English Nursery and Primary Schools

Moscow



Written Calculation Policy

January 2022

Review date April 2023

**AIMS**

This calculation policy has been created to support the effective implementation of the Primary National Curriculum of England and ensure a consistent approach throughout the school.

The policy focuses on the four operations of addition, subtraction, multiplication and division and includes a list of the key mental maths skills that support written methods.

For each operation, there are different stages, starting with the practical methods that enable conceptual understanding moving through to methods that allow children to demonstrate efficiency in procedural approaches.

It is important to emphasise that a range of methods may be more appropriate for certain calculations and certain individuals. The approaches outlined below are linked to specific year groups, however children may choose to continue to use a method with which they are more familiar, until they have built up the confidence, understanding and strategies required.

**GENERAL**

**Children in the Early Years should focus on practical experiences of calculating number through play activities and diagrammatical representations. It is not expected that any formal written methods are used until Year 1.**

It is important that children’s mental methods of calculation are explicitly taught and practised on a regular basis and secured alongside their learning and use of written methods.

The aim is that children use mental methods when appropriate, but for calculations that they cannot do in their heads they use a written method accurately and with confidence.

Children are taught and acquire secure mental methods of calculation and one written method of calculation which they know they can rely on when mental methods are not appropriate.

This policy shows the possible stages of each written method for all four operations, each stage building towards a more refined method.

**Using and applying is a key theme and one of the aims of National Curriculum and before children move onto the next stage in written calculation it is important that their skills are broadened through their use and application in a range of contexts, these include:**

• using inverse

• missing box questions

• using units of measure including money and time

• word problems

• open ended investigations

**ADDITION**

There are some key basic skills that children need to help with addition, which include:

• counting

• estimating

• recalling all addition pairs to 10, 20 and 100 (7 + 3 = 10, 17 + 3 = 20, 70 + 30 = 100)

• knowing number facts to 10 (6 + 2 = 8)

• adding mentally a series of one-digit numbers (5 + 8 + 4)

• adding multiples of 10 (60 + 70) or of 100 (600 + 700) using the related addition fact, 6 + 7, and their knowledge of place value

• partitioning two-digit and three-digit numbers into multiples of 100, 10 and 1 in different ways (432 into 400 + 30 + 2 and also into 300 + 120 + 12)

• understanding and using addition and subtraction as inverse operations.

**THE FOUR STAGES OF WRITTEN ADDITION**

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| Stage 1: Practical (combining) and adding on (increasing) |
| Prior to recording addition steps on a number line, children will work practically with equipment where they are **combining** sets of objects. As they become more confident, this practical addition of sets of objects will be mirrored on a number line so that the two are being done together and children are **adding on**. This will prepare them for the abstract concept of adding numbers rather than objects. |
| Stage 2: Number tracks and number lines |
| Steps in addition can be recorded on a number line. The steps often bridge through a multiple of 10 and, this is more efficient if children know how to partition 1-digit numbers.    In this example, 7 has been partitioned into 2 and 5 which makes bridging through 10  more efficient.      In these examples, the 6 in 36 has been partitioned into 2 and 4 which makes bridging  through 10 more efficient.  With practice, children will need to record fewer jumps. |
| Stage 3: Partitioning (expanded columnar method) |
| Partition both numbers into tens and ones or hundreds, tens and ones (using a grid makes this easier).    This builds on children’s mental maths skills of partitioning and recombining  40 + 30 = 70 8 + 6 = 14 48 + 36 = 84 |
| Stage 4: Efficient (column method) |
| Column addition remains efficient when used with larger whole numbers or decimals, and when adding more than two numbers, once learned, the method is quick and reliable.    Children should always be encouraged to estimate their answers first. |

**SUBTRACTION**

There are some key basic skills that children need to help with subtraction, which include:

• counting

• estimating

• recalling all addition pairs to 10, 20 and 100 along with their inverses (7+3=10, 10–3=7, 17+3=20, 20–3=17, 70+30=100, 100–30=70)

• knowing number facts to 10 and their inverses (6+2=8, 8-2=6)

• subtracting multiples of 10 (160-70) using the related subtraction fact, (16-7), and their knowledge of place value

• partitioning two-digit and three-digit numbers into multiples of 100, 10 and 1 in different ways (432 into 400 + 30 + 2 and also into 300 + 120 + 12)

