All Saints' CE Primary School - Maths Written Methods Policy

Children are introduced to the processes of calculation through practical, oral and mental activities. As children begin to understand the underlying ideas they develop ways of recording to support their thinking and calculation methods, use particular methods which apply to special cases, and learn to interpret signs and symbols involved. Over time children use models and images, such as empty number lines, to support their mental and informal written methods of calculation. As children's mental methods are strengthened and refined, so too are their informal written methods. These methods become more efficient and succinct and lead to efficient written methods that can be used more generally. By the end of Year 6 children are well equipped with mental, written and calculator methods that they understand and can use correctly. When faced with a calculation, children are able to decide which method is most appropriate and have strategies to check its accuracy. At whatever stage in their learning, and whatever method is being used, it must still be underpinned by a secure and appropriate knowledge of number facts, along with those mental skills that are needed to carry out the process and judge if it was successful.

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

- Have a secure knowledge of number facts and a good understanding of the four operations.
- Are able to use this knowledge and understanding to carry out calculations mentally and to apply general strategies when using one-digit and two-digit numbers and particular strategies to special cases involving bigger numbers.
- Make use of diagrams and informal notes to help record steps and part answers when using mental methods that generate more information than be kept in their heads.
- Have an efficient, reliable, compact method of calculation for each operation that children can apply with confidence when undertaking calculations that they cannot carry out mentally.
- Use a calculator effectively, using their mental skills to monitor the process, check the steps involved and decide if the numbers displayed make sense.

Mental Methods of Calculation

Oral and mental work in maths is essential, particularly so in calculation. Early practical, oral and mental work must lay the foundations by providing children with a good understanding of how the four operations build on efficient counting strategies and a secure knowledge of place value and number facts. Ongoing oral and mental work provides practice and consolidation of these ideas. It must also give the opportunity to apply what they have learned to particular cases and to general cases where children make decisions and choices for themselves.

The ability to calculate mentally forms the basis of all methods of calculation and has to be maintained and refined. A good knowledge of numbers or a feel for numbers is the product of structured practice and repetition. It requires an understanding of number patterns and relationships developed through directed enquiry, use of models and images and the application of acquired number knowledge and skills. Secure mental calculation requires the ability to:

- Recall key number facts instantly.
- Use taught strategies to work out the calculation.
- Understand how the rules and laws of arithmetic are used and applied.

Written Methods of Calculation.

The framework below sets out progression in written methods of calculation that highlights how children would move from informal methods of recording to expanded methods that are staging posts to a compact written method for each of the four operations.

The aim is that by the end of Key Stage 2, the majority of children should be able to use an efficient written method for each operation with confidence and understanding. This policy promotes the use of what are commonly known as "standard" written methods – methods that are efficient and work for any calculations, including those that involve whole numbers or decimals.

In setting out these aims, the intention is that our school will have a greater consistency in our approach to calculation that all teachers understand and work towards. The challenge for teachers is determining when their children should move on in refinement in the method and become confident and more efficient at written calculation.

Children should be equipped to decide when it is best to use a mental, written or calculator method based on the knowledge that they are in control of this choice as they are able to carry out all three methods with confidence.

Written Methods for Addition of Numbers.

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. These steps show the stages in building up to using an efficient written method for addition of numbers by the end of Year 6.

To add successfully, children need to be able to:

- Recall all addition pairs to 9 + 9 and complements in 10.
- Add mentally a series of one-digit numbers such as 5 + 8 + 4.
- Add multiples of 10 (such as 60 + 70) or of 100 (such as 600 + 700) using the related addition fact, 6 + 7, and their knowledge of place value.
- Carry out column addition and subtraction of 2 integers less than 1000 and column addition of more than 2 such integers.
- Carry out column addition and subtraction of numbers involving decimals.

Written Methods for Subtraction of Numbers.

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. These steps show the stages in building up to using an efficient written method for subtraction of numbers by the end of Year 6.

