Moorside Primary School

Moorside
Primary School

Maths Calculation Policy

Our Purpose
Moorside Community Primary is a school at the heart of our diverse community in the West End of Newcastle.
We pride ourselves in belonging to a caring school community where everyone is welcome.
We strive to deliver an outstanding education for all our children.
We help everyone to become caring and active citizens.
We encourage everyone to thrive and achieve their full potential.

Our Vision
We want everyone in our school to work together to make us as good as any school can be.
We want to create new opportunities for everyone to succeed.
We want to create a culture which broadens all of our horizons.
We want everyone to be able to tackle the challenges we will face in an ever changing world.
We want all of our children to effectively engage with each other and with our community.

Our values
We all believe...
Our local community deserves a school they can be proud of.
We are a caring community where everyone is welcome.
We all value, respect and support each other.
Our community has the right to be safe and healthy.
Our children should have the chance to enjoy and be enthused by their time in our school.

We all agree...
Everyone will always try their best and take pride in all that they do.
Everyone will demonstrate good manners at all times.
Everyone will respect each other and show consideration.
Everyone will respect and care for our environment and resources.
Everyone will celebrate each other's successes and achievements.

Introduction

This document recommends an approach for developing progression in the conceptual and procedural aspects of calculation across Key Stages 1 and 2. It takes into account the mathematics programmes of study and non statutory guidance for the National Curriculum 2014.

The document covers:

- Calculations that can be done wholly or partially by mental methods, based on fluency with number facts and understanding of place value and number operations and sometimes using horizontally presented number sentences or empty number lines to show steps in thinking.
- The use of expanded or informal written methods to support understanding of compact, formal written methods and
- Developing fluency in the use of formal written methods by the end of key stage 2.

Children should work towards being able to use, by the end of Key Stage 2:

- A range of strategies for mental calculations *appropriate to the numbers involved.*
- One formal written method (for each number operation) for calculations that cannot be done mentally.

Progression in mental calculation skills can be supported by:

- The ability to quickly recall a range of number facts and an understanding of how to use them to derive other related facts.
- Understanding how numbers and calculations can be represented by materials and images such as arrays, ten frames, Numicon shapes.
- An understanding of the number system (order and relative position of numbers, place value, etc), the four number operations and the laws of arithmetic associated with them
- Understanding of how symbols are used to record calculations especially the equals sign. Care should be taken that the equals sign is used correctly e.g. $42 + 35 = \mathscr{D}$ might be calculated by partitioning the second number to add the tens followed by the units. This could be recorded as:
  $42 + 30 = 72$
  $72 + 5 = 77$
  But not as $42 + 30 = 72 + 5 = 77$ as this involves an incorrect use of the first equals sign.
- An understanding of how calculations can be represented on empty number lines. They will need to work with numbered tracks and lines first before they are confident to rely on empty lines alone. To make good use of empty lines children need to be able to:
  o Move forward <u>and back</u> confidently on the number line.
  o Make jumps of different sizes.
  o Recognize landmark numbers such as multiples of 10
  o **Know** and use number complements to 10 and how these relate to multiples of 10.
  o Partition and recombine numbers in appropriate ways e.g. $7 + 5$ as $7 + 3 + 2$, or $28 + 9$ as $28 + 10 - 1$.

Teachers should **model** the use of number sentences and number lines to aid steps in calculations. Children should be encouraged to record the steps in their mental calculations some of the time. Recording is useful when explaining methods to others and to show which strategy has been used. It is not necessary to always record, especially for those children who have efficient mental methods. Teachers should use their judgement about when to require recording.

Progression to fluency with a formal written method for each number operation can be made by
  o The appropriate use of informal or expanded written methods that build on mental methods and which continue to highlight understanding of the number system and number operations.
  o Linking of these expanded methods to the formal written method when it is first introduced to highlight steps that may be concealed, and hence not understood, in the procedural execution of the formal written method.
  o Appropriate levels of practice of formal written methods to develop fluency.

Children should continue to develop their mental calculation skills with larger numbers once written methods are introduced and should be given opportunities to identify which calculations might be done mentally.

Teachers need to judge when children are ready to move from mental to written calculations. The following lists offer some guidance.

Addition and subtraction
Can pupils:

- Recall addition and subtraction facts to 20?
- Understand place value and partition numbers?
- Add three single digit numbers mentally?
- Add or subtract any pair of two digit numbers mentally?
- Explain their mental strategies orally and record them using horizontal number sentences or an empty number line?

Multiplication and division
Can pupils:
- Quickly recall multiplication and division facts for 2, 3, 4, 5 and 10 times tables?
- Understand what happens when a number is multiplied by 0 or 1?
- Understand 0 as a place holder?
- Multiply two-and three-digit numbers mentally by 10 and 100?
- Model understanding of the commutative, distributive and associative laws (though not necessarily know the names)?
- Double and halve two-digit numbers mentally?
- Explain mental strategies orally and with recording?

This document considers addition and subtraction together followed by multiplication and division. **Links between number operations should be emphasised regularly**.
A year-by-year approach has been taken in line with the format of the National Curriculum 2014 programmes of study but teachers should have regard to other year group expectations when planning for different abilities.

Addition and subtraction
The first table below gives an overview of the calculation expectations for each year group. Statements highlighted in **bold** can be matched to the National Curriculum 2014 programmes of study or non statutory guidance. Other items are suggested approaches for schools to follow to support children's understanding of calculation methods.
The second table in this section sets of how children's recording of calculations might look depending on the mental strategy or written method being used.