• understanding and using subtraction and addition as inverse operations

**THE FOUR STAGES OF WRITTEN SUBTRACTION**

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| Stage 1: Practical (taking away) |
| Prior to recording subtraction steps on a number line, children will work practically with equipment where they are ‘taking away’ a small group from a larger set of objects. As they become more confident, this practical subtraction will be mirrored on a number line so that the two are being done together. This will prepare them for the abstract concept of subtracting numbers rather than objects. |
| Stage 2: Number tracks and number lines |
| Counting back (to be introduced before counting up for difference)  Steps in subtraction can be recorded from right to left on a number line. The steps often bridge through a multiple of 10 and, this is more efficient if children know how to partition 1-digit numbers.    In this example, 7 has been partitioned into 2 and 5 which makes bridging through 10 more efficient.      In these examples, 27 has been partitioned into tens and units then the 7 in 27 has been partitioned into 3 and 4 which makes bridging through 10 more efficient.  With practice, children will need to record fewer jumps.  Counting up (to be introduced after counting back)  Steps in subtraction can be recorded from left to right on a number line. The steps often bridge through a multiple of 10.    When carrying out money calculations that involve finding change or when calculating  time duration, children should use this method.  They will decide whether to count back or forwards, seeing both as ‘finding the difference’.  It is useful to ask children whether counting up or back is the more efficient for calculations such as 57–12 or 86–77. |
| Stage 3: Partitioning (expanded columnar method) |
| Partition both numbers into tens and ones or hundreds, tens and ones (using a grid makes this easier).    This builds on children’s mental maths skills of partitioning and recombining  40 + 30 = 70 8 + 6 = 14 48 + 36 = 84 |
| Stage 4: Efficient (column method) |
| Column subtraction remains efficient when used with larger whole numbers or decimals. Once learned, the method is quick and reliable.    Children should always be encouraged to estimate their answers first. |

**MULTIPLICATION**

There are some key basic skills that children need to help with multiplication, which include:

• counting

• estimating

• understanding multiplication as repeated addition

• recalling all multiplication facts to 12 × 12

• partitioning numbers into multiples of one hundred, ten and one

• working out products (70×5, 70×50, 700×5, 700×50) using the related fact 7×5 and their knowledge of place value

• adding two or more single-digit numbers mentally

• adding multiples of 10 (60+70) or of 100 (600+700) using the related addition fact, 6+7, and their knowledge of place value

• adding combinations of whole numbers

• understanding and using division and multiplication as inverse operations

**THE FIVE STAGES OF WRITTEN MULTIPLICATION**

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| Stage 1: Practical (repeated addition) |
| Children will work practically with equipment grouping objects to see multiplication as repeated addition. As they become more confident, this practical grouping of objects will be mirrored on a number line using the vocabulary ‘lots of’, ‘groups of’, ‘how many lots’, ‘how many times’ so that the two are being done together. This will prepare them for the abstract concept of multiplying numbers rather than objects.    This image can be expressed as:  • 2 multiplied by 5  • two, five times  • 5 groups of 2  • 5 lots of 2  • 5 jumps of 2 on a number line |
| Stage 2: Practical and pictorial arrays (towards grid method) |
| Children use arrays to demonstrate their understanding of commutativity for multiplication facts.    Children use their knowledge of known multiplication tables  This 3 x 7 array can also be seen as 3 x 5 add 3 x 2 |
| Stage 3: Partitioning (grid method) |
| Partition both numbers into tens and ones or hundreds, tens and ones (using a grid makes this easier). |
| Stage 4: Short (column method) |
| Children should always be encouraged to estimate their answers first. |
| Stage 5: Long (column) |
| In the examples given, it is also correct to multiply starting with the tens digit (i.e. multiplying by the most significant digit first). |

**DIVISION**

There are some key basic skills that children need to help with subtraction, which include:

• counting

• estimating

• understanding division as repeated subtraction

• partitioning two-digit and three-digit numbers into multiples of 100, 10 and 1 in different ways (432 into 400 + 30 + 2 and also into 300 + 120 + 12)

• recalling multiplication and division facts to 12 × 12

• recognising multiples of one-digit numbers and dividing multiples of 10 or 100 by a single-digit number using their knowledge of division facts and place value

• knowing how to find a remainder working mentally, for example, find the remainder when 48 is divided by 5

• understanding and using division and multiplication as inverse operations

**THE FOUR STAGES OF WRITTEN DIVISION**

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| Stage 1: Practical (sharing) |
| Children will work practically with equipment sharing objects one to one.    12 cakes are shared equally between 3 people. |
| Stage 2: Number lines (grouping) |
| Children will move from sharing objects practically to grouping them, this will be mirrored on a number line, working from right to left so that they see division as repeated subtraction. This will prepare them for the abstract concept of dividing numbers rather than objects.    Each cake box holds 3 cakes, if I have 12 cakes, how many cake boxes will I need?  How many times can I subtract 3 from 12?  Using their knowledge of the inverse relationship between multiplication and division, children can use their multiplication tables when grouping on a number line, working from left to right.  How many groups of 3 are there in 12?  First without and then with remainders and ensuring that divisors offer an appropriate level of challenge. |
| Stage 3: Short division |
| Short division method is initially taught through partitioning the dividend and “chunking” the divisor into easily manageable sets. i.e. 248÷2= (200÷2) +(40÷2) +(8÷2). Once this method is clearly understood, the children may move on to true short division and “carrying” the remainder. |
| Stage 4: Long division |
| With long division, there is the opportunity to teach an expanded method first (i.e. chunking) |