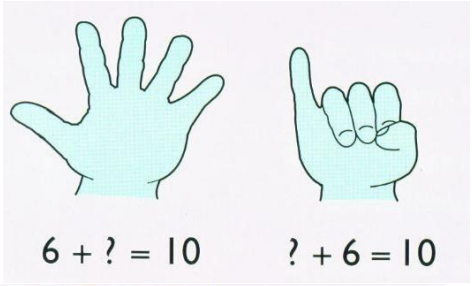
To subtract successfully, children need to be able to:

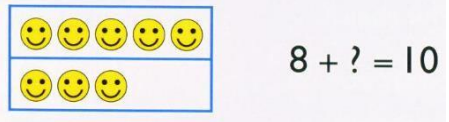
- Recall all addition and subtraction facts to 20.
- Subtract by counting up from the smaller number to the larger using number lines.
- Subtract multiples of 10 (such as 160 – 70) using the related subtraction fact, (16 – 7) and their knowledge of place value.
- Carry out column addition and subtraction of 2 integers less than 1000 and column addition of more than 2 such integers.
- Carry out column addition and subtraction of numbers involving decimals.

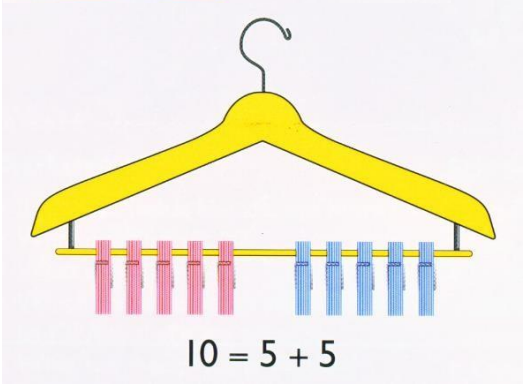
Progressing towards ELG

Addition – Stage 1

Simple verbal word problems. There are opportunities for pupils to record voluntarily in writing.



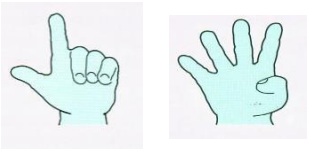




These images or other visual aids such as Numicon, bead strings etc. maybe used.

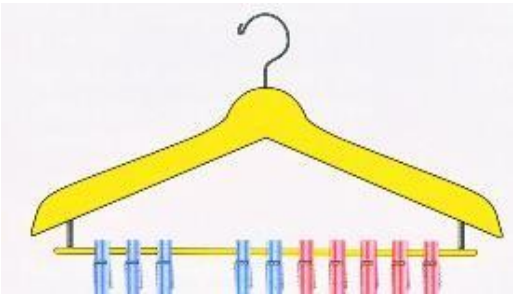
Subtraction – Stage 1

Simple verbal word problems. There are opportunities for pupils to record voluntarily in writing.



5 – 2 =

Pupils to find the difference between two numbers.



These images or other visual aids such as Numicon, bead strings etc. maybe used.

Addition – Stage 2

Record in writing:

3	+	4	=	□		□	=	3	+	4
3	+	□	=	7		7	=	□	+	4
□	+	4	=	7		7	=	3	+	□
□	+	∇	=	7		7	=	□	+	∇

Pupils to use number lines to 20.

+ = signs and missing numbers

6 + 3 = 5 + □ =

Subtraction – Stage 2

Recording in writing:

7	-	3	=	□		□	=	7	-	3
7	-	□	=	4		4	=	□	-	3
□	-	3	=	4		4	=	7	-	□
□	-	∇	=	4		4	=	□	-	∇

Progressing toward ELG Addition

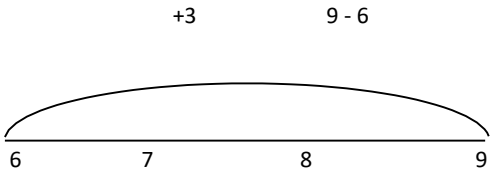
- Combining two or more sets of objects up to 10.
- Add using a numberline up to 10 and beginning to record.
- Add by counting on up to 10 without a numberline.

Progressing toward ELG Subtraction

- Taking away objects from a set up to 10.
- Subtract using a numberline up to 10 and beginning to record.
- Subtract by counting back up to 10 without a numberline.

