St Ann's Primary School

Lower Key Stage 2

Addition and Subtraction Progression and Calculation Policy

Year 3

Addition and Subtraction

National Curriculum Objectives

- Add and subtract numbers mentally, including:
  - A three-digit number and ones
  - A three-digit number and tens
  - A three-digit number and hundreds
- Add and subtract numbers with up to three digits, using formal written methods of columnar addition and 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 addition and subtraction.

Ready to Progress Criteria

- 3NF – 1 secure fluency in addition and subtraction facts that bridge 10, through continued practice
- 3NF – 3 apply place-value knowledge to known additive number facts.

- 3AS-1 Calculate complements to 100.
- 3AS – 3 Add and subtract up to three-digit numbers using columnar methods.
- 3AS-3 Manipulate the additive relationship: Under the inverse relationship between addition and subtraction, and how both relate to the part-part-whole structure. Understand and use the commutative property of addition, and understand the related property for subtraction.

Vocabulary

Add, more, altogether, biggest, most, more, smallest, less, least, fewer, fewest, value, equal to, equals, make, take away, leaves, before, after, plus, total, group, count on, count back, minus, subtract, how many more, how many fewer, how many left, how much less is…, worth, digit, tens, ones/units, column, between, sum, partition, exchange, hundreds, regroup, partition, addition, subtraction, tens boundary, difference, strategy, inverse, decrease, increase

Further Information

- In Y3, we continue to develop Year 2 strategies as appropriate and develop these strategies into 3 digit and 2 digit calculations.

- The move into formal written methods MUST be accompanied by practical apparatus ALONGSIDE the written to ensure children have understanding of the written algorithm.
- When using the formal written method, children will not be ready for bridging ten until they have had plenty experience of regrouping/ exchanging (ten ones for one ten, ten tens for one hundred and the other ways).

- Children must be shown how to apply their calculations in the context of problems including problems with measures.
- When problem solving, children must be taught to solve problems using the most efficient method.
- Ensure children have plenty of opportunity to partition numbers in different ways, e.g. 43 as 40 and 3, but also 30 and 14, 20 and 24,etc.
- Allow children the opportunity to decide whether a problem is addition or subtraction.

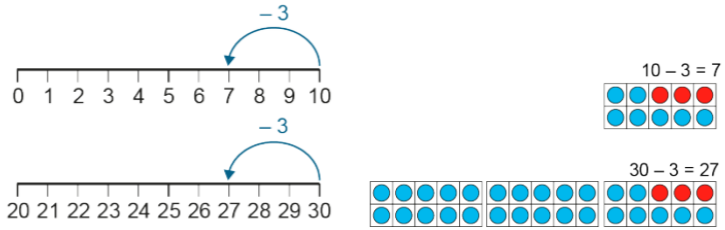
DFE Guidance and Videos
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/897801/Maths_guidance_year_3.pdf
https://www.youtube.com/watch?v=9rlue2OaupU&list=PL6gGtLyXoeq-FMWk00AlcIPo3fhGmi03D&index=4
NCETM Spine Materials
https://www.ncetm.org.uk/teaching-for-mastery/mastery-materials/primary-mastery-professional-development/number-addition-and-subtraction/

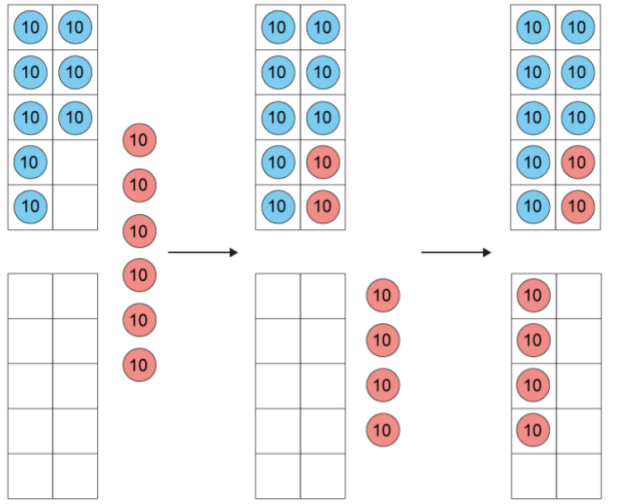
Textbook Links
Be mindful that the textbooks do not always show the method or language we use as a school. The calculation policy must be used for this.

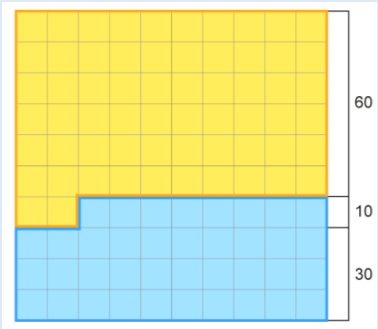
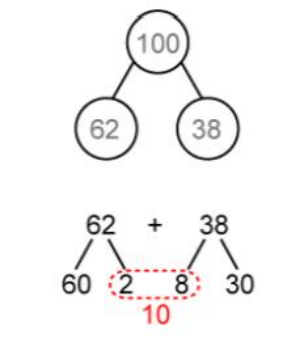
Maths No Problem
Textbook 3A Lessons 5, 6,7,8, 9, 10 – adding
Textbook 3A lessons 15, 16, 17, 18, 19 – subtracting

Power Maths
Textbook 3A (practice books can also be used to support planning and resourcing)
Unit 2 – Addition and Subtraction (1)
Unit 3 – Addition and Subtraction (2)

Addition and subtraction
Fluency in facts and mental procedures

Addition and subtraction facts that bridge 10 **(3NF – 1)**	Before pupils begin work on columnar addition and subtraction (3AS–1), it is essential that pupils have automatic recall of addition and subtraction facts within and across 10. These facts are required for calculation within the columns in columnar addition and subtraction. All mental calculation also depend on these facts. Refer back to the Y2 fluency in facts document for strategies on how to secure these facts.	**Identifying core number facts: columnar addition** 4 6 5 + 4 2 9 8 9 4 1 **Figure 72: columnar addition of 465 and 429** Within-column calculations: 5 + 9 = 14 6 + 2 + 1 = 9 4 + 4 = 8 **Identifying core number facts: columnar subtraction** 6 1 7 4 9 – 2 8 6 4 6 3 **Figure 73: columnar subtraction of 286 from 749** Within-column calculations: 9 – 6 = 3 7 – 1 = 6 14 – 8 = 6 6 – 2 = 4
subtracting ones from a multiple of 10	Building on from Y2, children should be taught to subtract a ones from any multiple of 10. eg **I know that 10 – 3 = 7 so I know that 30 – 3 = 27** Children should apply their knowledge of subtract facts to 10 to help them calculate this. Practising counting back from any multiple of 10 will help secure this understanding.	Children could be shown this in the context of 2AS-3 but these models should begin to become mental images for the children. 

