

All Saints, Laxfield Primary School

2017 Calculation Policy

The following calculation policy has been devised to meet requirements of the National Curriculum 2014 for the teaching and learning of mathematics, and is also designed to give pupils a consistent and smooth progression of learning in calculations across the school. Please note that early learning in number and calculation in Reception follows the Development Matters EYFS document, and this calculation policy is designed to build on progressively from the content and methods established in the Early Years Foundation Stage.

Age stage expectations

The calculation policy is organised according to age stage expectations as set out in the National Curriculum 2014, **however it is vital that pupils are taught according to the stage that they are currently working at**, being moved onto the next level as soon as they are ready, or working at a lower stage until they are secure enough to move on.

Providing a context for calculation:

It is important that any type of calculation is given a real life context or problem solving approach to help build children's understanding of the purpose of calculation, and to help them recognise when to use certain operations and methods when faced with problems. This must be a priority within calculation lessons.

National Curriculum Addition

Year One

The + and = signs and missing numbers

Children need to understand the concept of equality before using the '=' sign. Calculations should be written either side of the equality sign so that the sign is not just interpreted as 'the answer'.

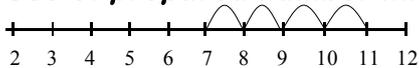
Example

$$\begin{aligned} 2 &= 1 + 1 \\ 2 + 3 &= 4 + 1 \\ 3 &= 3 \\ 2 + 2 + 2 &= 4 + 2 \end{aligned}$$

Missing numbers need to be placed in all possible places.

$$\begin{aligned} 3 + 4 &= & &= 3 + 4 \\ 3 + &= 7 & &7 = + 4 \\ + 4 &= 7 & &7 = 3 + \end{aligned}$$

Use of prepared number lines and concrete objects



Children are encouraged to record by drawing jumps on prepared lines.

Year Two

The + and = signs and missing numbers

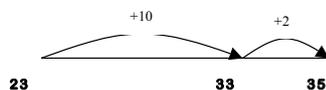
Continue using a range of equations (See Year 1) but with appropriate, larger numbers as specified in Year 2 grade level standards, i.e. extend to $14 + 5 = 10 +$ and $32 + + = 100$ $35 = 1 + + 5$.

Partition into tens and ones and recombine

$$\begin{aligned} 12 + 23 &= 10 + 2 + 20 + 3 \\ &= 30 + 5 \\ &= 35 \end{aligned}$$

Partitioning the second number only

$$\begin{aligned} 23 + 12 &= 23 + 10 + 2 \\ &= 33 + 2 \\ &= 35 \end{aligned}$$



Example: Add 9 or 11 by adding 10 and adjusting by 1 $35 + 9 = 44$

Year Three

The + and = signs and missing numbers

Continue using a range of equations as in Year 1 and Year 2 but with appropriate larger numbers specified in the gradelevel standards.

Progression in mental calculations with larger numbers

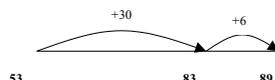
Calculate HTU + U
Calculate HTU + TU
Calculate HTU + HTU

Progress from no crossing of boundaries to crossing of boundary.

Partition into tens and ones and recombine Develop from Year 2- partitioning both numbers and recombining.

Refine to partitioning the second number only:

$$\begin{aligned} 36 + 53 &= 53 + 30 + 6 \\ &= 83 + 6 \\ &= 89 \end{aligned}$$



Add a near multiple of 10 to a two-digit number Continue work from Year 2 but with appropriate

numbers: $35 + 19$ is the same as $35 + 20 - 1$.

Formal methods of columnar addition to add numbers with up to three digits

$$\begin{array}{r} 285 \\ +73 \\ \hline 8 \\ 150 \\ \hline 200 \\ 358 \end{array}$$

Extend to decimals in the context of money

$$\begin{array}{r} \text{£ } 2.50 + \text{£ } 1.75 \\ \text{£ } 2.50 \\ + \text{£ } 1.75 \\ \hline \text{£ } 4.25 \\ 1 \end{array}$$

The expanded method should be used if children experience persisting difficulties.