**THE CALCULATION SEQUENCE – Application of Skills**

1. Provide an estimate for the calculation - *Using knowledge of number and the number system, rounding and approximating, make a reasonable estimate.*
2. Teach the calculation skill - *What is the objective you are teaching? Include example questions, increasing in complexity,* *for both operations.*
3. Ensure you have taught the inverse - *Plan example questions, increasing in complexity. Ensure methods used are in line with school calculation policy. Check that children understand that inverse can also be used to check calculations*
4. Devise similar calculations but include units - *Which units do you need to include? Check the measures applicable to your year group for length, weight, capacity, money and time.*
5. Complete missing box questions - *Include units in these questions, as above. The box may cover single digits or an entire number. Vary the position of the missing box within the calculation.*
6. Present questions in a range of styles – *Encourage children to memorise key symbols and vocabulary. Try to mirror the formats that children may encounter in assessments or in real life scenarios.*
7. Complete word problems, 1 and 2 step, including units - *Write problems, ensuring the numbers are sized correctly in line with the objective and that units are also used.*
8. Provide opportunities for open ended investigations - *Plan example questions and investigations. Ensure children are working with the correct operations, appropriate size of numbers and use of units for context.*

**PROGRESSION ACROSS THE YEAR GROUPS**

|  |  |  |
| --- | --- | --- |
| Addition | | |
|  | Typical calculations | Suitable methods |
| Early Years | U+1  U+U | * Practical |
| Y1 | U+U  TU + U (to 20 including zero) | * Practical * Number line |
| Y2 | TU + U  TU + multiples of 10  TU + TU  U + U + U | * Practical * Number line * Expanded columnar |
| Y3 | HTU + U  HTU + TU  HTU + HTU | * Number line * Expanded columnar * Column |
| Y4 | THTU + HTU  THTU + THTU | * Expanded columnar * Column |
| Y5 | THTU.t + THTU.t  THTU.th + THTU.th | * Expanded columnar * Column |
| Y6 | THTU.tht + THTU.tht | * Column |

**PROGRESSION ACROSS THE YEAR GROUPS**

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| --- | --- | --- |
| Subtraction | | |
|  | Typical calculations | Suitable methods |
| Early Years | U-1  U-U | * Practical |
| Y1 | U-U  TU - U (to 20 including zero) | * Practical * Number line |
| Y2 | TU - U  TU - multiples of 10  TU - TU  U - U - U | * Practical * Number line * Expanded columnar |
| Y3 | HTU - U  HTU - TU  HTU - HTU | * Number line * Expanded columnar * Column |
| Y4 | THTU - HTU  THTU - THTU | * Expanded columnar * Column |
| Y5 | THTU.t - THTU.t  THTU.th - THTU.th | * Expanded columnar * Column |
| Y6 | THTU.tht - THTU.tht | * Column |

**PROGRESSION ACROSS THE YEAR GROUPS**

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| --- | --- | --- |
| Multiplication | | |
|  | Typical calculations | Suitable methods |
| Early Years | UxU | * Practical (repeated addition) |
| Y1 | UxU | * Practical (repeated addition) * Practical and pictorial arrays |
| Y2 | UxU | * Practical (repeated addition) * Practical and pictorial arrays |
| Y3 | TU x U | * Grouping on a number line progressing into Expanded (grid) |
| Y4 | TU x U  HTU x U | * Expanded (grid) progressing into Short |
| Y5 | HTU x U  THTU x U  TU x TU | * Expanded (grid) progressing into Short * Expanded (grid) progressing into Long |
| Y6 | THTU x U  TU x TU  HTU x TU  THTU x TU  U.t x U  U.th x U  U.t x TU  U.t x TU | * Expanded (grid) progressing into Short * Short * Expanded (grid) progressing into Long * Long |

**PROGRESSION ACROSS THE YEAR GROUPS**

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| --- | --- | --- |
| Division | | |
|  | Typical calculations | Suitable methods |
| Early Years | U ÷ U | * Practical sharing |
| Y1 | U ÷ U  TU ÷ U | * Practical sharing * Number-line grouping |
| Y2 | U ÷ U  TU ÷ U | * Practical sharing * Number-line grouping |
| Y3 | TU ÷ U | * Grouping on a number line progressing into Short |
| Y4 | TU ÷ U  HTU ÷ U | * Grouping on a number line progressing into Short * Short (remainders to be expressed as r) |
| Y5 | HTU ÷ U  THTU ÷ U | * Short (remainders to be expressed as r, then as a fraction and as a decimal) |
| Y6 | THTU ÷ U  HTU ÷ TU  THTU ÷ TU  U.th ÷ U  TU.th ÷ U  HTU.th ÷ U  THTU.th ÷ U | * Short (remainders to be expressed as r, then as a fraction and as a decimal) * Long (remainders to be expressed as r, then as a fraction and as a decimal) * Short (remainders to be expressed as a decimal) |

*To be reviewed: April 2023*