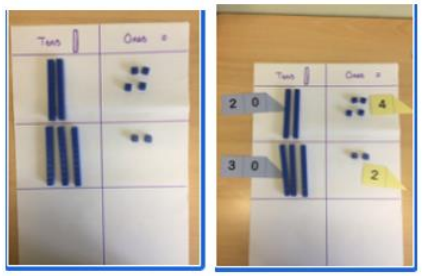
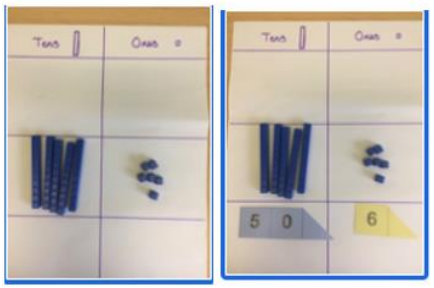
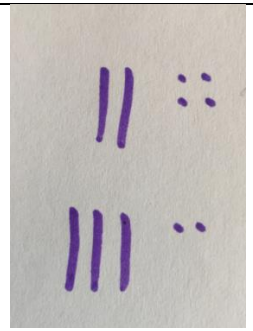
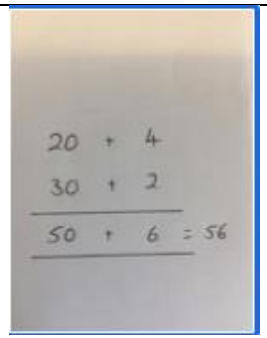
Add and subtract multiples of 10 crossing the hundreds boundary **3NF - 3**	Children to apply their knowledge of scaling to help them secure number facts involving adding and subtracting multiples of 10. eg 8 + 6 = 14 80 + 60 = 140 If I know _____ , the I know _____. Children are to learn how to scale facts in the order shown.	Chn to be show how facts relate using PV counters and tens frames to support.  Figure 75: tens frames with 10-value counters showing 80 + 60 = 140 - Scaling addition and subtraction facts within 10. Eg 90-30 = 60 - Scaling addition and subtraction facts that bridge 10. Ef 80 + 60 = 140 - Scaling doubles of any single digit number eg 60 + 60 = 100 - Scaling halves of any teen number eg Half of 120 = 60 - Scaling near doubles of any single digit number eg I know 60 + 60 = 120 so I know 60 + 70 = 130

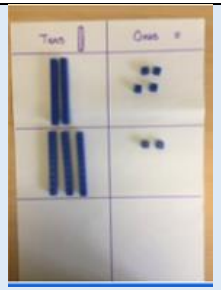
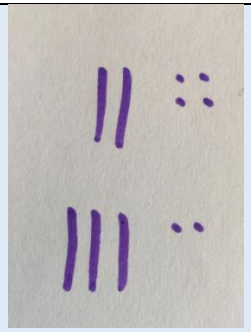
Doubling 2-digit numbers mentally and halving 2-digit numbers	Children should be taught how to double any two digit number mentally. eg 38 + 38 = 76 Half of 76 = 38	Children to calculate these doubles through partitioning and recombining. eg Double 38 Double 30 = 60 Double 8 = 16 60 + 16 = 76 and half of 76 = half of 60 and half of 16 (identifying half of 70 as not as easy as half of 60) half of 60 = 30 half of 16 = 8 30 +8 = 38
Calculating complements to 100 3AS-1	Children should be taught to recognise complements to 100 in Y3. Initially, this should be explored through children seeing how 100 can be physically or pictorially split into two equal parts (using dienes or a 100 square). This can be done alongside the part whole model and the partitioning model shown so children can relate the abstract notation to the pictorial and create a picture in their heads. eg **62 + 38 = 100** Children need to have time exploring what numbers are complements to 100 and which are not. This will help secure their understanding and overcome the common misconception of the multiples of 10 make 100 and then the ones make 10.	 

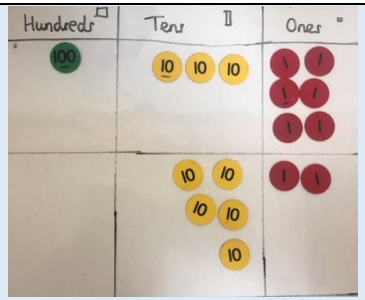
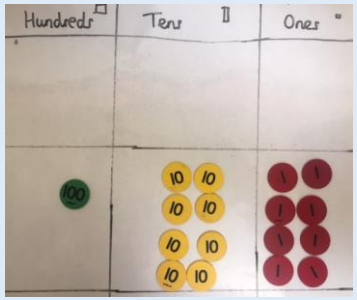
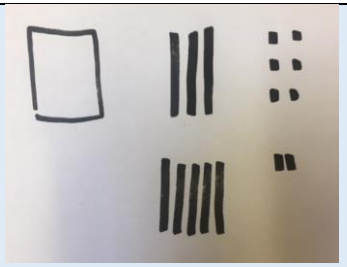
Add and subtract a 2-digit number to or from a multiple of 10 (including crossing the tens boundary)	Children to apply their thinking from previous steps to help them calculate answers to a multiple of ten add or subtract a 2 digit number. eg 110 – 27 = 83	Children should be taught to partition and count on or back in tens to find either the total or the difference as well as knowledge of number bonds to 10. Children may also relate what they know about complements to 100 to calculate too. 110 – 27 = 110 – 20 – 7 = 83
Add and subtract a 3d number and ones, tens and hundreds	Children should be taught to recognise what is changing when they are adding or subtracting ones, multiples of 10 or multiples of 100 from a given 3 digit number. eg 325 + 6 = 325 + 60 = 325 + 600 = Children should notice what place value columns are changing and which ones cannot change when adding a given multiple of 1, 10 or 100. Children should also apply facts they have previous learnt eg single digit add single digit bridging the tens boundary.	Children can explore and notice what is changing by using manipulatives such as diennes. When bridging the ten or the hundreds boundary, children should be taught to partition to support their thinking eg 325 + 6 = 325 + 5 + 1 = 331 or 453 – 7 = 453 – 3 – 4 = 446 To do this children must be secure in making and breaking single digit numbers (see Y1 and Y2 factual fluency).