Year Four

The + and = signs and missing numbers

Continue using a range of equations as in Key Stage 1 and Year 3 but with appropriate numbers.

Partition into hundreds, tens and ones and recombine Either partition both numbers and recombine or partition the second number only e.g.

$$\begin{aligned} 358 + 73 &= 358 + 70 + 3 \\ &= 428 + 3 \\ &= 431 \end{aligned}$$

Add or subtract the nearest multiple of 10 or 100, then adjust

Continue as in Year 2, 3 and 4 but with appropriate numbers e.g. $458 + 79 =$ is the same as $458 + 80 - 1$

Addition of numbers with at least four digits using formal method of columnar addition

$$\begin{array}{r} 358 \\ +73 \\ \hline 431 \\ 11 \\ \hline 3587 \\ +675 \\ \hline 4262 \\ 111 \end{array}$$

The formal, efficient method of columnar addition will involve crossing of boundaries (at the tens, hundreds and/or thousands). Take a systematic approach to teaching this looking at crossing each boundary in turn before mixed practice.

Revert to expanded method if children experience difficulties.

Extend addition to decimals (same number of decimal places) and adding several numbers (with different numbers of digits).

National Curriculum Subtraction

Year One

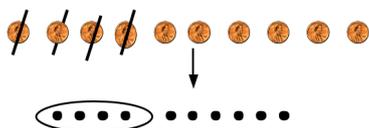
The - and = signs and missing numbers

$$7 - 3 = ? \qquad ? = 7 - 3$$

$$7 - ? = 4 \qquad 4 = ? - 3$$

Use of pictures, marks and concrete objects

Sam spent 4p. What was his change from 10p?



Number Lines

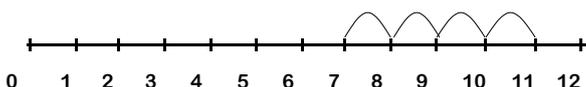
Example- Counting Back/Down

$$11 - 7$$



Example- Counting On/Up

The difference between 7 and 11



Children are encouraged to record by drawing jumps on prepared lines and constructing their own lines.

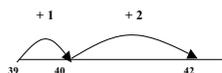
Year Two

The - and = signs and missing numbers

Continue using a range of equations (See Year 1) but with appropriate numbers in relation to Year 2 grade-level standards, i.e. extend to $14 + 5 = 20 -$.

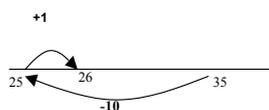
Find a small difference by counting up

$$42 - 39 = 3$$



Example: Subtract 9 or 11 & begin to add/subtract 19 or 21

$$35 - 9 = 26$$



Use known number facts and place value to subtract

(Partition second number only) $37 - 12 = 37 - 10 - 2 = 27 - 2 = 25$

Year Three

The - and = signs and missing numbers

Continue using a range of equations as in Year 1 and Year 2 but with appropriate larger numbers specified in the gradelevel standards.

Find a small difference by counting up

Continue from Year 2 but with appropriate numbers, e.g. $102 - 97 = 5$

Subtract mentally a 'near multiple of 10' to or from a two-digit number, extending to three digit numbers

Continue as in Year 2 but with appropriate numbers e.g. $78 - 49$ is the same as $78 - 50 + 1$

Progression in mental calculations with larger numbers

Calculate HTU - U

Calculate HTU - T

Calculate HTU - H

Progress from no crossing of boundaries to crossing of boundary.

Formal methods of columnar subtraction to subtract numbers with up to three digits
See Appendix 1 examples in Year 5 and Year 6 section of this document.

*From Year 3 onwards, teachers need to keep in mind the methods specified in grade-level standards for end of Key Stage 2. Children should be developing their capacity to use formal written methods for all four number operations.

Year Four

The - and = signs and missing numbers

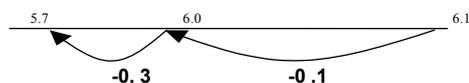
Continue using a range of equations as in Key Stage 1 and Year 3 but with appropriate numbers.

Differences

Find a difference by counting up, e.g. $8006 - 2993 = 5013$. This can be modelled on an empty number line.