Tools to aid learning
As a school, we are following the national curriculum objectives to deliver high quality lessons. We can use the following tools as an aid for all learners:
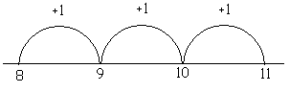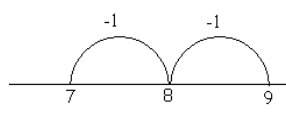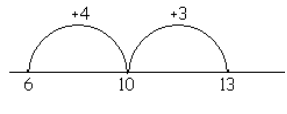
- White Rose Hub materials
- NRICH https://nrich.maths.org/
- STEM https://www.stem.org.uk/resources/collection/4286/core-maths
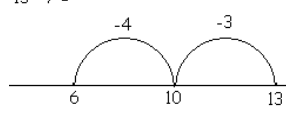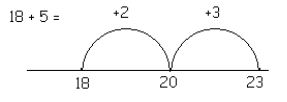
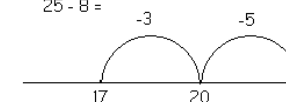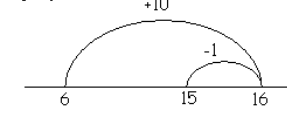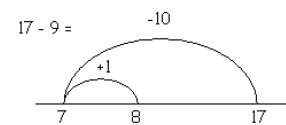| Year	Addition and subtraction
1	Children in Year 1 should: • **Use concrete objects and pictorial representations, including number lines, to support their solution of addition and subtraction problems.** • **Represent and use number bonds and related subtraction facts within twenty, memorizing and reasoning with these bonds.** • **Add and subtract one-digit and two-digit numbers to twenty, including zero (and realize the effect of adding or subtracting zero to establish the relationship between these operations)** • **Read, write and interpret mathematical statements involving addition (+), subtraction (-) and (=) signs in a range of formats e.g. $\triangle + 5 = 12$ or $7 = \lozenge - 9$**
2	Children in Year 2 should: • **Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100 e.g. use 3 + 7 = 10 to derive 30 + 70 = 100** • **Use concrete objects and pictorial representations to support their solution of addition and subtraction problems and to add and subtract mentally including TO+/-O, TO** • **O+/- T, TO +/- TO, O + O + O.** • **Show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot. Use the associative law of addition to show for example that 5 +2 + 1 = 1 + 5 + 2 = 1 + 2 + 5** • **Recognize and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems** • Record mental additions and subtractions using horizontal number sentences and/or empty number lines to show and explain the steps in their calculations. • **Recording in columns supports place value and prepares for formal methods.**
3	Children in Year 3 should: • **Add and subtract numbers mentally including HTO +/- O, HTO+/- T, HTO+/- H** • Use horizontal number sentences and empty number lines sometimes to support explanation of their mental calculation methods. • **Solve varied addition and subtraction problems including missing number problems using number facts and place value.** • Develop their understanding of written methods; working from expanded to **using** (compact) **formal written methods of columnar addition and subtraction with numbers of up to three digits.** Particular attention should be paid to the language used when modeling these methods. The value of digits should be retained according to place value and use of practical materials /representations may aid understanding • **Estimate the answer to a calculation and check using inverse operations.**
4	Children in Year 4 should: • **Continue to add and subtract numbers** with up to four digits **mentally** where the nature of the numbers makes this appropriate. They may use horizontal number sentences or empty number lines to support an explanation of the steps in their calculation. They should be given opportunities to identify calculations which are appropriate for a mental method and explain why. • **Add and subtract numbers with up to four digits using the formal written methods of columnar addition and subtraction where appropriate**. Their understanding of the procedures involved may be supported by the use of expanded written methods and practical materials if required. • **Estimate and use inverse operations to check answers to a calculation.**
5	Children in Year 5 should: • **Add and subtract numbers mentally with increasingly large numbers e.g. 12,462 – 2300 = 10,162.** Use horizontal number sentences and empty number lines sometimes to support explanation of their methods. They should be given opportunities to identify calculations which are appropriate for a mental method and explain why. • **Add and subtract whole numbers with more than four digits, including using formal written methods (columnar addition and subtraction).**Particular attention should be paid to the language used when modelling these methods. The value of digits should be retained according to their place value. Understanding of the procedures involved may be supported by the use of expanded written methods and practical materials if required.

	•	**Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy**
	•	**Solve addition and subtraction multi-step problems in context, deciding which operations to use and why.**
6	Children in Year 6 should:	
	•	**Perform mental calculations including with mixed operations and large numbers** (and decimals)**.** Use horizontal number sentences and empty number lines sometimes to support explanation of their methods. They should be given opportunities to identify the most appropriate tool for calculations ie mental method, mental with recording or formal written method explain why.
	•	**Practise addition and subtraction for (appropriate) larger numbers** and decimals **using the formal written methods of columnar addition and subtraction.** Those who are not able to use the compact formal method may use an expanded method and work towards an understanding of the formal written method. Particular attention should be paid to the language used when modelling these methods. The value of digits should be retained according to their place value. Materials / representations may support understanding.
	•	**Use estimation to check answers to calculations and determine, in the context of the problem, an appropriate degree of accuracy.**
	•	**Round answers to a specified degree of accuracy.**
	•	**Use knowledge of the order of operations, and use of brackets, to carry out calculations involving the four operations.**
	•	**Solve addition and subtraction multi-step problems in contexts, deciding which operations to use and why.**

NOTE: Pupils should <u>memorise</u> and reason with number bonds to 10 and 20. Use of structured materials such as numicon may support this and <u>reduce dependence on count by ones strategies.</u>		Pupils should become familiar with the terms: *put together, add, altogether, total, take away, distance between, difference between, more than and less than* so they develop the concept of addition and subtraction and can use these operations flexibly.		
Strategy	**Addition sentences**	**Number lines**	**Subtraction sentences**	**Number lines**
Counting on/back	8 + 3 = 11	+1 +1 +1 8 9 10 11	9 − 2 = 7	−1 −1 7 8 9
Reordering: Count on from larger number	3 + 8 = ✎ rewrite as 8 + 3 = 11	Reorder before using number line as above		
Find pairs that total 10	3 + 4 + 7 = 3 + 7 + 4 = 10 + 4 = 14			
Partition into 5 and a bit	5 + 8 = ✎ 5 + 5 + 3 = 10 + 3 = 13			
	7 + 8 = ✎ 5 + 2 + 5 + 3 = 5 + 5 + 2 + 3 = 10 + 5 = 15			
Use near doubles	5 + 6 = ✎ 5 + 5 + 1 = ✎ 10 + 1 = 11			
Begin to bridge through 10	6 + 7 = ✎ 6 + 4 + 3 = 10 + 3 = 13	6 + 7 = +4 +3 6 10 13	13 − 7 = ✎ 13 − 3 − 4 = 10 − 4 = 6	13 - 7 = −4 −3 6 10 13
	18 + 5 = ✎ 18 + 2 + 3 = 20 + 3 = 23	18 + 5 = +2 +3 18 20 23	25 − 8 = ✎ 25 − 5 − 3 = 20 − 3 = 17	25 - 8 = −3 −5 17 20 25
Add or subtract 9	6 + 9 = ✎ 6 + 10 − 1 = 16 − 1 = 15	6 + 9 = +10 −1 6 15 16	17 − 9 = ✎ 17 − 10 + 1 = 7 + 1 = 8	17 - 9 = −10 +1 7 8 17