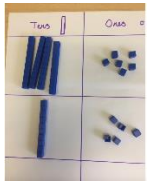
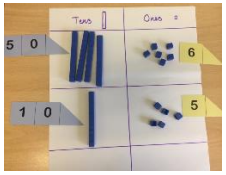
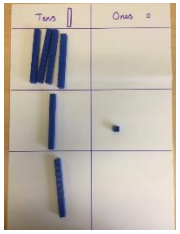
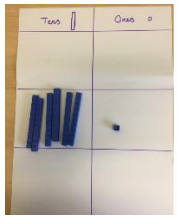
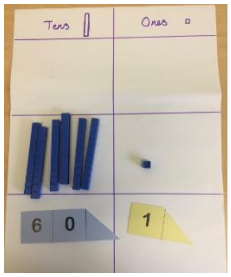
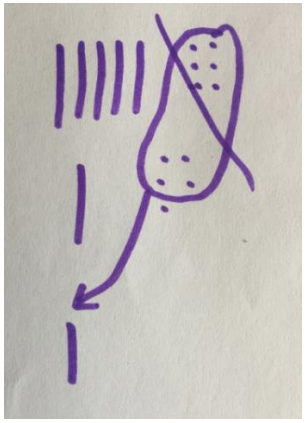
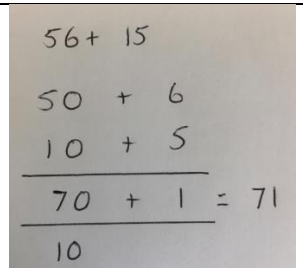
Finding a small difference between a pair of 2-digit numbers lying either side of a multiple of 10	Once children have grasped the concept of difference (taught in Y2 and revisited in Y3 – **3AS-4**), they should apply this thinking to finding small difference between a pair of numbers which lie each side of a multiple of 10 in any for digit number. eg 605 – 596	Children to recognise that these number sentences can be calculated by difference by relating the facts to the bar model. Children to calculate the answer to these questions by counting on to the multiple of 10 or 100 and counting on or back to the given number. eg 605 – 596 = 596 + ___ = 605 596 + ___ = 600 596 + **4** = 600 600 + ___ = 605 600 + **5** = 605 **4+5 = 9** or 605 – 596 = 605 – **5** = 600 600 – **4** = 596 **5 + 4 = 9**

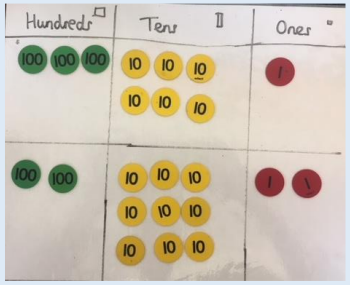
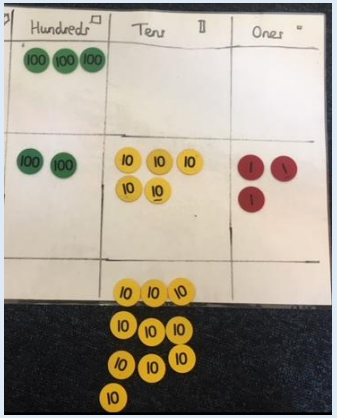
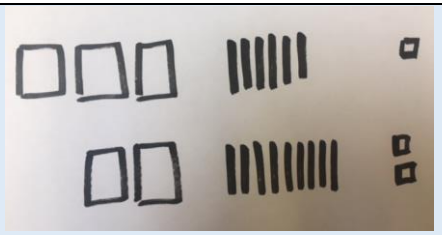
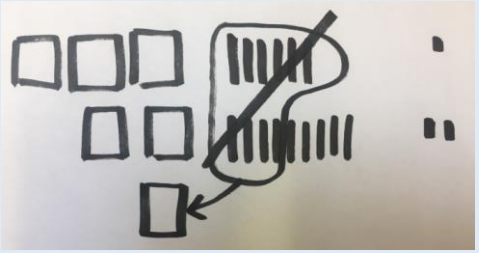
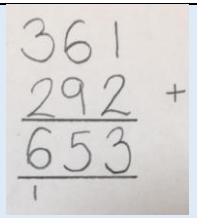
Addition Written Strategies

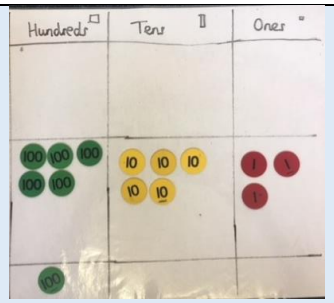
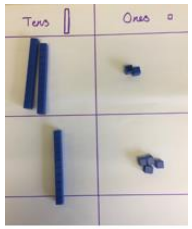
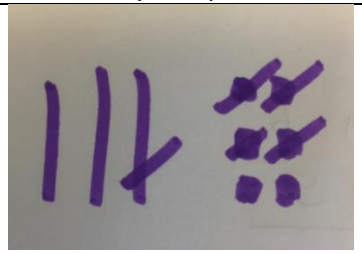
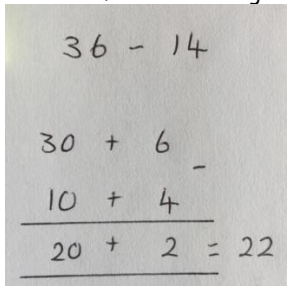
	Concrete (make)	Pictorial (draw)	Abstract (write)
2d+1d (for 2d+1d refer back to Y2 – this should be a mental method prior to starting below methods)			
Expanded method 2d + 2d This method to be used for children who struggle to access the formal written method. (no regrouping)	This method should only be used to teach children what each digit within the column method should mean. Children should be moved past this method quickly.   Children to use the following talk frames to support them. "4 ones plus 2 ones equals 6 ones. 2 tens add 3 tens equals 5 tens."		 Children must always start from the ones.

