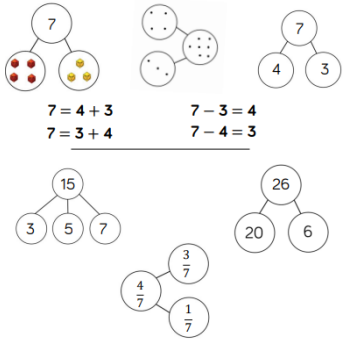
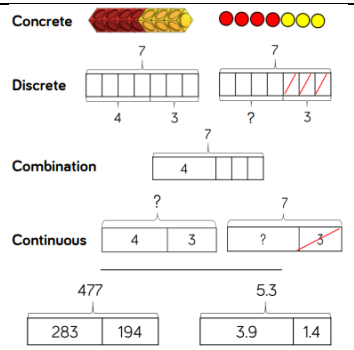
St Oswald's CofE Academy

St Oswald's Calculation Policy

This policy has been largely adapted from the White Rose Maths Hub with further material added from NCETM and the Mastering Number programme. It is a working document and will be revised and amended as necessary.

Overview of the different models and images that can support the teaching of different concepts.

Name	Model	Benefit
Part- Whole Model		This part-whole model supports children in their understanding of aggregation and partitioning. Due to its shape, it can be referred to as a cherry part-whole model. When the parts are complete and the whole is empty, children use aggregation to add the parts together to find the total. When the whole is complete and at least one of the parts is empty, children use partitioning (a form of subtraction) to find the missing part. Part-whole models can be used to partition a number into two or more parts, or to help children to partition a number into tens and ones or other place value columns. In KS2, children can apply their understanding of the part-whole model to add and subtract fractions, decimals and percentages.
Bar Model (single)		The single bar model is another type of a part-whole model that can support children in representing calculations to help them unpick the structure. Cubes and counters can be used in a line as a concrete representation of the bar model. Discrete bar models are a good starting point with smaller numbers. Each box represents one whole. The combination bar model can support children to calculate by counting on from the larger number. It is a good stepping stone towards the continuous bar model. Continuous bar models are useful for a range of values. Each rectangle represents a number. The question mark indicates the value to be found. In KS2, children can use bar models to represent larger numbers, decimals and fractions.

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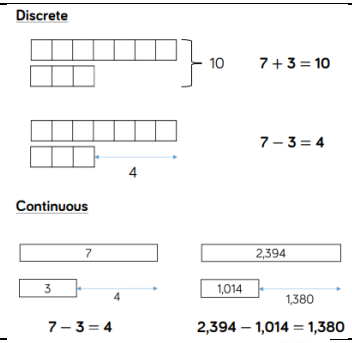
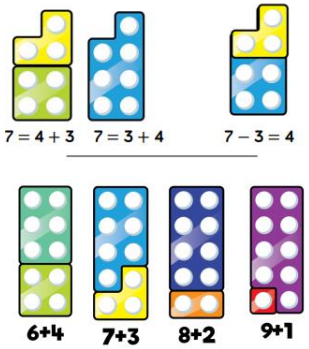
Bar Model (multiple)		The multiple bar model is a good way to compare quantities whilst still unpicking the structure. Two or more bars can be drawn, with a bracket labelling the whole positioned on the right hand side of the bars. Smaller numbers can be represented with a discrete bar model whilst continuous bar models are more effective for larger numbers. Multiple bar models can also be used to represent the difference in subtraction. An arrow can be used to model the difference. When working with smaller numbers, children can use cubes and a discrete model to find the difference. This supports children to see how counting on can help when finding the difference
Number Shapes		Number shapes can be useful to support children to subitise numbers as well as explore aggregation, partitioning and number bonds. When adding numbers, children can see how the parts come together making a whole. As children use number shapes more often, they can start to subitise the total due to their familiarity with the shape of each number. When subtracting numbers, children can start with the whole and then place one of the parts on top of the whole to see what part is missing. Again, children will start to be able to subitise the part that is missing due to their familiarity with the shapes. Children can also work systematically to find number bonds. As they increase one number by 1, they can see that the other number decreases by 1 to f