YEAR 2

Establish the use of efficient, non-counting based, strategies using bonds to 20, place value etc.
Use of representations and materials such as ten frames and base ten materials may support understanding.

Strategy	Addition sentences	Number lines	Subtraction sentences	Number lines
Counting on/back in ones and tens. **Move children to using known bonds to reduce reliance on this.**	$34 + 3 = $ $23 + 20 = $	+10 +10 / 23 … 43 +1 +1 +1 / 34 … 37	$27 - 4 = $ $45 - 20 = $	-1 -1 -1 -1 / 23 … 27 -10 -10 / 25 … 45
Count up to find a small difference			$82 - 79 = $	+1 +2 / 79 80 82
Reordering	$5 + 7 + 5 = $ $5 + 5 + 7 = $			
Use near doubles	$6 + 7 = $ $6 + 6 + 1 = $ $40 + 39 = $ $40 + 40 - 1 = $			
Bridge through multiples of 10	$25 + 7 = $ $25 + 5 + 2 = $	+5 +2 / 25 30 32	$45 - 8 = $ $45 - 5 - 3 = $	-3 -5 / 37 40 45
Partitioning using multiples of 10. *Partition both numbers or just the second.*	$25 + 14 = $ $20 + 10 = 30$ $\;\;5 + \;\;4 = \;\;9$ or $25 + 10 = 35$ $35 + 4 = 39$	+10 +4 / 25 35 39	$46 - 23 = $ $40 - 20 = 20$ $\;\;6 - \;\;3 = \;\;3$ or $46 - 20 = 26$ $26 - 3 = 23$ NB In cases such as $43 - 26 = $ $30\;\;40 - 20 =$ $13\;\;3\;\;6 \;=$	-3 -20 / 23 26 46
Compensating to add/subtract numbers close to a multiple of 10	$24 + 19 = $ $24 + 20 - 1 = $ $58 + 21 = $ $58 + 20 + 1 = $	+20 -1 / 24 43 44 +20 +1 / 58 78 79	$70 - 11 = $ $70 - 10 - 1 = $ $53 - 19 = $ $53 - 20 + 1 = $	-1 -10 / 59 60 70 -20 +1 / 33 34 53

		YEAR 3		
Strategy	**Addition sentences**	**Number lines**	**Subtraction sentences**	**Number lines**
Children should calculate mentally with up to three digit numbers when nature of numbers makes this appropriate. They should use number bonds and place value to make efficient steps in their calculations. They may sometimes use a number line to record their thinking but may be able to work without jottings e.g. 433 + 200, 385 – 40, 501 – 4. They may use the following strategies and recording.				
Add/subtract ones, tens and hundreds using number bonds and place value to find most efficient steps.	$90 + 40 = $ 🖊		$110 – 30 = $ 🖊	
Count up to find a difference			$504 – 498 = $ 🖊	
Bridge through multiples of 10	$49 + 7 = $ 🖊 $49 + 1 + 6 = $ 🖊		$62 – 7 = $ 🖊 $62 – 2 – 5 = $ 🖊	
Compensating to add/subtract numbers close to a multiple of 10	$543 + 29 = $ 🖊 $543 + 30 – 1 = $		$273 – 29 = $ 🖊 $273 – 30 + 1 = $ 🖊	
Partitioning using multiples of 10 *Partition both numbers or just the second*	$86 + 57 = $ 🖊 $80 + 50 = 130$ $6 + 7 = 13$ or $86 + 50 = 136$ $136 + 7 = 143$		$96 – 24 = $ 🖊 $90 – 20 = 70$ $6 – 4 = 2$ or $96 – 20 = 76$ $76 – 4 = 72$	

Introducing the **formal written method of columnar addition and subtraction**

	Addition	Subtraction
Partitioning both numbers using multiples of 10 and using the expanded method my help children move to the formal written method with understanding.	$\begin{array}{r} 67 \\ + 24 \\ \hline 11 \\ 80 \\ \hline 91 \end{array}$	$\begin{array}{r} 87 = 80 + 7 \\ - 53 \quad 50 + 3 \\ \hline 30 + 4 \end{array}$ $\begin{array}{r} 70 \quad 13 \\ 83 = \cancel{80} + \cancel{3} \\ - 57 \quad 50 + 7 \\ \hline 20 + 6 \end{array}$
Introduce the **formal method** with or without regrouping as appropriate for pupils	$\begin{array}{r} 234 \\ +145 \\ \hline 379 \end{array}$ $\quad$ $\begin{array}{r} 234 \\ +178 \\ \hline 412 \\ 1\ 1 \end{array}$	$\begin{array}{r} 285 \\ - 123 \\ \hline 162 \end{array}$ $\quad$ $\begin{array}{r} {}^{7\ 1} \\ 285 \\ - 127 \\ \hline 158 \end{array}$

