

Calculation Methods



Year Six

ADDITION

National Curriculum Objectives: Addition objectives from Addition, subtraction, multiplication and division strand.	Key Skills/ other linked NC Objectives (Place Value)	Key Vocabulary
• Perform mental calculations, including with mixed operations and large numbers. • Use their knowledge of the order of operations to carry out calculations involving the four operations. • Solve addition multi-step problems in contexts, deciding which operations and methods to use and why. • Solve problems involving four-operations. • Use estimation to check answers to calculations.	• Read, write, order and compare numbers up to 10,000,000 and determine the value of each digit.	<i>Consolidate use of all previously taught vocabulary.</i>

Children should:

- Have access to a wide range of practical resources and equipment, counting materials, models and images and should be given the opportunity to use these to support their understanding of mental and written methods at all stages.
- Spend time learning and practising mental methods for addition. This will include exploring number and different ways to partition number, to support addition strategies as well as adding the nearest multiple of 10, 100 and 1000 and adjusting (e.g. to add 9, 49, 99 999 etc.); using near doubles; partitioning and recombining; inverse and using number bonds.

Mental Methods: The children should be taught to use the following mental strategies, and to use jottings to support their methods, where appropriate.

- Consolidate all strategies from previous years
- Partition, adding the most significant digit first
- Compensating: adding a whole number, multiple of 10 or double and adjust.
- Use knowledge of place value and related calculations e.g. $680 + 430$, $6.8 + 4.3$, $0.68 + 0.43$ can all be worked out using the related calculation $68 + 43$.

Written method of column addition should be used in a variety of contexts and with numbers of increasing size and complexity.

This should include addition several numbers with different numbers of decimal places (including in the context of measures and money).

Tenths, hundredths and thousandths should be correctly aligned, with the decimal place lined up vertically, including in the answer row.

Zeros should be added into empty decimals places to show there is no value to add.



	2	3	.	3	6	1
+		9	.	0	8	0
	5	2	.	3	0	0
	8	4	.	7	4	1

Adding several numbers with more than four-digits.



	8	2	6	3	1	
+		3	4	2	5	
	2	1	3	6	2	5
	2	9	9	6	8	1

SUBTRACTION

National Curriculum Objectives: Subtraction objectives from Addition, Subtraction, Multiplication and Division Strand	Key Skills/ other linked NC Objectives (Place Value)	Key Vocabulary
• Perform mental calculations, including with mixed operations and large numbers. • Use their knowledge of the order of operations to carry out calculations involving the four operations. • Solve subtraction multi-step problems in contexts, deciding which operations and methods to use and why. • Solve problems involving four-operations. • Use estimation to check answers to calculations.	• Read, write, order and compare numbers up to 10,000,000 and determine the value of each digit.	<i>Consolidate use of all previously taught vocabulary.</i>

Children should:

- Be given the opportunity to apply their previous learning into new contexts and use it to solve problems in different ways.
- Where children are not confident with previous learning or do not have a solid understanding of the place value and maths underpinning the strategies, they should have the opportunity to track back and fill these gaps in their learning.
- Children should be given the opportunity to regularly and independently select the most effective method from their repertoire.
- Children should be given the opportunity to interpret and use mathematical pictures and practical resources as part of their varied fluency, reasoning and problem solving.

Mental Methods:

- Consolidate all mental strategies from previous year groups.
- Counting back in powers of tens, including tenths, hundredths and thousandths.
- Use knowledge of place value and related calculations
- Subtract a power of ten, or a whole number and adjust.
- Find the difference by counting up through the nearest multiple of 0,1, 10, 100 or 1,000 then adjust.
- Continue to use the relationship between addition and subtraction.

Written Methods:

Step 1: Using the compact column method to subtract more complex numbers.



	0	1		2		
	~~1~~	2	6	~~8~~	2	1
-		3	9	1	5	1
		8	7	1	7	0

Step 2: Use the compact column method to subtract money and measures, including decimals with different numbers of decimal places. Children can fill empty decimal places with zeros to show the place value in each column.



	0	9		3		
	~~1~~	0	5	.	4	1
-		3	7	.	0	8
		6	8	.	3	3

Ensure children have experience of using this method for subtraction where there is a 0 in the column they need to exchange from, and that they understand, through clear modelling (using practical resources) how to move to the next column and exchange then 'move' the value along.



	2	1		5	9	
	~~2~~	2	7	~~6~~	~~0~~	0
-	1	4	8	5	3	2
	1	7	9	0	6	8

MULTIPLICATION

National Curriculum Objectives: Multiplication objectives from Addition, subtraction, multiplication and division strand.	Key Skills/ other linked NC Objectives (Place Value)	Key Vocabulary
• Multiply numbers up to 4-digits by 2-digit numbers using long multiplication. • Perform mental calculations, including with mixed operations and large numbers. • Identify common factors and common multiples. • Use their knowledge of the other of operations to carry out calculations involving the four operations. • Solve problems involving the four operations. • Use estimation to check answers to calculations.	• Understanding place value in large numbers	<i>All previous vocabulary, plus:</i> Tenths, hundredths, decimals

Children should:

- Have the opportunity to consolidate previous multiplication work and track back if they are not secure.
- Have the opportunity to apply short and long division to various contexts and use it as part of their varied fluency, reasoning and problem solving.
- Be given regular opportunity to approximate before they calculate and use this to check the accuracy of their calculations.