Use known number facts and place value to subtract decimals

$$6.1 - 0.4 = 5.7$$



Subtraction with at least four digits using formal method of columnar subtraction

For instance, $6467 - 2684 = 3783$

Using expanded column subtraction where children experience difficulty with decomposition.

Extend subtraction to decimals (same number of decimal places) and adding several numbers (with different numbers of digits)

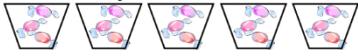
As specified in Year 3, teachers need to keep in mind the methods specified in grade-level standards for end of Key Stage 2. Children should be developing their capacity to use formal written methods for all four number operations.

National Curriculum Multiplication

Year One

Use of pictures and objects

There are 3 sweets in one bag.
How many sweets are there in 5 bags?



Count in multiples of one, two, five and ten Counting steps using bead string and on prepared number lines.



Counting in multiples using a range of objects, e.g. pairs of legs on animals; fingers in gloves etc.

Use of arrays

Counting in rows and columns



Two groups of three is six
Three groups of two is six

So $6 = 2 + 2 + 2$ or $6 = 3 + 3$

Year Two

The x and = signs and missing numbers

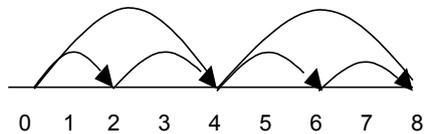
$7 \times 2 = ?$ $? = 2 \times 7$
 $7 \times ? = 14$ $14 = ? \times 7$ $? \times 2 = 14$ $14 = 2 \times ?$

Use materials, arrays, repeated addition

(including solving problems in context)

●● ●● ●● ●● 4×2 or $4 + 4$ ●●●● ●●●●
 2×4

Or repeated addition



$2 + 2 + 2 + 2$

Year Three

The x and = signs and missing numbers

Continue using a range of equations as in Year 2 but with appropriate numbers in relation to grade-level standards.

TU x U

Use known facts $\times 3$, $\times 4$, $\times 8$ (Year 3 grade-level standards) and $\times 2$, $\times 5$ and $\times 10$ (Year 2 grade-level standards).

x	30	5	x	30	2
2	60	10	3	90	6

At Year 3, children progress to using more formal written methods. In this case, the grid method drawing on knowledge of place value, multiplication facts and their ability to recombine partitioned numbers to derive an answer.

*From Year 3 onwards, teachers need to keep in mind the methods specified in grade-level standards for end of Key Stage 2. Children should be developing their capacity to use formal written methods for all four number operations.

Year Four

The x and = signs and missing numbers

Continue using a range of equations but with appropriate numbers for Year 4.

TU x U (See Year 3) and HTU x U (Introduced in Year 4 grade-level standards).

Partition

$$23 \times 4 = 92$$

$$\begin{aligned} 23 \times 4 &= (20 \times 4) + (3 \times 4) \\ &= (80) + (12) \\ &= 92 \end{aligned}$$

Use the grid method of multiplication

23×7 is approximately $20 \times 10 = 200$

x	20	3
7	140	21

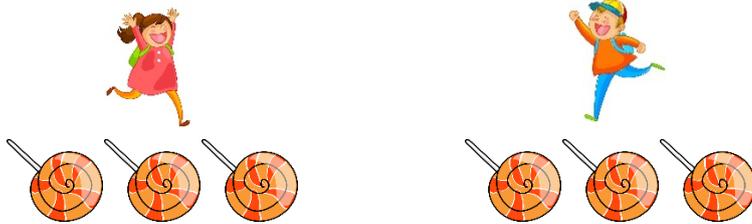
As specified in Year 3, teachers need to keep in mind the methods specified in grade-level standards for end of Key Stage 2. Children should be developing their capacity to use formal written methods for all four number operations.

Use of pictures and objects or marks

12 children get into teams of 4 to play a game. How many teams are there?

**Sharing**

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



Make use of practical activities involving sharing, e.g. distributing cards when playing a game, putting objects onto plates, into cups, hoops etc.