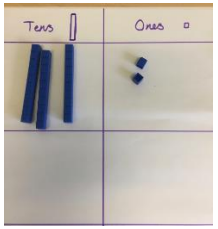
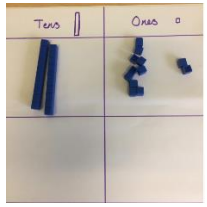
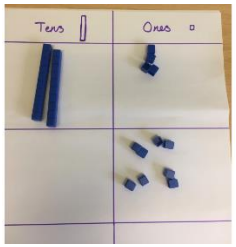
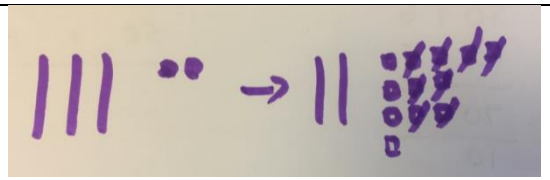
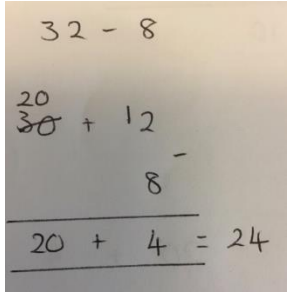
Compact method 2d + 2d (no regrouping) 3AS-2	  Place value counters could be used to instead of Dienes at this stage. This can occur if children have a solid understanding of what each digit represents. "4 ones plus 2 ones equals 6 ones. 2 tens add 3 tens equals 5 tens."		2 3 3 4 + 5 7 Children must be taught to always start from the ones. Use rulers for line drawing.

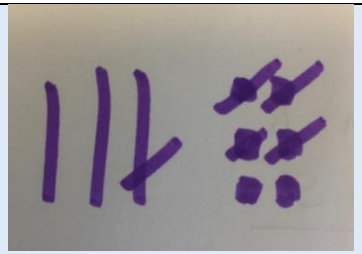
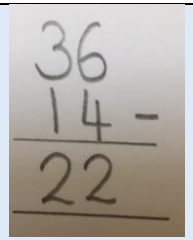
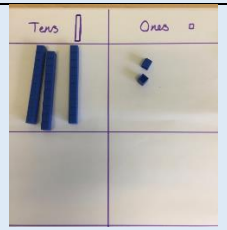
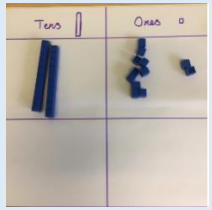
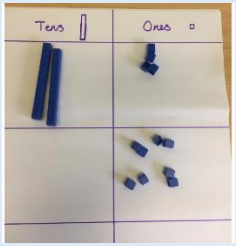
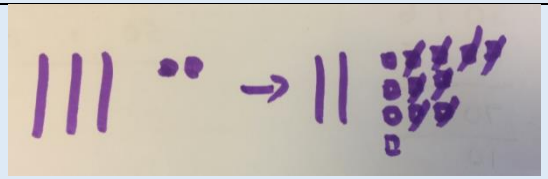
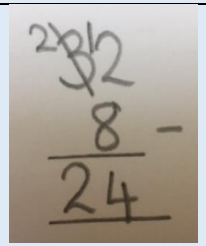
Compact method 3d + 2d (no regrouping) 3 AS-2	  Place value counters could be used to instead of Dienes at this stage. This can occur if children have a solid understanding of what each digit represents. It is always useful to show both representations.		136 52 + 188 Children must always start from the ones. Use rulers for line drawing.

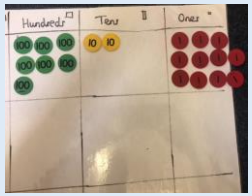
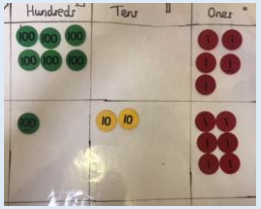
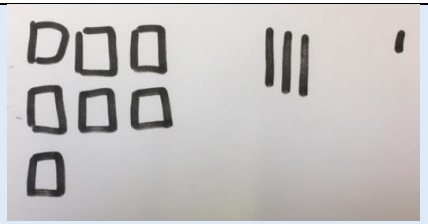
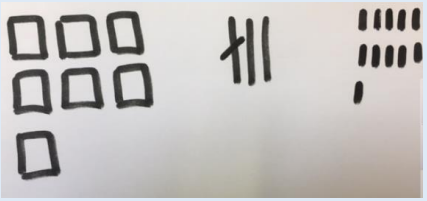
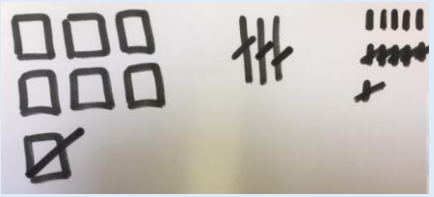
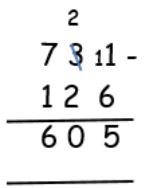
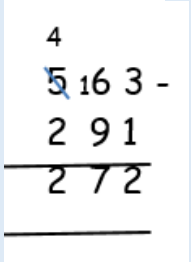
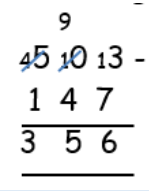
Expanded method (regrouping) <u>This method to be used to expose the structure of the mathematics and for children who struggle to understand the written method.</u> 2d + 2d	This method should only be used to teach children what each digit within the column method should mean. Children should be moved past this method quickly.      Children should physically exchange 10 ones for 1 one. They should use the following talk frame to support their learning.	 	 Children must be taught to start from the ones. Use rulers for line drawing.

