

Calculation Methods



Year Three

ADDITION

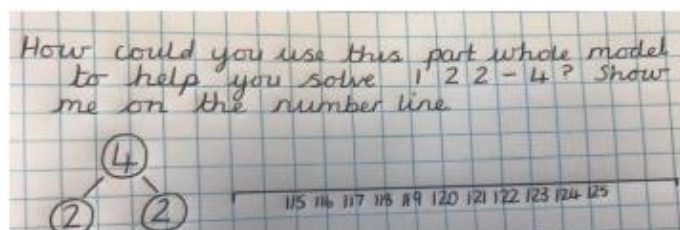
National Curriculum Objectives: Addition objectives from Addition and Subtraction Strand	Key Skills/ other linked NC Objectives (Place Value)	Key Vocabulary
- Add numbers mentally, including three-digit numbers and ones. - Add numbers mentally, including three-digit numbers and tens. - Add numbers mentally, including three-digit numbers and hundreds. - Add numbers with up to 3 digits, using formal written method of columnar addition. - Estimate the answer to a calculation and use inverse operations to check answers. - Solve problems including missing number problems, using number facts, place value, and more complex addition.	- Find 10 or 100 more than a given number. - Recognise the place value of each digit in a three-digit number. - Identify, represent and estimate numbers using different representations. - Read and write numbers up to 1000 in numerals in words. - Compare and order numbers up to 1000.	<i>KS1 Vocab plus:</i> Combined, more, column, carrying, expanded, compact

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, starting with questions which do not cross boundaries and progressing to those that do. This will include exploring number and different ways to partition number, to support addition strategies as well as adding the nearest multiple of 10 and adjusting (e.g. to add 9, 99 etc.), using near doubles and partitioning and recombining.

Calculate $346 + 6 =$

$$\begin{array}{c}
 6 \\
 \swarrow \quad \searrow \\
 4 \quad 2 \\
 346 + 4 = 350 \\
 350 + 2 = 352
 \end{array}$$



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

- Counting on in hundreds, tens and ones to find the total.
- Partitioning into hundreds, tens, and ones in different ways, then recombine ($824 = 800 + 20 + 4$, $824 = 700 + 110 + 14$).
- Reorder the numbers when adding.
- Bridge through a multiple of 10, then adjust.
- Use known facts and place value to add
- Use patterns of similar calculations
- Compensating: add or subtract 10, 20 or 100 and adjust.

Steps for Written Methods:

Step 1: To apply expanded column methods from Y2 when adding three-digit numbers. This may be new teaching for the children, depending on whether they were ready for this in Year 2.

Therefore, they may need to track back.



$$\begin{array}{r} 437 \\ + 225 \\ \hline \end{array} = \begin{array}{l} 400 + 30 + 7 \\ 200 + 20 + 5 \\ \hline 600 + 50 + 12 = 662 \end{array}$$

Step 2: Introduce the expanded column method.



$$\begin{array}{r} 238 \\ + 87 \\ \hline 15 \\ 110 \\ 200 \\ \hline 325 \end{array}$$

Add the ones column first, in preparation for the compact method.

Step 2 and Step 3 can be taught alongside each other to ensure the children understand the value of the numbers they are adding in the compact method.

Step 3: Move to the compact column addition, first without carrying and then with.



$$\begin{array}{r} 237 \\ + 82 \\ \hline 319 \\ 1 \end{array}$$

Add the ones first.

Carry numbers underneath the bottom line.

Ensure correct use of vocabulary throughout.

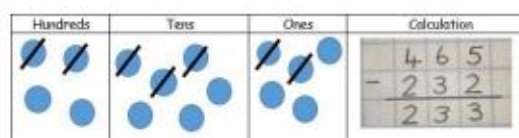
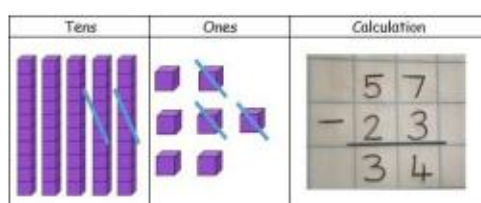
E.g. we are adding 3 tens and 7 tens (30 and 70) to make 10 tens or 100, as opposed to 3 and 7 equals 10.

SUBTRACTION

National Curriculum Objectives: Subtraction objectives from Addition and Subtraction Strand	Key Skills/ other linked NC Objectives (Place Value)	Key Vocabulary
- Subtract numbers mentally, including three-digit numbers and ones. - Subtract numbers mentally, including three-digit numbers and tens. - Subtract numbers mentally, including three-digit numbers and hundreds. - Subtract numbers with up to 3 digits, using formal written method of columnar subtraction. - Estimate the answer to a calculation and use inverse operations to check answers. - Solve problems including missing number problems, using number facts, place value, and more complex subtraction.	- Find 10 or 100 more than a given number. - Recognise the place value of each digit in a three-digit number. - Identify, represent and estimate numbers using different representations. - Read and write numbers up to 1000 in numerals in words. - Compare and order numbers up to 1000.	<i>KS1 Vocab plus:</i> Fewer, less, reduce, how many less? How many remain? Exchange, decrease, value, digit, hundreds

Children should:

- Continue to use practical resources alongside the developing calculation strategies. These will include dienes, place value counters, place value charts, digit cards etc and will be appropriate for support children's subtraction with three-digit numbers.
- Apply their understanding of using concrete resources to using pictorial representations alongside their abstract calculations.