Mental Methods:

- Rapid recall of all times tables up to 12X12 - as in Year 4 and Year 5
- Recalling square and cubed numbers
- Use known facts and place value to multiply.
- Use related facts to multiply.
- Scaling up using known facts.
- Use the relationship between multiplication and division.

Written Methods: Short and long Multiplication

Children will use short multiplication to multiply numbers with more than 4 digits by a one-digit number, to multiply money and measures and to multiply decimals with up to 2 decimal places by a single digit.



	4	.	2	6
x				8
3	4	.	0	8
	2		4	

Children will use long division to multiply numbers with up to 4-digits by two-digit numbers.


$$\begin{array}{r} 3876 \\ \times 42 \\ \hline 7752 \\ 155040 \\ \hline 162792 \end{array}$$

DIVISION

National Curriculum Objectives: Division objectives from Multiplication and Division Strand	Key Skills/ other linked NC Objectives	Key Vocabulary
• Divide numbers up to 4 digits by a two-digit whole number using long division and interpret remainders as whole number remainders, fractions, or by rounding as appropriate for the context. • Divide numbers up to 4 digits by a two-digit whole number using short division where appropriate, interpreting remainders as appropriate to the context. • Perform mental calculations including with mixed operations and large numbers. • Use estimation to check answers to calculations. • Solve problems involving addition. • Use knowledge of order of operations to carry out calculations involving the four operations.	• Identify common factors and prime numbers. • Use estimation to check answers to calculations.	<i>Consolidate all previous vocabulary.</i>

Children should:

- Be given the opportunity to develop their division skills in a range of contexts, with a focus on presenting their remainders appropriately for the context.
- Learn to use long division to divide by two-digit numbers, and use these methods efficiently.

Mental Methods:

- Counting in steps of powers of 10.
- Recall division facts for all the times tables, up to 12X12
- Use understanding of place value and what happens to the value of each digit when it is divided by 10, 100 or 1,000.
- Use known facts and place value to solve calculations.
- Use knowledge of division facts e.g. when carrying out a division to find a remainder.
- Use factor pairs to divide
- Use the relationship between multiplication and division
- Consolidate all previously taught strategies.

Written Methods:

Step 1: Extend use of short division for dividing by one-digit numbers.

Children continue to develop their use of short division and how to express remainders as whole numbers, fractions, rounded numbers and decimals. Specific teaching to take place to support children in understanding each of these and when they should be



$$\begin{array}{r} 0815 \text{ r } 1 \\ 8 \overline{) 6521} \\ \underline{815} \\ 815 \frac{1}{8} \end{array}$$

$$\begin{array}{r} 0815.125 \\ 8 \overline{) 6521.020} \\ \underline{6521} \\ 0200 \end{array}$$

Step 2: Dividing by two-digit numbers

Long Division - 'Chunking Method'

Supported by their secure understanding of the division learning done previously, children should be introduced to long division by chunking.

Children should be taught how to set this out clearly, including noting down multiples of the number to support this process. They should be encouraged to take away the largest 'chunk' they can each time to limit the number of steps and therefore likely errors. Children should aim to get to the answer in a maximum of 3 steps.



$$\begin{array}{r} 147 \text{ r } 23 \\ 67 \overline{) 9872} \\ \underline{6700} \quad (\times 100) \\ 2872 \\ \underline{2680} \quad (\times 40) \\ 492 \\ \underline{469} \quad (\times 7) \\ 023 \end{array}$$

Formal Method for Long Division

When the children have a clear understanding of the place value within their division calculations, they can move onto a formal method for long division. This reduces the amount of related facts that they need to use, and therefore will improve their efficiency.



$1 \times 67 = 67$	$10 \times 67 = 670$	$100 \times 67 = 6700$
$2 \times 67 = 134$	$20 \times 67 = 1340$	$200 \times 67 = 13400$
$3 \times 67 = 201$	$30 \times 67 = 2010$	
$4 \times 67 = 268$		
$5 \times 67 = 335$		
$6 \times 67 = 402$		
$7 \times 67 = 469$		

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

Divide

Multiply

Subtract

Step 2: Using Short Division to divide by two-digit numbers

When children are fully secure with long division for dividing by a two-digit number, they may progress to a short division method. Be aware that there are multiple parts to each step and therefore children may make errors if they rush or if their understanding is not yet secure.



$$\begin{array}{r} 0288 \\ 15 \overline{)4320} \end{array}$$