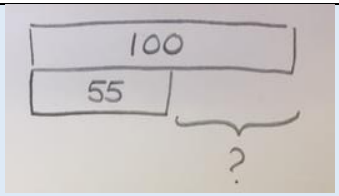
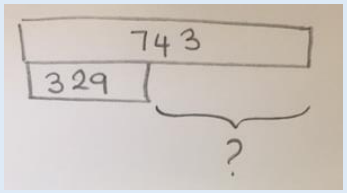
Compact method (with regrouping) 2d + 2d 3d + 3d /2d 3 AS -2	  Children to identify that 15 tens has 10 tens to exchange for 100 and 5 tens to remain in the tens column. They could be brought down off the grid then exchanged.	 	 Children must be taught to start from the ones. Use rulers for line drawing.

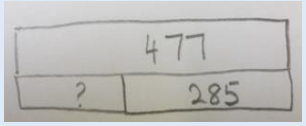
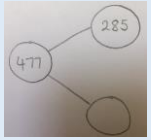
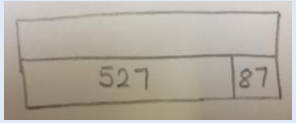
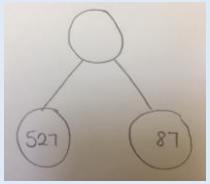
	 Children should physically exchange 10 ones for 1 one and 10 tens for 1 hundred. Children need to have this multiplicative understanding prior to exchanging.		
<u>Subtraction Written Strategies</u>			
	Concrete (make)	Pictorial (draw)	Abstract (write)
Expanded column method <u>This method to be used to expose the structure of the mathematics and for children who struggle to understand the written method.</u> (no regrouping)	This method should only be used to teach children what each digit within the column method should mean. Children should be moved past this method quickly.   Use Dienes to make the bigger number. Then, take away the smaller number. Always begin with the ones. "6 ones minus 4 ones equals 2 ones. 3 tens minus 1 ten equals 2 tens."		It is **vital** that children really understand non-standard partitioning before this step or the mixture of the + and – signs could confuse them.  Children must be taught to start from the ones. Use rulers for line drawing.

Expanded column method (regrouping) <u>This method to be used to expose the structure of the mathematics and for children who struggle to understand the written method.</u>	This method should only be used to teach children what each digit within the column method should mean. Children should be moved past this method quickly.   		 Children must be taught to start from the ones. Use rulers for line drawing.

Compact column method 2d – 2d 3d – 3/2d (no regrouping) 3 AS-2	 Use Dienes to make the bigger number. Then, take away the smaller number. Always begin with the ones. Children need to use the following talk frame to support their learning. "6 ones minus 4 ones equals 2 ones. 3 tens minus 1 ten equals 2 tens."		 Children must be taught to start from the ones. Use rulers for line drawing.
Compact column method 2d – 2d/1d (with regrouping) 3 AS-2	   		 Children must be taught to start from the ones. Use rulers for line drawing.

Compact column method (with regrouping) 3d – 1d/2d/3d 3 AS-2	   When children become secure in regrouping, they should be encouraged to move away from using the manipulatives to support.	  	Children should be taught to regroup from the tens and the hundreds. They should also be taught how to regroup when there is a 0 in a place value column.   

difference 3AS-3	  Children to use rods to show difference. Children will need to understand that rods can take on different values. They can show difference as a missing part or they can put a part in to represent the difference.	  Bar models do not need to be drawn with a ruler but they need to be reasonable in size. Children should also draw the bars relative to the size of the number. Where possible, try to draw bars on white paper.	Difference can be presented as a missing addition number sentence. eg 329 + ____ = 743 Children should rewrite this as a subtraction number sentence. 743 – 329 = _____ "There is a missing part. To find the missing part, we subtract the other part from the whole."

part whole / bar model 3AS – 3	**Missing subtraction part**   **Missing whole**  	**Missing subtraction part**   **Missing whole**  	The part whole model can be used to help find missing numbers. This can be used for number sentences with any value of number not just 3d and 2d (refer back to Y1 and Y2). **Missing addition part (mentioned above links to difference)** **Missing subtraction part** eg 477 - ___ = 285 Children should rewrite this by swapping the answer with the difference. 477 – 285 = ____ **Missing whole** eg __ - 527 = 87 Children should rewrite the number sentences as an addition number sentence. 527 + 87 = ____ "There is a missing part. To find the missing part, we add the 2 parts."

Year 4

Addition and Subtraction

National Curriculum Objectives

- Add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate
- Solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why.
- Solve simple measure and money problems involving fractions and decimals to two decimal places.

Ready to Progress Critieria

- 4NF-3 Scaling number facts by 100

There are no statements for the ready to progress criteria for Y4 addition and subtraction. Where needed, ideas from Y3 can be adapted to 4 digit numbers.

Vocabulary

Add, more, altogether, biggest, most, more, smallest, less, least, fewer, fewest, value, equal to, equals, make, take away, leaves, before, after, plus, total, group, count on, count back, minus, subtract, how many more, how many fewer, how many left, how much less is…, worth, digit, tens, ones/units, column, between, sum, partition, exchange, hundreds, regroup, partition, addition, subtraction, tens boundary, difference, strategy, inverse, decrease, increase, decimal point, tenths, hundredths

Further Information

- Children must be taught to use the most appropriate method to solve a calculation or problem (children will need to be explicitly shown mental methods and when to use them as well as how to use the formal columnar method).
- Pupils must be taught to use the column method, applying what they have learnt about adding 2 and 3 digit numbers to 4 digit numbers. Children should be able to add/subtract 2 and 3 digit numbers securely prior to adding a number to a 4 digit number.
- Children should move away from using manipulatives to support using formal methods for 4 digit numbers. They should however still be able to 'say' what each digit in the number represents eg 6 hundreds add 8 hundreds equals 14 hundreds, this is the same as 1 thousand and 4 hundreds.

DFE Guidance and Video

NA – refer to year 3 information to support.

NCETM Spine Materials

https://www.ncetm.org.uk/teaching-for-mastery/mastery-materials/primary-mastery-professional-development/number-addition-and-subtraction/

Textbooks

Be mindful that the textbooks do not always show the method or language we use as a school. The calculation policy must be used for this.