- Continue to develop their understanding of finding the difference. They should experience difference contexts and representations for doing this and start to become more secure with choosing the most effective strategy to do this.

Mental Methods:

- Counting back in hundreds, tens and ones.
- Counting on as a mental strategy for subtraction when the numbers are close together (e.g. 131-129), and for finding a small difference.
- Compensating: subtract mentally a near multiple of 10 then adjust.
- Bridging through a multiple of 10
- Use knowledge of number facts and place value to subtract pairs of numbers
- Subtract a two-digit number by partitioning it then subtracting tens and ones.
- Use patterns of similar calculations
- Use the relationship between addition and subtraction.

Written Methods:

Step 1:

Introduce this method with examples where no exchanging is required. Use this as an opportunity to reinforce place value and check children's understanding before moving on.

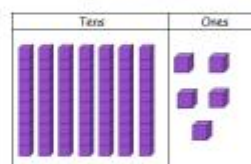


$$87 - 33 = 54$$

$$\begin{array}{r} 80 + 7 \\ - 30 + 3 \\ \hline 50 + 4 = 54 \end{array}$$

Step 2:

Introduce exchanging through practical subtraction. Make the larger number with dienes and then physically exchange a row of 10 for ten ones. Model how to record this.



$$75 - 37 = 38$$

$$\begin{array}{r} 60 \\ 70 + 5 \\ - 30 + 7 \\ \hline 30 + 8 = 38 \end{array}$$

Step 3:

Once the children are secure with the 'exchanging' method, they can use this to subtract two and three-digit numbers in a variety of contexts.



$$242 - 154 = 88$$

$$\begin{array}{r} 100 \quad 30 \\ 200 + 40 + 2 \\ - 100 + 50 + 4 \\ \hline 0 + 80 + 8 = 88 \end{array}$$

Step 4:

If children are ready, and have a secure understanding of the maths involved, they may use compact column subtraction for three-digit numbers. However, children must not be moved onto this stage too soon.



$$\begin{array}{r} 5 \overset{1}{4} \\ 6 \overset{8}{8} 2 \\ - 365 \\ \hline 287 \end{array}$$

MULTIPLICATION

National Curriculum Objectives: Multiplication objectives from Multiplication and Division Strand	Key Skills/ other linked NC Objectives (Place Value)	Key Vocabulary
- Recall and use multiplication and division facts for the 3,4 and 8 times tables. - Write and calculate multiplication using the multiplication tables they know, including for two-digit numbers times one-digit numbers, using mental methods and progressing to formal written methods. - Solve problems, including missing number problems, involving multiplication, including positive integer scaling problems and corresponding problems in which n objects are connected to m objects.	Count from 0 in multiples of 4 and 8.	<i>All previous vocabulary, plus:</i> Product, multiple

Children should:

- Continue to develop their understanding of multiplication through use of practical resources and pictorial representations. Year 2 multiplication must be consolidated for those children who do not have a secure understanding.
- Be given the opportunity to practise their recall of the 2,5 and 10 times tables from the start of Year 3, before any new multiplication objectives are introduced.
- Start to be introduced to the grid method for multiplication. However, in order to do this, children need secure understanding of the maths which will underpin this.

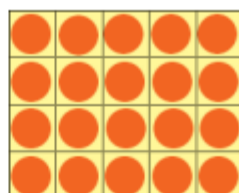
Mental Methods:

- Counting in 2s, 5s, 10s, 3s, 4s and 8s.
- Repeated addition
- Recall multiplication facts for 2, 5 and 10 times tables (from Year 2)
- Recall multiplication facts for 3, 4 and 8 times tables
- Use known facts and place value to multiply by 2,3,4,5,8 and 10.
- Use doubles to link to x2, x4 and x8.
- Reorder a calculation, understanding that multiplication can be done in any order.

Written Methods for multiplying a two-digit number by a one-digit number.

Step 1: Arrays

Reinforce Year 2 work on arrays, ensuring children have a secure understanding and can apply these to calculate facts for the 3, 4 and 8 times tables.



$$4 + 4 + 4 + 4 + 4 = 20$$

$$5 + 5 + 5 + 5 = 20$$

$$4 \times 5 = 20$$

$$5 \times 4 = 20$$

Step 2: Introducing the grid method using arrays

Introduce the grid method to the children by making the arrays to represent the multiplication statement. E.g. "We need 4 rows of 10 and 4 rows of 3".