YEAR 4				
Strategy	**Addition sentences**	**Number lines**	**Subtraction sentences**	**Number lines**
Children should calculate mentally with up to four digit numbers when nature of numbers makes this appropriate. They should use number bonds and place value to make efficient steps in their calculations. They may sometimes use a number line to record their thinking but may be able to work without jottings e.g. 1433 + 200, 985 – 420, 1510 – 40. They may use the following strategies.				
Count up to find a small difference			$403 - 386 = $ ✐ $4008 - 3993 = $ ✐	+7 +8 3993 4000 4008
Bridge through multiples of 10	$357 + 7 = $ ✐ $357 + 3 + 4 = $ ✐	+3 +4 357 360 364	$905 - 7 = $ ✐ $905 - 5 - 2 = $ ✐	-2 -5 898 900 905
Compensating to add/subtract numbers close to a multiple of 10	$74 + 58 = $ ✐ $74 + 60 - 2 = $ ✐	+60 -2 74 132 134	$283 - 71 = $ ✐ $283 - 70 - 1 = $ ✐	-1 -70 212 213 283
Partitioning using multiples of 10 *Partition both numbers or just the second.*	$88 + 76 = $ ✐ $80 + 70 = 150$ $8 + 6 = 14$ or $88 + 70 = 158$ $158 + 6 = 164$	+70 +6 88 158 164	$98 - 43 = $ ✐ $90 - 40 = 50$ $8 - 3 = 5$ or $98 - 40 = 58$ $58 - 3 = 55$	-3 -40 55 58 98

Developing the formal written method of columnar addition and subtraction

	Addition	Subtraction
Most children should add and subtract numbers with up to four digits using the formal written methods of columnar addition and subtraction.		
For children who are not ready for these formal methods use: o the informal expanded method for addition, adding the least significant digits first and o the expanded decomposition method for subtraction Move from these when ready to the **formal written method** supporting children to understand regroupings involved. Place value materials and representations may support children to understand the written procedure if required	358 + 73 11 120 300 431 358 + 73 431 1 1	$40 + 14$ $754 = 700 + \cancel{50 + 4}$ 7⁴5¹4 $- 36$ $\cancel{}30 + 6$ - 36 $700 + 10 + 8$ 718

		YEAR 5		
Strategy	**Addition sentences**	**Number lines**	**Subtraction sentences**	**Number lines**
Children should calculate mentally with large numbers when nature of numbers makes this appropriate e.g. 12,462 – 2,300 = 10,162. They should use number bonds and place value to make efficient steps in their calculations. They may sometimes use a number line to record their thinking but may be able to work without jottings. They may use the following strategies.				
Count up to find a small difference			$705 - 287 = \mathscr{D}$ $8006 - 2993 = \mathscr{D}$	
Bridge through whole numbers for decimals	$3.8 + 2.6 = \mathscr{D}$ $3.8 + 0.2 + 2.4 = \mathscr{D}$		$7.5 - 0.8 = \mathscr{D}$ $7.5 - 0.5 - 0.3 = \mathscr{D}$	
Compensating to add/subtract numbers close to a multiple of 10	$346 + 59 = \mathscr{D}$ $346 + 60 - 1 = \mathscr{D}$ $406 - 1 = 405$ $478 + 71 = \mathscr{D}$ $478 + 70 + 1 = 549$		$425 - 58 = \mathscr{D}$ $425 - 60 + 2 = \mathscr{D}$ $365 + 2 = 367$ $583 - 71 = \mathscr{D}$ $583 - 70 - 1 = \mathscr{D}$	
Partition using multiples of 10. *Partition both numbers or just the second.*	$324 + 58 = \mathscr{D}$ $320 + 50 = 370$ $ 4 + 8 = 12$ or $324 + 50 = 374$ $374 + 8 = 382$		$428 - 43 = \mathscr{D}$ $428 - 40 - 3 = \mathscr{D}$	

	Addition	Subtraction
Most children use the formal written methods of columnar addition and subtraction with appropriate **whole numbers of <u>more than 4 digits</u>**		
Most children use the formal written methods.	$\begin{array}{r} 587 \\ + 475 \\ \hline 1062 \\ \scriptstyle 11 \end{array}$	$\begin{array}{r} {}^{6}\cancel{7}\,{}^{14}\cancel{5}\,{}^{1}4 \\ - \;\; 2\;\;8\;6 \\ \hline \;\;4\;\;6\;8 \end{array}$
Use the expanded methods to support children who are not ready for the compact written method to understand and move towards use of the formal methods. Place value materials and representations may support children to understand the written procedure if required.	$\begin{array}{r} 587 \\ +475 \\ \hline 12 \\ 150 \\ 900 \\ \hline 1062 \end{array}$	$\begin{array}{l} 600 + 140 \\ 40\;+ 14 \\ 754 = \cancel{700} + \cancel{50+4} \\ \underline{-286} \quad 200 + 80 + 6 \\ 400 + 60 + 8 \end{array}$

	YEAR 6			
Strategy	**Addition sentences**	**Number lines**	**Subtraction sentences**	**Number lines**
Children should continue to calculate mentally with large numbers and decimals **when nature of numbers makes this appropriate e.g. 12,462 – 2,300 = 10,162.** They should use number bonds and place value to make efficient steps in their calculations. They may sometimes use a number line to record their thinking but will often be able to work without jottings. They may use the following strategies.				
Count up to find a small difference			$8004 - 2785 = $ ✐	
Bridge through whole numbers for decimals	$3.8 + 2.6 = $ ✐ $3.8 + 0.2 + 2.4 = $ ✐		$7.5 - 0.8 = $ ✐ $7.5 - 0.5 - 0.3 = $ ✐	
Compensating to add/subtract numbers close to a multiple of 10 and whole numbers when working with decimals	$7.5 + 0.9 = $ ✐ $7.5 + 1.0 - 0.1 = $ ✐		$19.3 - 2.9 = $ ✐ $19.3 - 3.0 + 0.1 = $ ✐	
Partition using multiples of 10. *Partition both numbers or just the second.*	$540 + 280 = $ ✐ $540 + 200 + 80 = $ ✐		$276 - 153 = $ ✐ $276 - 100 - 50 - 3 = $ ✐	

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	Addition	Subtraction
Most children use the formal written methods of columnar addition and subtraction.		
Most children use the formal written methods. Extend practice to numbers with any number of digits and to two or three decimal places. Use expanded method for those who are not ready for the formal written method and support understanding through the use of place vale materials and smaller numbers as appropriate. .	7648 +1486 9134 1 1 1 7648 +1486 14 120 1000 8000 9134	5 13 1 6 4 6 7 - 2 6 8 4 3 7 8 3 600 + 140 40 + 14 754 = 7̶0̶0̶ + 5̶0̶ + 4̶ -286 200 + 80 + 6 400 + 60 + 8

