CALCULATIONS POLICY

A quick outline

This is a quick guide outlining the school's progression through written strategies for addition, subtraction, multiplication and division.

Children work through the progression so that they can understand, use, apply and explain a compact method of calculation by the end of Year 6, although it is expected that children throughout the school will be able to explain and apply the current mental and written methods they are using. As children will move at the pace appropriate to them, teachers will be presenting strategies and equipment appropriate to children's level of understanding.

The policy includes examples and diagrams, showing how we teach calculations, as consistency in layout and presentation is important to support learning and progression. The policy also includes the equipment and resources that will be used to support children's understanding of the strategy.

The importance of mental maths

While the policy focuses on written calculations in maths, we recognise the importance of the mental strategies and known facts that form the basis of all calculations. The following checklists outline the key skills and number facts that children are expected to develop throughout the school.

To add and subtract successfully, children should be able to:

- Recall all addition pairs to 9 + 9 and number bonds to 10
- Recognise addition and subtraction as inverse operations
- Add mentally a series of one digit numbers *(e.g. 5 + 8 + 4)*
- Add and subtract multiples of 10 or 100 using the related addition fact and their knowledge of place value *(e.g. 600 + 700, 160 — 70)*
- Partition 2 and 3 digit numbers into multiples of 100, 10 and 1 in different ways *(e.g. partition 74 into 70 + 4 or 60 + 14)*

To multiply and divide successfully, children should be able to:

- Recall all multiplication facts to 10 x 10
- Calculate products such as 50 x 7, 50 x 70, 700 x 5 or 700 x 50 using the related fact 7 x 5 and their knowledge of place value, including patterns of multiplying and dividing by the powers of 10
- Add 2 or more single digit numbers mentally
- Partition 2 and 3 digit numbers into multiple of 100, 10 and 1 in different ways
- Add and subtract multiples of 10 or 100 using the related addition fact and their knowledge of place value
- Recognise multiplication and division as inverse operations
- Know subtraction facts to 20 and use this knowledge to subtract multiples of 10 *(e.g. 120—80, 320—90)*
- Use tables knowledge to estimate how many times one number divided into another *(e.g. how many 6s there are in 47 or how many 23s there are in 92)*

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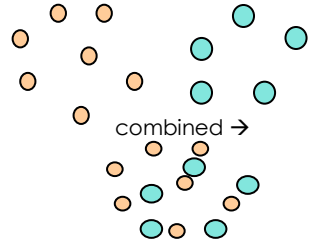
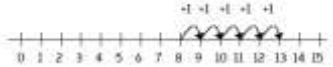
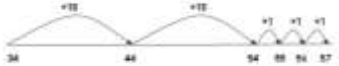
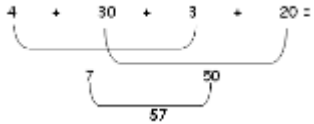
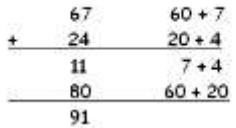
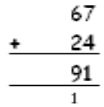
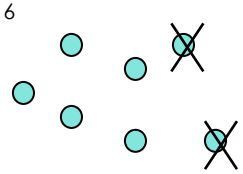
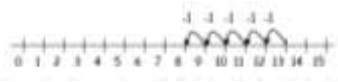
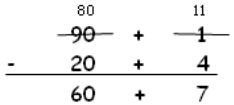
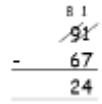
ADDITION

Phase 1 **Counting on and adding with objects** Use equipment and real objects. 1. Putting together – two or more amounts or numbers are put together to make a total, starting at 1. 2. Combining 2 sets of objects, when one amount is made bigger. Count on from the total of the first set. Always start with the largest number.	Phase 2 **The 100 square and number line** The number line helps children move from using concrete objects to the abstract concept of number along a continuum. The 100 square helps children understand that when adding ten to a number, the units stay the same.	Phase 3 **The empty number line** The empty number line helps to record the steps in the way to calculating the total.	Phase 4 **Partitioning** Children will partition the number into hundreds, tens and units to help them to work with manageable parts of a large number before recombining to find the answer.	Phase 5 **The expanded vertical method** Using columns to add vertically, starting with units, then tens. This then leads into **Phase 6** **The compact vertical method** This involved children understanding that digits can be 'carried' into the next column, such as carrying ten or carrying a hundred.
	8 + 5 = 13 	34 + 23 = 57  and then more efficiently 	34 + 23 = 57 4 + 3 + 30 + 20 = 7 + 50 = 57 	67 + 24 = 91  