Maths No Problem Book

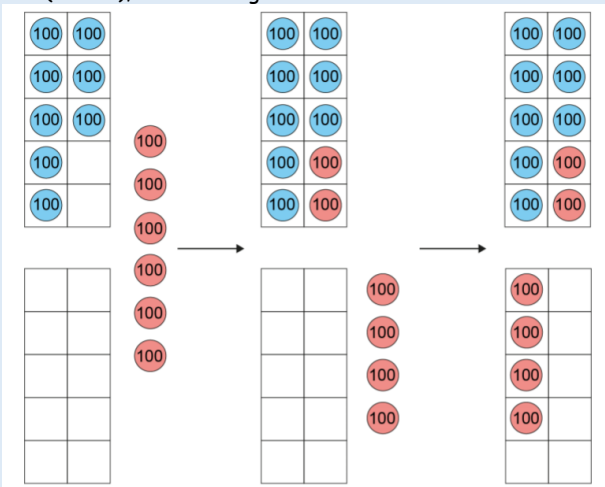
Textbook 4A Chapter 2

Power Maths

Textbook 4A (practice books can also be used to support planning and resourcing)

Unit 3 – addition and subtraction

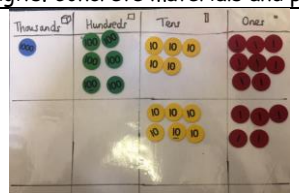
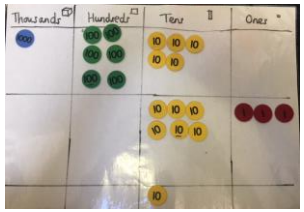
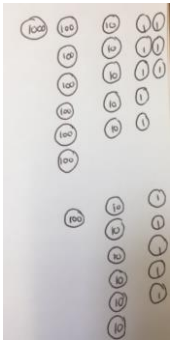
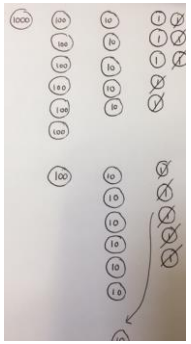
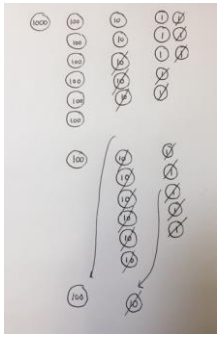
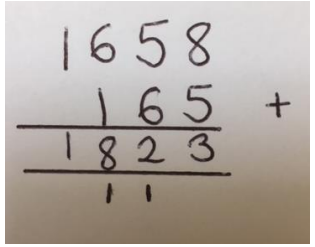
Addition and subtraction
Fluency in facts and mental procedures

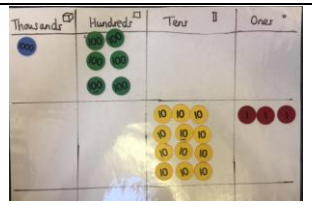
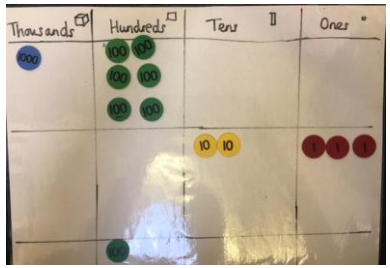
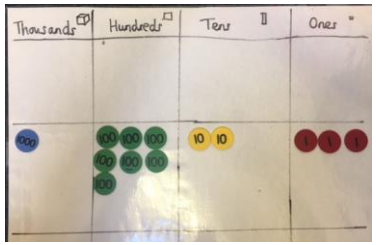
Scaling number facts by 100 **4NF-3**	Children should be taught to apply place value knowledge to known addition and subtraction facts (scaling facts by 100) eg 8 + 6 = 14 and 14 – 6 = 8 so 800 + 600 – 1,400 and 1,400 – 600 = 800 Children are to learn how to scale facts in the order shown.	For calculations such as 800 + 600 = 1,400 pupils can begin by using the tens frame and counters as they did for calculations across 10 (2AS-1) and across 100 (3NF-3), but ow using 100 – value counters.  Figure 116: tens frames with 100-value counters showing 800 + 600 = 1,400
		- Scaling addition and subtraction facts within 10. Eg 900-300 = 600 - Scaling addition and subtraction facts that bridge 10. Eg 800 + 600 = 1,400 - Scaling doubles of any single digit number eg 600 + 600 = 1,200 - Scaling halves of any teen number eg Half of 1,200 = 600 - Scaling near doubles of any single digit number eg I know 600 + 600 = 1,200 so I know 600 + 700 = 1,300

