simply re-teach the method.
- Written calculations should not be given as a homework exercise as this can cause confusion with parents teaching different methods.
- Teachers use assessment for learning to decide whether a child is ready to move to a more efficient method of calculation and where possible this method should be taught in a guided group.
- Teachers should ensure that children are secure with using and applying at each stage before moving onto the next stage.

Monitoring the Written Calculations Policy

Provision for implementing the written calculations policy throughout the school will be monitored by the Subject Leader for Mathematics in the school and in consultation with the Numeracy governor.

Signed: (Mathematics Subject Leader)

..... (Headteacher)

..... (Governor for Mathematics)

Date:/...../.....