Multiplication and Division

Children should develop understanding of multiplication as
- repeated addition
- describing an array
- scaling

And an understanding of division as:
- grouping
- sharing

Children can develop this understanding and perform calculations through recording in a variety of ways:
- drawing pictures and making marks
- drawing and partitioning arrays
- drawing jumps on number lines
- writing number sentences and using informal and formal written methods
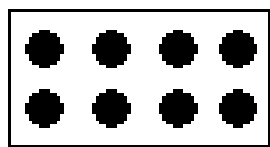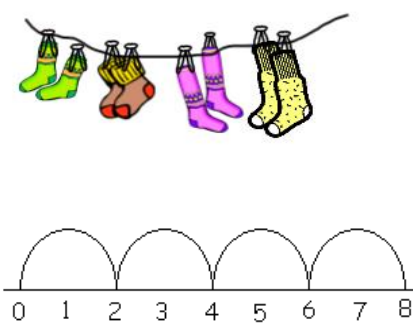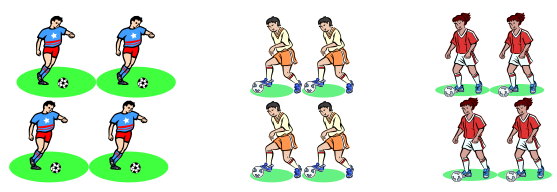
The first table below gives an overview of the calculation expectations for each year group. Statements highlighted in **bold** can be matched to the National Curriculum 2014 programmes of study or non-statutory guidance. Other items are suggested approaches for schools to follow to support children's understanding of calculation methods.
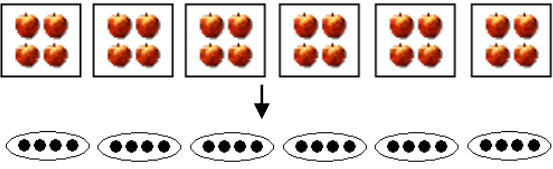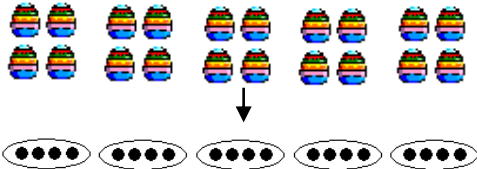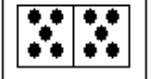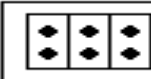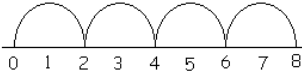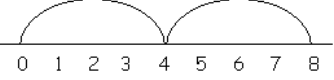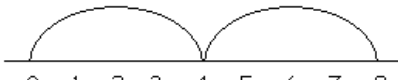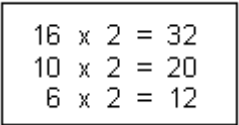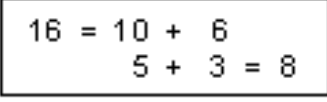
The second table in this section sets out how children's recording of calculations might look depending on the mental strategy or written method being used.