<table>
<tr><td>Year 1</td><td><u>Addition - Stage 3</u>
<u>+ = signs and missing numbers</u>
Continue using a range of number sentences as in Stage 2 but with appropriate, larger numbers. e.g. 43 + 9 or 25 + 15.
Extend to
14 + 5 = 10 + □

and adding three numbers

32 + □ = 100 35 = 1 + □ + 5</td><td><u>Subtraction – Stage 3</u>
Pupils to use number lines to 20.
<u>Find a small difference by counting on</u>
 

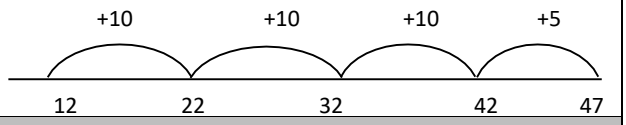
Extend to counting to next 10 e.g.</td></tr>
<tr><td></td><td><u>Year 1 Developing - Addition</u>
Add a single digit to a 2-digit number up to 20 with a numberline.

<u>Year 1 Secure – Addition</u>
Add a single digit to a 2-digit number up to 100 with a numberline.</td><td><u>Year 1 Developing – Subtraction</u>
Subtract a single digit from a 2-digit number up to 20 with a numberline.

<u>Year 1 Secure - Subtraction</u>
Subtract a single digit from a 2-digit number up to 100 with a numberline.</td></tr>
<tr><td>Year 2</td><td><u>Addition - Stage 4</u>
Add 9 or 11 by adding 10 and adjusting by 1
35 + 9 = 44
35 + 10 = 45 35 + 11 =
45 – 1 = 44 35 + 10 = 45
35 + 11 = 45 + 1 = 46

Pupils begin to record as a written form.</td><td><u>Subtraction – Stage 4</u>
<u>- = signs and missing numbers</u>
Continue using a range of number sentences as in stage 2 but with appropriate numbers.

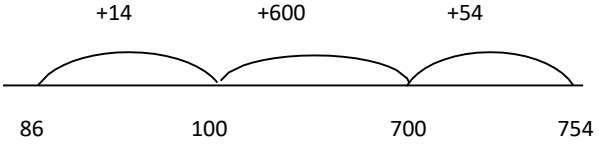
Extend to 14 + 5 = 20 - □</td></tr>
<tr><td></td><td><u>Addition – Stage 5</u>
<u>Add a near multiple of 10 to a two-digit number</u>
Similar to stage 4 e.g. 35 + 19 is the same as 35 + 20 – 1.
Adjust to more appropriate numbers
<u>Or</u>
Using stick and dots to represent tens and ones. Then add the sticks (tens) then the dots (ones) to get final answer.</td><td><u>Subtraction – Stage 5</u>
<u>Subtract 9 or 11. Begin to add/subtract 19 or 21</u>
35 – 9 = 26
35 – 10 = 25
25 + 1 = 26
Also
35 – 11 =
35 – 10 = 25
25 – 1 = 24</td></tr>
<tr><td></td><td><u>Addition - Stage 6</u>
<u>Pencil and paper procedures</u>
83 + 42 = 125
Adding ones first
83
+ <u>42</u>
95 (no carrying over)</td><td><u>Subtraction – Stage 6</u>
<u>Use known number facts and place value to subtract</u>. Adding ones may be the first step before adding 5.

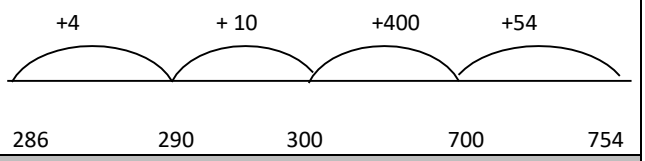
47 – 12
 
</td></tr>
<tr><td></td><td><u>Year 2 Developing – Addition</u>
Partitioning up to 50 – no bridging.

<u>Year 2 Secure – Addition</u>
Adding 2 2-digit numbers using column method with no ‘carrying’.</td><td><u>Year 2 Developing - Subtraction</u>
Up to 50 by partitioning.