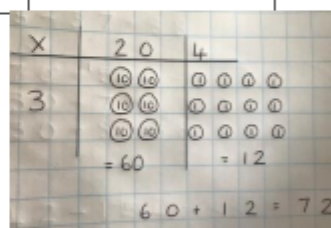
Then move onto using dienes, as a progression towards a more compact method.

Children can then represent the work they have done with the practical resources, in a way in which they understand, after modelling by the teacher.



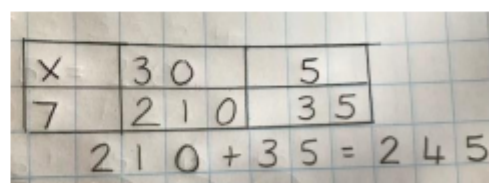
x	10	3
4	0000000000	000
	0000000000	000
	0000000000	000
	0000000000	000

x	Tens	Ones



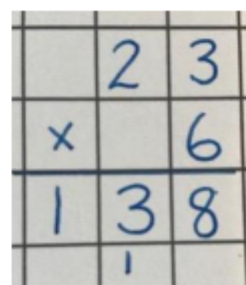
Step 3: Grid method

Once the children have a secure understanding of the above steps, the grid method can be introduced, alongside a pictorial representation to start with, then the children practise and use this in a variety of different contexts.



Step 4: Short multiplication

For those children who show a secure understanding of the previous steps and can use these in a variety of contexts, they may be shown how to record this as a short multiplication method. This should be done alongside the grid method so that children are clear on the link between the two.



DIVISION

National Curriculum Objectives: Division objectives from Multiplication and Division Strand	Key Skills/ other linked NC Objectives (Place Value)	Key Vocabulary
- Recall the division facts for the 3, 4 and 8 times tables. - Write and calculate division statements using the multiplication tables they know. - Solve problems, including missing number problems, involving division.	Count in multiples of 4, 8, 50 and 100.	<i>Previous vocabulary, plus:</i> <i>Inverse, short division, carry, remainder, multiple</i>

Children should:

- Be given the opportunity to explore division in a range of real-life contexts to enable them to start to build a secure understanding of division and recognise when they should use this operation.

Mental Methods:

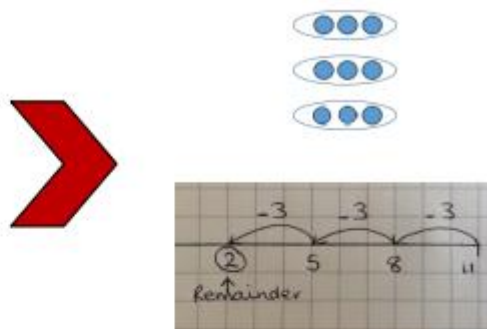
- Counting in 2s, 5s, 10s, 3s, 4s and 8s
- Recalling the division facts for the 2, 5 and 10 times tables- from Year 2
- Recalling the division facts for the 3, 4 and 8 times tables.
- Use known facts and place value to divide by 2, 3, 4, 5, 8 or 10
- Using knowledge that halving is the inverse of doubling and the same as dividing by 2. Use this to link to $\div 2$, $\div 4$ & $\div 8$.
- Using known facts/partition in different ways to become more efficient in mental calculations: e.g. $39 \div 3$ by taking 3 lots of 10 away mentally, then 3 lots of 3 to get 13 as the answer.
- Use the relationship between multiplication and division.
- Scaling down using known facts.

Written Methods:

Step 1: Developing understanding of grouping, using a number line and introducing remainders.

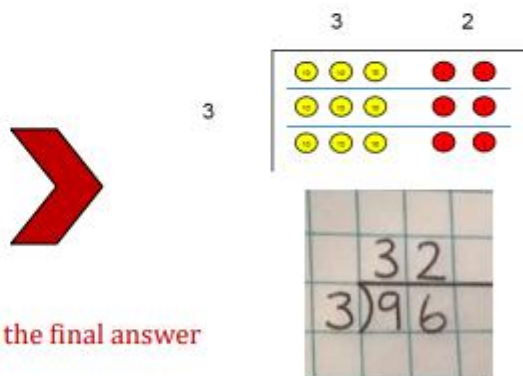
Children explore, through the continued use of practical equipment, pictures and number lines, the concept of remainders, how many are left etc. This is preparation for carry remainders across within short division.

Children also continue to develop their understanding of using grouping on a number line to divide, and also to find remainders.



Step 2: Introducing short division (no remainders and no numbers carried)

Once children are secure with division as grouping and sharing, using number lines, arrays etc. short division for larger two-digit numbers can be introduced. To start with, this should be introduced with numbers that have no remainders within, or at the end of the calculation.



Step 3: Short division, with no remainders in the final answer

Once children have shown a secure understanding of the above 2 steps, they should be taught how to use short division when remainders occur within the calculation and be shown how to carry the remainder onto the next digit.