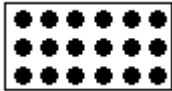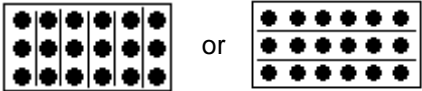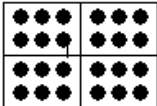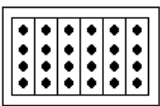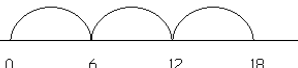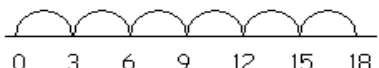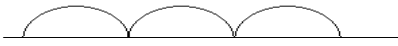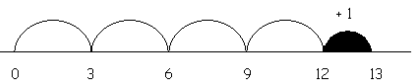| Year	Multiplication and division
1	Children in Year 1 should: • **Solve one step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.** • **Through grouping and sharing small quantities, pupils begin to understand: multiplication and division; doubling numbers and quantities; and finding simple fractions of numbers and quantities** • **Pupils make connections between arrays, number patterns and counting in twos, fives and tens.**
2	Children in Year 2 should: • **Use materials and contexts in which multiplication and division relate to grouping and sharing discrete and continuous quantities, to arrays and to repeated addition. Begin to relate ideas to fractions and measures** • **Recall and use the multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers.** • **Make connections between these tables and connect the 10 multiplication table to place value and the five table to divisions on a clock face** • Use number sentences to show multiplication as repeated addition. • Record multiplications and divisions as jumps on number lines. • **Calculate mathematical statements for multiplication and division within the multiplication tables and use x, ÷ and = signs.** • **Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot.** • **Use commutativity and inverse relationships to develop multiplicative reasoning e.g. 4 x 5 = 20 and 20 ÷ 5 = 4** • **Solve problems, including problems in contexts, involving multiplication and division, using materials, arrays, repeated addition, mental methods and multiplication and division facts.**
3	Children in Year 3 should: • Draw pictures and arrays to represent multiplications and divisions if necessary to support understanding, including for situations involving remainders. • Use number sentences and / or number lines to explain multiplication / division as repeated addition / subtraction • Partition arrays to find related number facts for single digit tables facts e.g. 8 x 4 = (4 + 4) x 4 or 8 x 4 = (5 + 3) x 4. • **Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables. Connect 2, 4 and 8 tables through doubling.** • **Develop efficient mental methods e.g. using commutativity and associativity and using known facts to derive other related facts.** • Use partitioning and use of the distributive law to introduce multiplication and division of a two digit by one digit number. Support this work with images and materials such as arrays and place value counters. • **Write and calculate mathematical statements for multiplication and division using the multiplication statements that they know, including for two-digit numbers times one digit numbers, using mental and progressing to formal written methods of short multiplication and division.** • Use tables facts to **solve problems including missing number, integer scaling and correspondence problems in which n objects are connected to m objects**
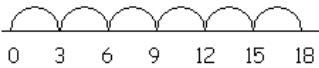
4	Children in Year 4 should:
	• **Recall multiplication and division facts for multiplication tables up to 12 x 12**
	• Explore division situations that give rise to remainders
	• **Use place value, known and derived facts to multiply and divide mentally (e.g. 600 ÷3 = 200 can be derived from 2 x 3 = 6), including multiplying by 0 and 1; dividing by 1; multiplying together three numbers.**
	• **Use knowledge of number facts and laws of arithmetic: commutative, associative and distributive to solve mental and written calculations.**
	• **Recognize and use factor pairs**
	• Use arrays and models such as the grid method or place value counters to develop understanding of the formal methods of short multiplication and division
	• **Multiply two digit and three digit numbers by a one digit number using formal written layout of short multiplication**
	• **Use the formal written method of short division with exact answers.**
	• **Solve one and two step problems in contexts involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and correspondence problems such as when n objects are connected to m objects.**
5	Children in Year 5 should:
	• **Apply all multiplication tables and related division facts frequently, commit them to memory and use them confidently to multiply and divide numbers mentally to make larger calculations.**
	• **Develop understanding and use of factors, multiples, factor pairs, common factors and multiples, primes, prime factors, non-primes (composite numbers), squares and cubes (including notation for these). Establish if a number up 100 is prime and recall primes to nineteen.**
	• **Multiply numbers up to four digits by a one or two digit number using a formal written method, including long multiplication for two-digit numbers**
	• **Divide numbers up to four digits by a one digit number using the formal written method of short division and interpret remainders appropriately for the context, including as fractions, decimals or by rounding.**
	• **Multiply and divide whole numbers and those involving decimals by 10, 100 and 1000**
	• Use an expanded / informal method if they are not ready for the formal methods and be supported towards an understanding of the compact method using e.g. the grid method or place value counters
	• **Use multiplication and division facts to solve problems involving scaling by simple fractions and problems involving simple rates**
6	Children in Year 6 should:
	• **Perform mental calculation, including with mixed operations and large numbers. Identify common factors, common multiples and prime numbers.**
	• **Multiply numbers up to four digits by a two digit whole number using the formal written method of long multiplication**
	• **Divide numbers up to four digits by a two digit whole number using the formal written method of long division and interpret remainders as whole number remainders, fractions or by rounding, as appropriate for the context.**
	• **Divide numbers up to four digits by a two digit whole number using the formal written method of short division where appropriate, and interpret remainders according to the context.**
	• **Use knowledge of the order of operations to carry out calculations involving the four operations.**
	• **Solve problems in context using all four number operations and determine, in the context of the problem, an appropriate degree of accuracy**
	• They should be given opportunities to identify the most appropriate tool for calculations ie mental method, mental with recording or standard method and explain why.
	• Use compact formal methods if they can do so efficiently and with understanding. Those who are not able to use a standard method should use an expanded method and work towards an understanding of a compact method.

Year 1	
Multiplication	**Division**

Pictures/marks

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

Arrays

2 groups of 4 or 4 groups of two

Jumps forward on a number line

Pictures/marks

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

Arrays

Put into groups of two

Share between two
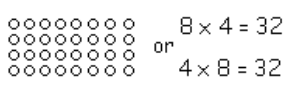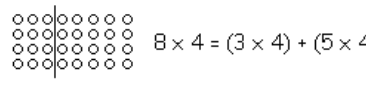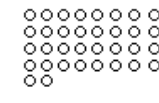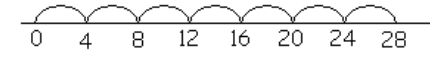
Jumps backwards on a number line

Year 2
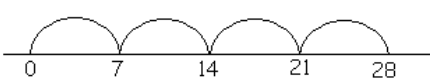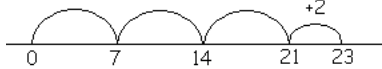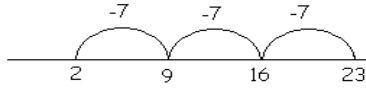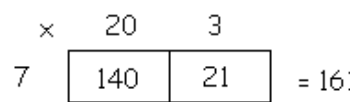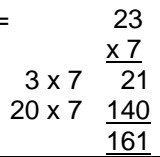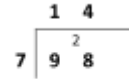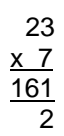
Multiplication	Division
Pupils should work towards fluent recall of 2, 5 and 10 multiplication tables and derivation of related division facts and use these to calculate and solve problems. They may be supported by the type of activities shown below and regular practice of tables facts. They could explore other tables in these ways.	
Pictures/marks There are 4 apples in one box. How many apples in 6 boxes? 	**Pictures/marks** 4 eggs fit in a box. How many boxes would you need to pack 20 eggs?
Other Jottings Arrays 2 x 4 or 4 x 2 Repeated addition $2 \times 4 = 2 + 2 + 2 + 2$ or $\qquad$ 4 x 2 = 4 + 4	**Other Jottings** Arrays 8 ÷ 2 $\qquad$ or Sharing 10 ÷ 2 $\qquad$ Grouping 10 ÷ 2
Number Lines (numbered then empty) 2 x 4 4 x 2 Recording by − drawing jumps on prepared line − constructing own lines	**Number Lines** (numbered then empty) 8 ÷ 2 8 ÷ 4 Recording by - drawing jumps on prepared lines - constructing own lines
Signs and symbols ℓ x 2 = ℓ $\qquad$ ℓ = 2 x 6 6 x ℓ = 12 $\qquad$ 12 = ℓ x 6 ℓ x 2 = 12 $\qquad$ 12 = ℓ x ℓ	**Signs and Symbols** 12 ÷ 2 = ℓ $\qquad$ ℓ = 12 ÷ 2 12 ÷ ℓ = 6 $\qquad$ 6 = ℓ ÷ 2 ℓ ÷ 2 = 6 $\qquad$ 6 = 12 ÷ ℓ ℓ ÷ ℓ = 6 $\qquad$ 6 = ℓ ÷ ℓ Extend to 15 − 10 = 10 ÷ ℓ
Doubling by partitioning $16 \times 2 = 32$ $10 \times 2 = 20$ $6 \times 2 = 12$	**Halving by partitioning** $16 = 10 + 6$ $5 + 3 = 8$

Year 3

Multiplication	Division
The focus should be on **recall and use of the multiplication and division facts for the 3, 4 and 8 multiplication tables. They connect the 2, 4 and 8 multiplication tables through doubling.** They may use activities and recording shown below to develop understanding and promote fluency.	