<u>Year 2 Secure – Subtraction</u>
Subtracting 2 2-digit numbers with no ‘exchanging’.</td></tr>
<tr><td>Year 3</td><td><u>Addition – Stage 7</u>
358 + 73 = 431

Add the ones first
358
<u>+ 73</u>
431 (carrying in any column)

Extend to decimals in the context of money</td><td><u>Subtraction – Stage 7</u>
<u>Use known number facts and place value to subtract</u>
 
</td></tr>
</table>

	Addition – Stage 8 **Add or subtract the nearest multiple of 10 or 100, then adjust** Continue as in previous stages but with appropriate numbers e.g. 458 + 79 = is the same as 458 + 80 – 1	**Subtraction – Stage 8** **Pencil and paper procedures** Complementary addition with bigger numbers. 754 – 286 = 468 
	Year 3 Developing – Addition Column addition TU with multibase if required. Year 3 Secure – Addition Column addition of 2 3-digit numbers.	Year 3 Developing - Subtraction Column subtraction TU with exchanging Ts with multibase if required. Year 3 Secure - Subtraction Column subtraction of 2 3-digit numbers with exchanging.
Year 4	**Addition – Stage 9** **Pencil and paper procedures** Extend to numbers with at least four digits 3587 + 675 = 4262 3587 + 675 4262 Extend to decimals (same number of decimal places) and adding several numbers (with different numbers of digits).	**Subtraction – Stage 9** Decomposition – no take and break 499 378 – **121**
	Addition – Stage 10 **Add the nearest multiple of 10, 100 or 1000, then adjust** Continue as in previous stages but with appropriate numbers including extending to adding 0.9, 1.9, 2.9 etc. 362 + 129 (300 + 100) (60 + 20) (2 + 9)	**Subtraction – Stage 10** **Decomposition – take and break** $^{3}4^{14}5^{1}3$ 3 9 8 – **0 5 5**
	Addition – Stage 11 **Pencil and paper procedures** Extend to numbers with any number of digits and decimals with 1 and 2 decimal places. 124.9 + 115.25 = 242.15 124.9 + 117.25 242.15 124.90 + 117.25 242.15 Extend to decimals (either one or two decimal places)	**Subtraction – Stage 11** **Decomposition with decimals** $^{3}4.^{14}5^{1}3$ 3 . 9 8 – **0 . 5 5**
	Year 4 Developing – Addition Column addition of 2 4-digit numbers. Year 4 Secure – Addition Column addition of decimals to 2 decimal places (d.p.)	Year 4 Developing – Subtraction Column subtraction of 2 4-digit numbers. Year 4 Secure – Subtraction Column subtraction of decimals to 2d.p
Year 5	Year 5 Developing – Addition Column addition of 2 5-digit numbers. Year 5 Secure – Addition Column addition up to 3 d.p.	Year 5 Developing – Subtraction Column subtraction of 2 5-digit numbers. Year 5 Secure – Subtraction Column subtraction up to 3 d.p.

Year 6	Year 6 - Addition	Year 6 – Subtraction

Written Methods for Multiplication of Numbers.

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. These steps show the stages in building up to using an efficient written method for multiplication of numbers by the end of Year 6.

To multiply successfully, children need to be able to:

- Recall all multiplication facts to 10 x 10.
- Add two or more single digit numbers mentally
- Add multiples of 10 (such as 60 + 70) or of 100 (such as 600 + 700) using the related addition fact, 6 + 7, and their knowledge of place value.
- Work out products such as 70 x 5, 70 x 50, 700 x 5 or 700 x 50 using the related fact 7 x 5 and their knowledge of place value.
- Extend pencil and paper methods to include decimals to 2 decimal places.

Written Methods for Division of Numbers.

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. These steps show the stages in building up to using an efficient written method for division of numbers by the end of Year 6.

Below shows the stages in building up to long division: first TU ÷ U, extending to HTU ÷ U, then HTU ÷ TU.