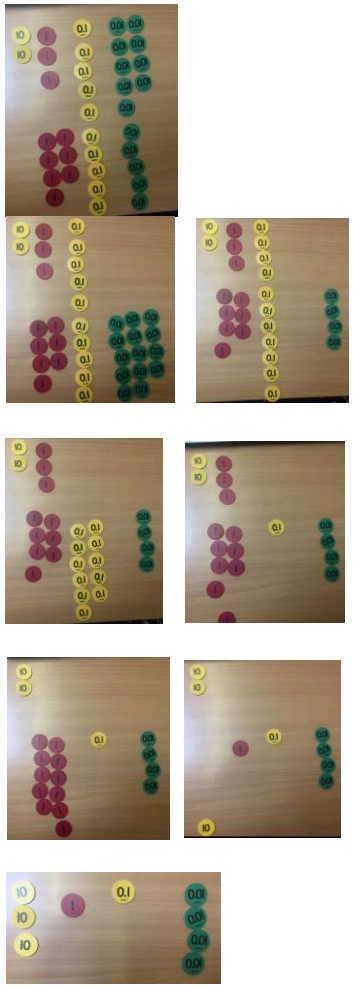
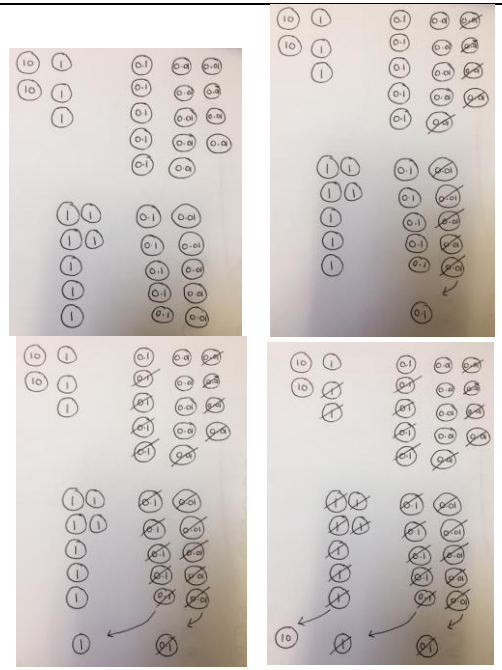
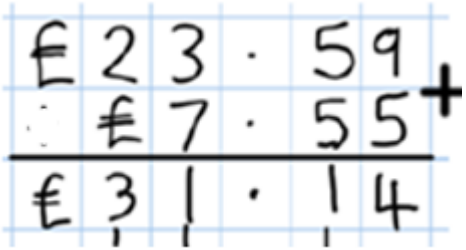
Double and half of 3 digit multiples of 10	Children should also be taught how to apply their understanding of scaling by 10 to help them double and halve 3 digit multiples of 10 eg double 790 halve 560	Children to be taught use knowledge of place value and related calculations to support them. eg double 790 double 79 = double 70 = double 9 double 70 = 140 double 9 = 18 140 + 18 = 158 158 x 10 = 1,580 **I know double 79 = 158 so I know that double 790 = 1,580**
Making complements to any multiple of 100	Children to be taught to apply their understanding of complements to 100 (3AS-1) to any multiple of 100. eg 521 + ___ = 600	521 + ____ = 600 **I know that 21 + 79 = 100 so I know that 521 + 79 = 600**
Calculation through small difference	Once children have grasped the concept of difference (taught in Y2 and revisited in Y3 – **3AS-4,** and Y4), they should apply this thinking to finding small difference between a pair of numbers which lie each side of a multiple of 10 in any for digit number. eg 6005 – 5996	Children to recognise that these number sentences can be calculated by difference by relating the facts to the bar model. Children to calculate the answer to these questions by counting on to the multiple of 10 or 100 and counting on or back to the given number. eg 6005 – 5996 = 5996 + ___ = 6005 5996 + ___ = 6000 5996 + **4** = 6000 6000 + ___ = 6005 6000 + **5** = 6005 **4+5 = 9** or 6005 – 5996 = 6005 – **5** = 6000 6000 – **4** = 5996 **5 + 4 = 9**

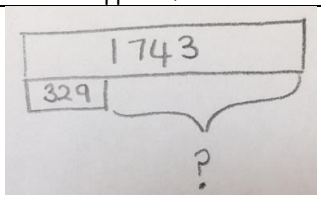
Same difference	Children to be explicitly taught that column method is not always the most efficient method. They should be taught to apply the same difference to help them calculate answers. (This method is shown below in a written format but the expectation is that this will become a mental strategy)

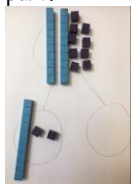
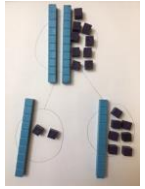
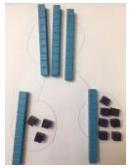
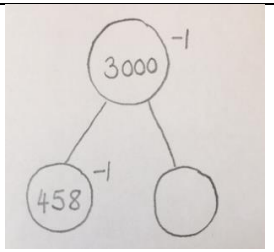
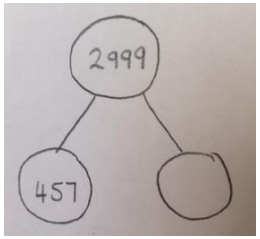
Addition Written Strategies

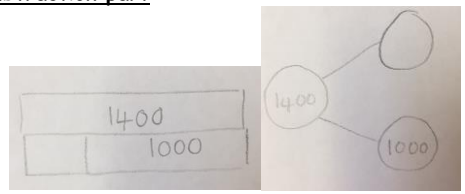
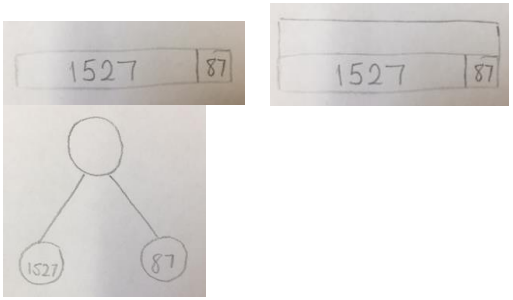
	Concrete (make)	Pictorial (draw)	Abstract (write)
Where possible children should be secure in the column method for 3 digit add 3/2/1 digit using the correct notation without the support of concrete materials or pictures prior to moving into 4 digits. Concrete materials and pictures can be used to support if needed but these need to be progressed from quickly.			
Columnar method with 2, 3 and 4 digits	  	  	 Children to be given addition number sentences that regroup and do not regroup. Children to be given number sentences with a mixed number of digits or the same number of digits.

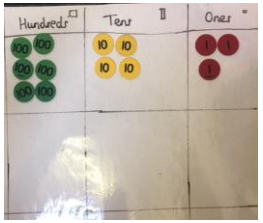
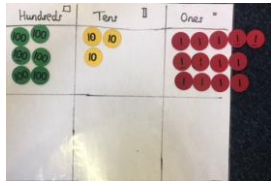
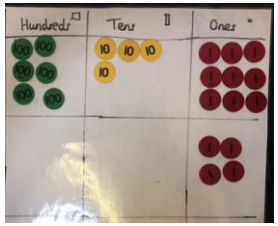
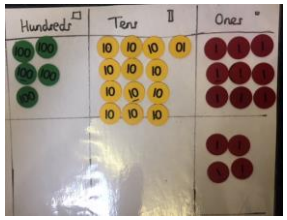
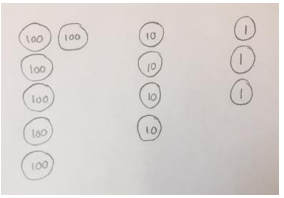
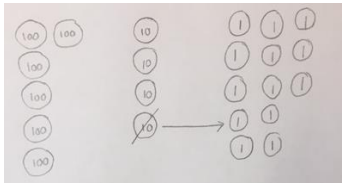
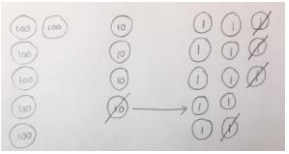
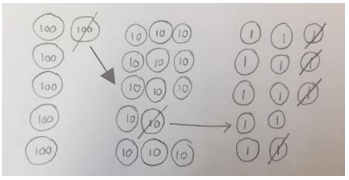
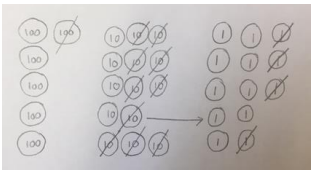
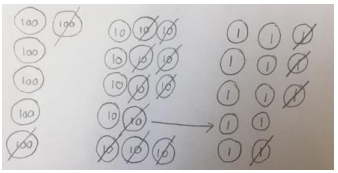
	   When children become secure in regrouping, they should be encouraged to move away from using the manipulatives to support.		