SUBTRACTION

Phase 1 **Counting backwards and subtracting with objects** 1. Where one quantity is taken away from another to calculate what is left. 2. Two quantities are compared to find the difference. 3. The quantity in the whole set and one part of the set are known, and may be used to find out how many are in the unknown part.	Phase 2 **The 100 square and number line** The number line helps children move from using concrete objects to the abstract concept of number along a continuum. The 100 square helps children understand that when subtracting ten from a number, the units stay the same.	Phase 3 **The empty number line** The empty number line helps to record the steps in the way to calculating the total or explain the steps in preparation for mental subtraction. Children are taught to count back along the number line. Children are also taught to count up between the 2 numbers to find the difference.	Phase 4 **Partitioning** Children will partition the number into hundreds, tens and units to help them to work with manageable parts of a large number before recombining to find the answer.	Phase 5 **The expanded vertical method** Partitioning the numbers into tens and units and writing one under the other mirrors the column method. **Phase 6** **The compact vertical method.** When they are fully confident with partitioning and understanding the effect, they are ready to move to the more efficient method.
8 – 2 = 6 	13 – 5 = 8 	57 – 23 = 34  or by counting up 	57 – 23 = 34 	91 – 67 = 24  

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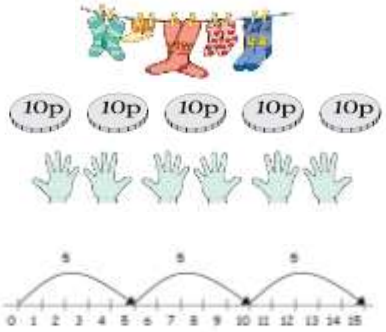
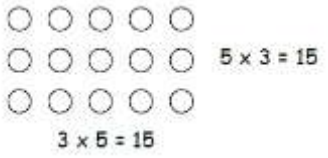
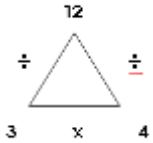
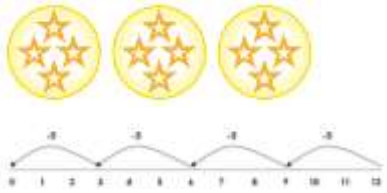
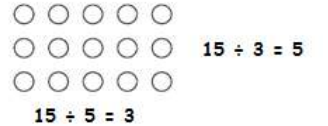
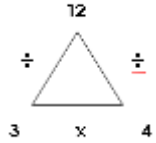
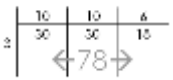
MULTIPLICATION

Phase 1 **Practical experiences, repeated addition and multiplication facts** Children put objects into groups or sets. They then move onto multiplication as repeated addition- adding the same number several times. Children begin to identify patterns within multiplications and learn times tables facts.	**Phase 2** **Arrays and inverse operations** We use arrays to model multiplication visually and to solve multiplication problems. Children learn that multiplication is commutative, which means that 3x5 is the same as 5x3.	**Phase 3** **Partitioning** The number being multiplied is partitioned, usually in tens and units. Each part is then multiplied and the answer added together to find the final answer.	**Phase 4** **The grid method** This follows on from the visual arrays, and provides an expanded method, using partitioning into to more manageable chunks, which are then recombined to find the final answer.	**Phase 5** **Long multiplication** This represents the grid method in a column, and shows the steps in working out. Children explain what they are doing by referring to the actual values of the digits in the columns. **Phase 6** **The standard short method** This is a compact, efficient method , where digits are carried below the line if needed.
	 3 x 4 = 12 4 x 3 = 12 12 ÷ 3 = 4 12 ÷ 4 = 3 	9 x 4 = (3 x 4) + (3 x 4) + (3 x 4) = 12 + 12 + 12 = 36 6 x 14 = = (2 x 10) + (4 x 10) + (4 x 6) = 20 + 40 + 24 = 84	38 x 5 = x | 10 | 10 | 10 | 8 5 | 50 | 50 | 50 | 40 23 x 8 = x | 20 | 3 8 | 160 | 24 160 + 24 184	23 x 8 = 20 + 3 x 8 160 (20 x 8) 24 (3 x 8) 184 23 x 8 184

DIVISION

Phase 1 **Practical experiences, repeated subtraction and division facts** To divide on a number line, first with no remainders, and later with remainders.	**Phase 2** **Arrays and inverse operations** We use arrays to model division visually and to solve division problems. Children learn that 12 ÷ 3 = 4 and 12 ÷ 4 = 3.	**Phase 3** **Partitioning** One way to work out TU ÷ U mentally is to partition TU into a multiple of the divisor plus the remaining part and then dividing each part separately.	**Phase 4** **Chunking and the expanded method** Children start by 'taking off' groups of 10x the number, when then they have a secure knowledge of multiplication facts and pale value, they should be able to move on to taking off bigger 'chunks'.	**Phase 5** **Long division** This is sometimes called the 'bus stop' method and links directly back to arrays and chunking.
	 3 x 4 = 12 4 x 3 = 12 12 ÷ 3 = 4 12 ÷ 4 = 3 	84 ÷ 7 = 12 We know that 70 and 14 are multiples of 7, so we can calculate 70 ÷ 7 and 14 ÷ 7 separately and recombine. 70 ÷ 7 + 14 ÷ 7 = 10 + 2 = 12 78 ÷ 3 = 	78 ÷ 3 = 78 - 30 (10 x 3) 48 - 30 (10 x 3) 18 - 18 (6 x 3) 0 So 78 ÷ 3 = 10 + 10 + 6 =26	196 ÷ 6 = **32 r 4** **6** | 196 - 180 16 - 12 4

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