Year Two

The ÷ and = signs and missing numbers

$$6 \div 2 = ?$$

$$? = 6 \div 2$$

$$6 \div ? = 3$$

$$3 = 6 \div ?$$

$$? \div 2 = 3$$

$$3 = ? \div 2$$

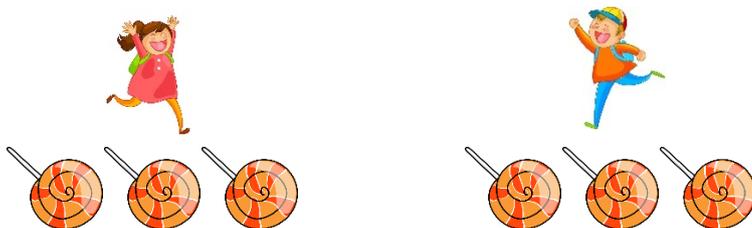
Use materials, arrays, repeated addition

(including solving problems in context)

Use of sharing and grouping**Sharing**

6 sweets are shared between 2 people.

How many do they have each?

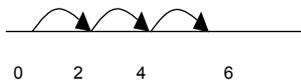
**Grouping**

There are 6 sweets.

How many people can have 2 each?

(How many 2's make

6?)

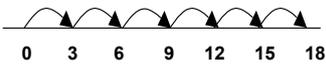


Find and name fractions of length, shape and sets of objects and quantities

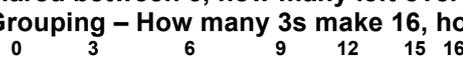
Use of diagrams- count all equal parts to determine denominator. Link to division into equal groups/parts.

Year Three

MD3.2 The \div and $=$ signs and missing numbers **Continue using a range of equations as in Year 2 but with appropriate numbers in relation to grade-level standards.**

MD3.2 TU \div U Grouping  **How many 3s make 18?**

MD3.2 & MD3.3 Remainders
 $16 \div 3 = 5 \text{ r}1$

Sharing – There are 16 sweets shared between 3, how many left over?
 **Grouping – How many 3s make 16, how many left over?**


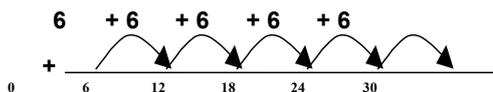
Children with secure knowledge of multiplication facts and subtraction may progress to ‘chunking’ where TU are divided by U.

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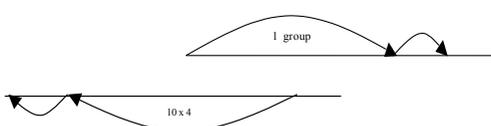
Year Four

The \div and $=$ signs and missing numbers
Continue using a range of equations but with appropriate numbers for Year 4.

MD4.3 Sharing and grouping **$30 \div 6$ can be modelled as:**
Grouping – groups of 6 taken away and the number of groups counted e.g.



Sharing – sharing among 6, the number given to each person.



Remainders
Note three approaches below:
 $41 \div 4 = 10 \text{ r}1$

+40

+1

$$41 = (10 \times 4) + 1$$

MD4.5 TU \div U

72 \div 5 lies between $50 \div 5 = 10$ and $100 \div 5 = 20$

- $\begin{array}{r} 72 \\ \underline{50} \\ 22 \end{array}$ (10 groups) or (10 x 5)
 - $\begin{array}{r} 22 \\ \underline{20} \\ 2 \end{array}$ (4 groups) or (4 x 5)
- Answer: 14 remainder 2

MD4.5 HTU \div U

Can progress from no remainder to remainders. Where remainders are involved, care needs to be taken to ensure they are interpreted correctly in context of problems.

256 \div 7 lies between $210 \div 7 = 30$ and $280 \div 7 = 40$

- $\begin{array}{r} 256 \\ \underline{70} \\ 186 \end{array}$ (10 groups) or (10 x 7) 186
 - $\begin{array}{r} 186 \\ \underline{140} \\ 46 \end{array}$ (20 groups) or (20 x 7) 46
 - $\begin{array}{r} 46 \\ \underline{42} \\ 4 \end{array}$ (6 groups) or (6 x 7)
- Answer: 36 remainder 4

As specified in Year 3, teachers need to keep in mind the methods specified in grade-level standards for end of Key Stage 2 (See Year 5 and Year 6 Calculation Policy Document). Children should be developing their capacity to use formal written methods for all four number operations.