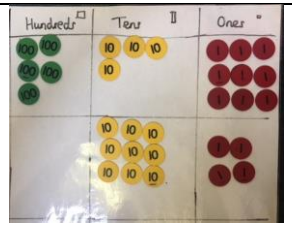
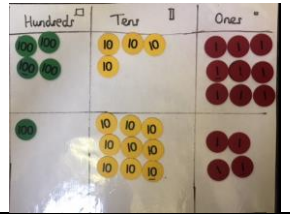
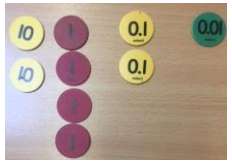
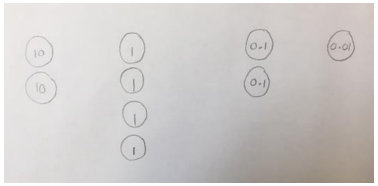
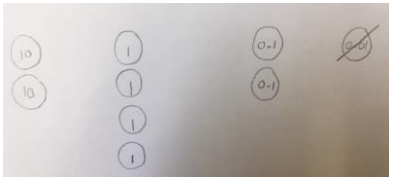
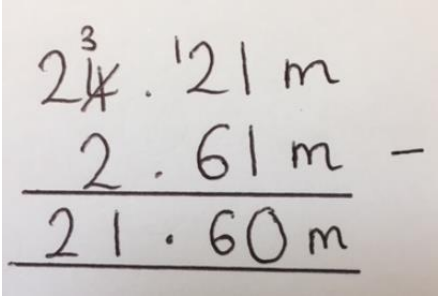
column addition with decimals	23.59 + 7.55 = PV counters can be placed onto a scaffold where needed. 		 Include 2dp in the context of money and/or other measures. The decimal point should be aligned in the same way as the other PV columns. It must be in the same column in the answer.

	When children become secure in regrouping, they should be encouraged to move away from using the manipulatives to support.		
Subtraction Written Strategies			
	Concrete (make)	Pictorial (draw)	Abstract (write)
Where possible children should be secure in the column method for 3 digit add 3/2/1 digit using the correct notation without the support of concrete materials or pictures prior to moving into 4 digits. Concrete materials and pictures can be used to support if needed but these need to be progressed from quickly.			
Difference (children should consider how to solve the calculation exposed by the bar model – they need to consider the most efficient way)	  Children to use rods to show difference. Children will need to understand that rods can take on different values. They can show difference as a missing part or they can put a part in to represent the difference.	 Bar models do not need to be drawn with a ruler but they need to be reasonable in size. Children should also draw the bars relative to the size of the number. Where possible, try to draw bars on white paper.	Difference can be presented as a missing addition number sentence. eg 329 + ____ = 1743 Children should rewrite this as a subtraction number sentence. 1743 – 329 = _____ "There is a missing part. To find the missing part, we subtract the other part from the whole." This method can be used with numbers of any size (refer back to prior year groups).
same difference (moving towards a mental strategy)	Children can place counters/ Denies into the part whole model to see the change. 30 – 13 =	Children to use the part whole model to support the children to understand that they can change the whole and one part by the same and that the difference remains the same. Children to explore this with familiar numbers and then extend to larger numbers.	Children can use the same difference to help them calculate an answer. This can move a subtraction from have lots of regrouping to having no regrouping. 3000 – 458 could be changed to 2999 – 457 "If I change the whole and one part, the difference stays the same."

	 Children to make the original sentence. Children to adjust the whole and the part.  Children to calculate their answer.  Children can be shown that this is the same as the original by adjust the whole and part back and check the difference is the same.  This may be a different way of using apparatus on the part whole model so children may need to be shown that all the Dienes do not add up to the whole.	 	This would allow the children to either mentally subtract or to subtract using column method with no regrouping.

part whole (children should consider how to solve the calculation exposed by the bar model – they need to consider the most efficient way)	**Missing subtraction part**   **Missing whole**  	**Missing subtraction part**  **Missing whole** 	The part whole model can be used to help find missing numbers. This can be used for number sentences with any value of number not just 3d and 2d (refer back to Y1, Y2 and Y3). **Missing addition part (mentioned above links to difference)** **Missing subtraction part** eg 1477 - ___ = 285 Children should rewrite this by swapping the answer with the difference. 1477 – 285 = ____ **Missing whole** eg __ - 1527 = 87 Children should rewrite the number sentences as an addition number sentence. 1527 + 87 = ____ "There is a missing part. To find the missing part, we add the 2 parts."

Column subtraction with 2, 3 and 4 digits	643 – 194 =     	643 – 194 =      	5 13 ~~6~~ ~~4~~ 13 - 1 9 4 4 4 9 9 ~~4~~ ~~5~~ ~~1~~ ~~0~~ 13 - 1 4 7 3 5 6 Children to be given subtraction number sentences that regroup and do not regroup. Children to be given number sentences with a mixed number of digits or the same number of digits. It is very important to teach children how regroup back through a place value column of 0 or two place value columns with 0 in.

	 		
Column subtraction with decimals	24.21m – 2.61m = The place value counters can be placed onto a scaffold if needed.   When children come to regroup. They need to have a secure understanding that ten 0.1 make 1 whole, ten 0.01 make 0.1 and that one hundred 0.01 make 1 whole.	24.21m – 2.61m =  	 Include 2dp in the context of money and/or other measures. The decimal point should be aligned in the same way as the other PV columns. It must be in the same column in the answer.