To divide successfully in their heads, children need to be able to:

- Understand and use the vocabulary of division.
- Recall multiplication and division facts to 10 x 10, recognise multiples of one digit numbers and divide multiples of 10 or 100 by a single number using their knowledge of division facts and place value.
- Know how to find a remainder.
- Understand and use multiplication and division as inverse operations.

To carry out written methods of division successfully, children also need to be able to:

- Understand division as repeated subtraction.
- Estimate how many times one number divides into another.
- Multiply a two digit number by a single digit number mentally.
- Subtract numbers using the column method.
- Use pencil and paper methods to support, record and explain division.
- To extend pencil and paper methods to include remainders and decimals.

Year 1 Multiplication and Division

Multiplication – Stage 1

A whole range of visual and practical opportunities are modelled by the teacher and practised by children. Activities are linked to role play and real life skills. For example 3 sweets are in one bag, how many sweets are in 5 bags?

Moving towards

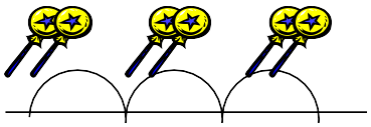
Arrays and repeated addition

• • • • 4 + 4
• • ••

2+ 2+2+2

By end of stage 1 pupils will be able to use a pictorial number line.

2 x 3



0 2 4 6

These images or other visual aids such as Numicon, bead strings etc. maybe used.

Division – Stage 1

Sharing: 6 sweets are shared between 2 people. How many do they have each?

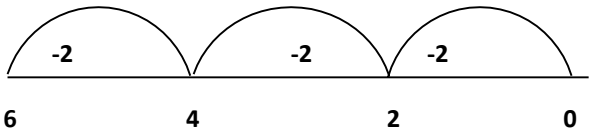
These images or other visual aids such as Numicon, bead strings etc. maybe used.

Division – Stage 2

Understand division as sharing and grouping

6 ÷ 2 can be modelled as:

Grouping: There are 6 sweets. How many people can have 2 each? (How many 2s make 6?)



Division – Stage 3

To recognise and understand the concept of a remainder.

Sharing: 7 sweets are shared between 2 people. How many do they have each?

What do we do with the one remaining? ●

Year 1 Secure – Multiplication
Using arrays up to 20.

Year 1 Secure - Division
Using concrete objects to divide up to 20.

Year 2 Multiplication and Division

Multiplication – Stage 2

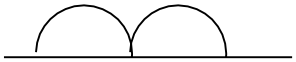
Arrays and repeated addition

• • • • 4 + 4
• • ••

2+ 2+2+2

Teacher models recording on a number line alongside practical problem.

1 bag 2 bags



0 3 6 sweets

Doubles to 10

Division – Stage 4

÷ = signs and missing numbers

Pupils also need to understand that = means "the same as" and that a missing number can be shown as □or ∇

6	÷	2	=	□		□	=	6	÷ 2
6	÷	□	=	3		3	=	6	÷ □
□	÷	2	=	3		3	=	□	÷ 2
□	÷	∇	=	3		3	=	□	÷ ∇

Year 3 Multiplication and Division

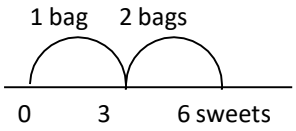
Multiplication – Stage 3

x = signs and missing numbers

Pupils also need to understand that = means "the same as" and that a missing number can be shown as □or ∇

7	x	2	=	□		□	=	2	x	7
7	x	□	=	14		14	=	□	x	7
□	x	2	=	14		14	=	2	x	□
□	x	∇	=	14		14	=	□	x	∇

Teacher models recording on a number line alongside practical problem.



Year 2 Developing – Multiplication
Partitioning up to 50 – no bridging.

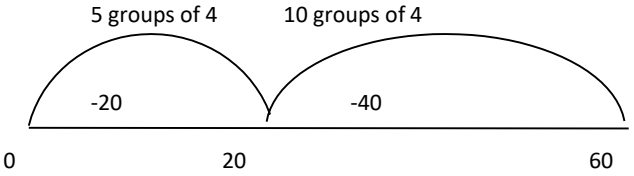
Year 2 Secure – Multiplication
Partitioning x by 2, 3 and 5 up to 100.