Arrays

Arrays
3 x 6 or 6 x 3

Repeated addition

$3 \times 6 = 3 + 3 + 3 + 3 + 3 + 3$

or $6 \times 3 = 6 + 6 + 6$

Arrays

Arrays 18 ÷ 3   or

Sharing 24 ÷ 4   Grouping 24 ÷ 4

Number Lines

3 x 6

6 x 3

Number Lines

18 ÷ 3

18 ÷ 6

Remainders
13 ÷ 3

Write and calculate mathematical statements for multiplication and division.

Multiplication	Division
6 x 8 = ✎ ✎ = 4 x 6 6 x ✎ = 30 30 = ✎ x 6 ✎ x 4 = 28 16 = 2 x ✎ ✎ x ✎ = 24 12 = ✎ x ✎	30 ÷ 5 = ✎ ✎ = 24 ÷ 6 12 ÷ ✎ = 6 6 = ✎ ÷ 5 ✎ ÷ 4 = 7 8 = 40 ÷ ✎ ✎ ÷ ✎ = 3 4 = ✎ ÷ ✎

Calculate two digit numbers times one digit numbers using mental and progressing to formal written methods. This could be done by developing the understanding of arrays to introduce the grid method which can then be related to the formal method.

 43 x3 =

3

	40	
3	120	9

Calculate two digit numbers divided by one digit numbers using mental methods.

e.g. Use multiples of the divisor and partitioning

56 ÷ 4   = (40+ 16) ÷ 4
         = 10 + 4
         = 14

 and progression to formal written method of short division supporting understanding through the use of practical materials

43x 3   43
            x 3
 3 x 3   = 9
 40x 3 = 120
          129   Leading to
                43
             x 3
            129
	$\begin{array}{r} 14 \\ 4\overline{)56} \end{array}$

Year 4

Multiplication		Division
Pupils should recall multiplication and division facts for multiplication tables up to 12 x 12. They may use activities and recording shown below to develop understanding and promote fluency.		
Develop the use of arrays to aid understanding of the commutative laws OOOOOOOO OOOOOOOO or $8 \times 4 = 32$ OOOOOOOO $\quad 4 \times 8 = 32$	and the distributive law OOO|OOOOO OOO|OOOOO $8 \times 4 = (3 \times 4) + (5 \times 4)$ OOO|OOOOO	Use arrays to develop ideas of remainders $34 \div 8$ OOOOOOOO OOOOOOOO OOOOOOOO OO
Use number lines $4 \times 7 =$ 0 4 8 12 16 20 24 28 7×4 = 0 7 14 21 28		**Number lines (including remainders)** $23 \div 7$ or +2 0 7 14 21 23 $23 \div 7$ -7 -7 -7 2 9 16 23
Record multiplication and division facts		
$3 \times 7 = \mathscr{l}$ $\mathscr{l} = 7 \times 3$ $3 \times \mathscr{l} = 21$ $21 = \mathscr{l} \times 3$ $\mathscr{l} \times 7 = 21$ $21 = 7 \times \mathscr{l}$ $\mathscr{l} \times \mathscr{l} = 21$ $21 = \mathscr{l} \times \mathscr{l}$		$21 \div 7 = \mathscr{l}$ $\mathscr{l} = 21 \div 7$ $21 \div \mathscr{l} = 3$ $3 = \mathscr{l} \div 7$ $\mathscr{l} \div 7 = 3$ $3 = 21 \div \mathscr{l}$ $\mathscr{l} \div \mathscr{l} = 3$ $3 = \mathscr{l} \div \mathscr{l}$
Use place value, known and derived facts to multiply and divide mentally. $30 \times 6 = 3 \times 6 \times 10 = 18 \times 10 = 180$		

Multiply two and three digit numbers by a one digit number using the formal written layout
 	
 They may use informal or expanded methods to support understanding of the formal written method.
 	
 Grid method
 23 x 7 =
 	
 $\times$ 20   3
 7 | 140 | 21 | $= 161$
		Continue to calculate two digit numbers divided by one digit numbers using mental methods.
		
		 e.g. Use multiples of the divisor and partitioning
		
		 $72 \div 5$ $= (50 + 22) \div 5$
		            $= 10 + 4$ remainder 2
		            $= 14$ remainder 2

Expanded method
 	
 $23 \times 7 =$ 23
             x 7
 3×7 21
 20×7 140
           161
		Develop understanding of and practice **the formal written method of short division with exact answers,** supported by practical materials if required
		
		    1 4
		        2
		 7 | 9 8
		
		 Answer: 14

Leading to **the formal written method to multiply two and three digit numbers by a one digit number.**
 	
            23   3   4   2
          x 7   x   7
        161   2   3   9   4
           2   2   1
 	
 Answer: 2394		

Year 5

Continue to practice and apply all tables facts and commit to memory.	
Multiplication	**Division**
Signs & Symbols Use signs and symbols to complete questions using known and derived facts eg 9 x 7 = ✐　　　　　　✐ = 60 x 2 ✐ x 7 = 63　　　　120 = ✐ x 2 9 x ✐ = 63　　　　120 = 60 x ✐ ✐ x ✐ = 63　　　　120 = ✐ x ✐	**Signs &** Symbols Use signs and symbols to complete questions using known and derived facts eg 56 ÷ 7 = ✐　　　　1600 ÷ 2 = ✐ ✐ ÷ 7 = 8　　　　✐ ÷ 2 = 800 56 ÷ ✐ = 8　　　　1600 ÷ ✐ = 800 ✐ ÷ ✐ = 8　　　　✐ ÷ ✐ = 800
Number Sentences Use number sentences to show mental strategy used. e.g. (i) 36 x 50 = 1800 　　　　　36 x 100 = 3600 　　　　　3600 ÷ 2 = 1800 　　(ii) 15 x 6 = 90 　　　　　15 x 3 = 45 　　　　　45 x 2 = 90	**Number Sentences** Use number sentences to show mental strategy used. e.g.(i) 198 ÷ 6 = (180 + 18) ÷ 6 = 30 + 3 = 33 e.g.(ii) 345 ÷ 15 = (300 + 45) ÷ 15 = 20 + 3 =23
Most children **Multiply numbers up to four digits by a one or two digit number using a formal written method, including long multiplication for two-digit numbers**	Most children **Divide number up to four digits by a one-digit number, using the formal written method of short division and interpret remainders appropriately for the context**