New Mathematics Calculation Policy: Year 5 and Year 6

The exemplification of formal methods here should be taken into account by all Key Stage 2 teachers so children are adequately prepared by Year 5 and into Year 6 to use the means of calculating specified in grade-level standards.

Addition & Subtraction

AS5.1
Columnar
Addition &
Subtraction

789 + 642 becomes

$$\begin{array}{r} 789 \\ + 642 \\ \hline 1431 \\ \hline 1 \quad 1 \end{array}$$

Answer: 1431

874 - 523 becomes

$$\begin{array}{r} 874 \\ - 523 \\ \hline 351 \end{array}$$

Answer: 351

932 - 457 becomes

$$\begin{array}{r} 8 \quad 12 \quad 1 \\ 932 \\ - 457 \\ \hline 475 \end{array}$$

Answer: 475

Multiplication & Division

MD5.5 Short Multiplication
(DfE, 2013,
Appendix 1)

24 × 6 becomes

$$\begin{array}{r} 24 \\ \times 6 \\ \hline 144 \\ \hline 2 \end{array}$$

Answer: 144

342 × 7 becomes

$$\begin{array}{r} 342 \\ \times 7 \\ \hline 2394 \\ \hline 2 \quad 1 \end{array}$$

Answer: 2394

2741 × 6 becomes

$$\begin{array}{r} 2741 \\ \times 6 \\ \hline 16446 \\ \hline 4 \quad 2 \end{array}$$

Answer: 16 446

MD5.7 & ASMD6.2b
Short Division
(DfE, 2013, Appendix 1)

98 ÷ 7 becomes

$$\begin{array}{r} 14 \\ 7 \overline{) 98} \\ \underline{7} \\ 28 \\ \underline{21} \\ 7 \end{array}$$

Answer: 14

432 ÷ 5 becomes

$$\begin{array}{r} 86 \text{ r}2 \\ 5 \overline{) 432} \\ \underline{40} \\ 32 \\ \underline{30} \\ 2 \end{array}$$

Answer: 86 remainder 2

496 ÷ 11 becomes

$$\begin{array}{r} 45 \text{ r}1 \\ 11 \overline{) 496} \\ \underline{44} \\ 56 \\ \underline{55} \\ 1 \end{array}$$

Answer: $45 \frac{1}{11}$

MD5.5 & ASMD6.1 Long
Multiplication
(DfE, 2013,
Appendix 1)

24 × 16 becomes

$$\begin{array}{r} 24 \\ \times 16 \\ \hline 144 \\ 240 \\ \hline 384 \end{array}$$

Answer: 384

124 × 26 becomes

$$\begin{array}{r} 124 \\ \times 26 \\ \hline 744 \\ 2480 \\ \hline 3224 \\ \hline 1 \quad 1 \end{array}$$

Answer: 3224

124 × 26 becomes

$$\begin{array}{r} 124 \\ \times 26 \\ \hline 744 \\ 2480 \\ \hline 3224 \\ \hline 1 \quad 1 \end{array}$$

Answer: 3224

ASMD6.2a
Long Division
(DfE, 2013, Appendix 1)

432 ÷ 15 becomes

$$\begin{array}{r} 28 \text{ r}12 \\ 15 \overline{) 432} \\ \underline{30} \\ 132 \\ \underline{120} \\ 12 \end{array}$$

Answer: 28 remainder 12

432 ÷ 15 becomes

$$\begin{array}{r} 28 \\ 15 \overline{) 432} \\ \underline{30} \\ 132 \\ \underline{120} \\ 12 \end{array} \begin{array}{l} 15 \times 20 \\ 15 \times 8 \end{array}$$

$$\frac{12}{15} = \frac{4}{5}$$

Answer: $28 \frac{4}{5}$

432 ÷ 15 becomes

$$\begin{array}{r} 28.8 \\ 15 \overline{) 432.0} \\ \underline{30} \\ 132 \\ \underline{120} \\ 120 \\ \underline{120} \\ 0 \end{array}$$

Answer: 28.8