Division – Stage 5

Jottings

1x 4 = 4
2 x 4 = 8
5 x 4 = 20
10 x 4 = 40

Chunking



Year 2 Developing – Division
Up to 50 by partitioning.

Year 2 Secure - Division
Numerical representation up to 100.

Multiplication – Stage 4

Grid Method

Use known facts and place value to carry out simple multiplications

x	30	2		
3	90	6	=	96

Multiplication – Stage 5

Grid method

23 x 7 is approximately 20 x 10 = 200

x	20	3		
7	140	21	=	161

140 + 21 = 161

Year 3 Developing - Multiplication
Simple grid method TU x U using x2, x3, x4, x5.

Year 3 Secure – Multiplication
Grid method TU x U using x2, x3, x4, x5, x6 and x8.

Division – Stage 6

Formal Short division method (bus stop)

$$\begin{array}{r} 0\,6\,1\,2 \\ 6\,\overline{)\,3^{3}6^{1}7^{1}2} \end{array}$$

Year 3 Developing – Division
Short division by 2, 3, 4 and 5 with carrying.

Year 3 Secure – Division
Short division method by 2, 3, 4, 5, 6 and 8 with carrying.

Year 4 Multiplication and Division

Multiplication – Stage 6

Formal Long Multiplication Method

47
6x
$28_{4}2$

Year 4 Developing – Multiplication
Simple grid method using HTU x U using all tables.
Year 4 Secure – Multiplication
Multiply 2 and 3 digits by a single digit.

Division – Stage 6

Formal Short division method (bus stop)

0 61 2
6 / $3^{3}67^{1}2$

Year 4 Developing – Division
Short division method by 2, 3, 4, 5, 6, 7 and 8, with carrying.
Year 4 Secure – Division
Short division by any single digit with remainders.

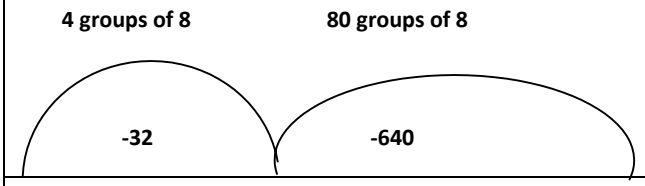
Division – Stage 7

Chunking with Remainders

676 ÷ 8 = 84 r4

Jottings

1x 8 = 8
2 x 8 = 16
5 x 8 = 40
10 x 8 = 80



80 groups of 8 = 640
4 groups of 8 = 32 +
672 How many are left over?

Year 5 Multiplication and Division

Multiplication – Stage 7

Grid method

72 x 38 is approximately 70 x 40 = 2800

x	70	2	
30	2100	60	= 2160
8	560	16	= 576
			= 2736

2100 + 60 = 2160
560 + 16 = 576

Extend to simple decimals with one decimal place.

x	1.00	0.40	
3	3.00	1.20	= 4.20

Multiplication – Stage 8

Formal Long Multiplication Method

456
23 x
$9_{1}1_{1}2\ 0$
$1\ 3_{1}6_{1}8+$
10 4 8 8

When the method is secure move onto calculations with decimals.

Division – Stage 8

Formal Long Division Method.

0 6 1 2
6/ 3 6 7 2
3 6
0 0 7-
6
1 2-
1 2
0

When the method is secure move onto calculations which divide by 2 digit numbers eg: 2345 ÷ 15 =

Year 5 Developing – Multiplication
Multiply a 3-digit number by 2-digit number.
Year 5 Secure – Multiplication
Multiply a 4-digit number by a 2-digit number.

Year 5 Developing – Division
Short division 3-digit number by a single digit.

Year 5 Secure – Division
Short division 4-digit by a single digit.

Year 6

Year 6 Developing – Multiplication
Multiply a number with 2d.p. by a single digit.

Year 6 Secure – Multiplication

Year 6 Developing – Division
Multiply a number with 2d.p. by a single digit.
Divide a 4 digit number by a 2-digit number by using the short division method
Year 6 Secure – Division
Divide a number with 2d.p. by a single digit.