Short multiplication	**Long multiplication for two digit numbers**	**Short division of number up to four digits**
342×7 becomes 　　　3　4　2 ×　　　　　7 ――――――― 2　3　9　4 　　2　1 Answer: 2394	24×16 becomes 　　　　2 　　　2　4 ×　　　1　6 ――――――― 　　2　4　0 　　1　4　4 ――――――― 　　3　8　4 Answer: 384	$432 \div 5$ becomes 　　　　8　6　r 2 　　　　　　3 5) 4　3　2 Answer: 86 remainder 2 $496 \div 11$ becomes 　　　　4　5　r 1 　　　　　　5 1 1) 4　9　6 Answer: $45\frac{1}{11}$

Use informal written methods for those not ready for the formal method or to develop understanding

Grid Method

346 x 9

×	300	40	6	
9	2700	360	54	= 3114

72 x 38 is approximately 70 x 40 = 2800

72×38

×	70	2	
30	2100	60	2160
8	560	16	+ 576
			2732

Expanded methods

```
              346
            x   9
  6 x 9       54
 40 x 9      360
300 x 9     2700
            3114
```

Year 6

Multiplication	Division
Continue to practice and complete multiplications and divisions	
8 x 9 = ✎ 370 x 2 = ✎ ✎ x 9 = 72 176 x 2 = ✎ 8 x ✎ = 72 ✎ x 2 = 3.9 ✎ x ✎ = 72	72 ÷ 9 = ✎ 1750 ÷ ✎ = 875 72 ÷ ✎ = 8 570 ÷ 2 = ✎ ✎ ÷ 9 = 8 ✎ ÷ 2 = 0.87 ✎ ÷ ✎ = 8
Use number sentences to show mental strategy used. e.g. 38 x 25 = 38 x 100 = 3800 3800 ÷ 4 = 950 e.g. 35 x 18 = 630 35 x 6 = 210 210 x 3 = 630	Use number sentences to show mental strategy used. e.g. (i) 198 ÷ 6 = (180 + 18) ÷ 6 = 30 + 3 = 33 e.g. (ii) 345 ÷ 15 = (300 + 45) ÷ 15 = 20 + 3 =23

Most pupils multiply multi-digit numbers up to four digits by a two-digit whole number using the formal written method of long multiplication	Most pupils: • Divide numbers up to four digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context. • Divide numbers up to four digits by a two-digit whole number using the formal written method of short division where appropriate and interpret remainders according to context. •

2741×6 becomes $\begin{array}{r} 2\ 7\ 4\ 1 \\ \times \qquad 6 \\ \hline 1\ 6\ 4\ 4\ 6 \\ \scriptstyle 4\ \ \ \ 2 \end{array}$ Answer: 16 446	124×26 becomes $\begin{array}{r} \scriptstyle 1\ \ 2 \\ 1\ 2\ 4 \\ \times \quad 2\ 6 \\ \hline 7\ 4\ 4 \\ 2\ 4\ 8\ 0 \\ \hline 3\ 2\ 2\ 4 \\ \scriptstyle 1\ \ 1 \end{array}$ Answer: 3224	$432 \div 5$ becomes $\begin{array}{r} 8\ 6\ \text{r}2 \\ \hline 5\ |\ 4\ 3\ \overset{3}{2} \end{array}$ Answer: 86 remainder 2	$\begin{array}{r} \quad 2\ \ 8\ \ \text{r}\ 12 \\ 1\ 5\ |\ 4\ 3\ 2 \\ \hline 3\ 0\ 0 \\ \hline 1\ 3\ 2 \\ 1\ 2\ 0 \\ \hline 1\ 2 \end{array}$ Answer: 28 remainder 12
Informal Written Methods Continue to develop written method and use expanded methods for children who are not ready for a compact method to develop understanding Grid Method 372×24 $\begin{array}{c|c|c|c|c} \times & 300 & 70 & 2 & \\ \hline 20 & 6000 & 1400 & 40 & 7440 \\ 4 & 1200 & 280 & 8 & +1488 \\ \hline & & & & 8928 \end{array}$	$432 \div 15$ becomes $\begin{array}{r} 2\ \ 8 \\ 1\ 5\ |\ 4\ 3\ 2 \\ \hline 3\ 0\ 0 \quad 15 \times 20 \\ \hline 1\ 3\ 2 \\ 1\ 2\ 0 \quad 15 \times 8 \\ \hline 1\ 2 \end{array}$ $\frac{12}{15} = \frac{4}{5}$ Answer: $28 \frac{4}{5}$ $432 \div 15$ becomes $\begin{array}{r} 2\ \ 8 \cdot 8 \\ 1\ 5\ |\ 4\ 3\ 2 \cdot 0 \\ \hline 3\ 0\ \downarrow \\ \hline 1\ 3\ 2 \\ 1\ 2\ 0 \\ \hline 1\ 2\ 0 \\ 1\ 2\ 0 \\ \hline 0 \end{array}$ Answer: 28·8
Standard written methods Short multiplication: ThHTO x O $\begin{array}{r} 4346 \\ \times \quad 8 \\ \end{array}$ $\begin{array}{ll} 6 \times 8 & 48 \\ 40 \times 8 & 320 \\ 300 \times 8 & 2400 \\ 4000 \times 8 & \underline{32000} \\ & \underline{34768} \end{array}$	