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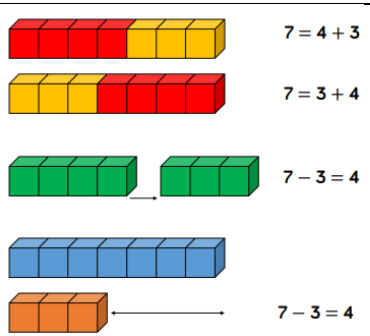
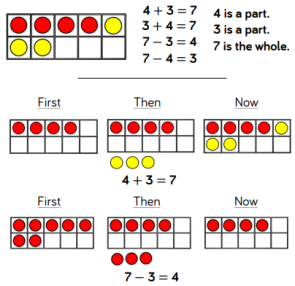
Cubes		Cubes can be useful to support children with the addition and subtraction of one-digit numbers. When adding numbers, children can see how the parts come together to make a whole. Children could use two different colours of cubes to represent the numbers before putting them together to create the whole. When subtracting numbers, children can start with the whole and then remove the number of cubes that they are subtracting in order to find the answer. This model of subtraction is reduction, or take away. Cubes can also be useful to look at subtraction as difference. Here, both numbers are made and then lined up to find the difference between the numbers. Cubes are useful when working with smaller numbers but are less efficient with larger numbers as they are difficult to subitise and children may miscount them.
Ten Frames (within 10)		When adding and subtracting within 10, the ten frame can support children to understand the different structures of addition and subtraction. Using the language of parts and wholes represented by objects on the ten frame introduces children to aggregation and partitioning. Aggregation is a form of addition where parts are combined together to make a whole. Partitioning is a form of subtraction where the whole is split into parts. Using these structures, the ten frame can enable children to find all the number bonds for a number. Children can also use ten frames to look at augmentation (increasing a number) and take-away (decreasing a number). This can be introduced through a first, then, now structure which shows the change in the number in the 'then' stage. This can be put into a story structure to help children understand the change e.g. First, there were 7 cars. Then, 3 cars left. Now, there are 4 cars.

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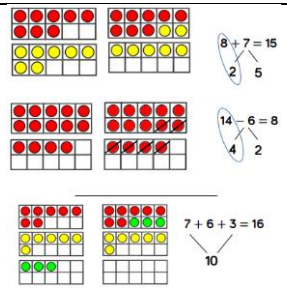
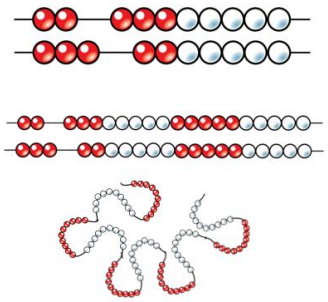
Ten Frames (within 20)		When adding two single digits, children can make each number on separate ten frames before moving part of one number to make 10 on one of the ten frames. This supports children to see how they have partitioned one of the numbers to make 10, and makes links to effective mental methods of addition. When subtracting a one-digit number from a two-digit number, firstly make the larger number on 2 ten frames. Remove the smaller number, thinking carefully about how you have partitioned the number to make 10, this supports mental methods of subtraction. When adding three single-digit numbers, children can make each number on 3 separate 10 frames before considering which order to add the numbers in. They may be able to find a number bond to 10 which makes the calculation easier. Once again, the ten frames support the link to effective mental methods of addition as well as the importance of commutativity.
Bead Strings		Different sizes of bead strings can support children at different stages of addition and subtraction. Bead strings to 10 are very effective at helping children to investigate number bonds up to 10. They can help children to systematically find all the number bonds to 10 by moving one bead at a time to see the different numbers they have partitioned the 10 beads into e.g. 2 + 8 = 10, move one bead, 3 + 7 = 10. Bead strings to 20 work in a similar way but they also group the beads in fives. Children can apply their knowledge of number bonds to 10 and see the links to number bonds to 20. Bead strings to 100 are grouped in tens and can support children in number bonds to 100 as well as helping when adding by making ten. Bead strings can show a link to adding to the next 10 on number lines which supports a mental method of addition

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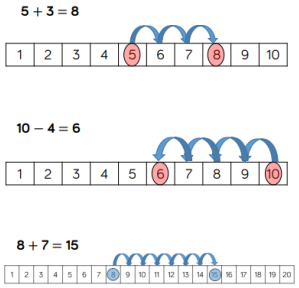
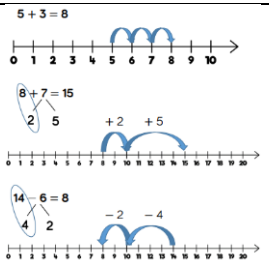
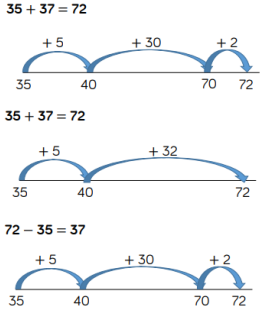
Number Tracks		Number tracks are useful to support children in their understanding of augmentation and reduction. When adding, children count on to find the total of the numbers. On a number track, children can place a counter on the starting number and then count on to find the total. When subtracting, children count back to find their answer. They start at the minuend and then take away the subtrahend to find the difference between the numbers. Number tracks can work well alongside ten frames and bead strings which can also model counting on or counting back. Playing board games can help children to become familiar with the idea of counting on using a number track before they move on to number lines.
Number Lines (labelled)		Labelled number lines support children in their understanding of addition and subtraction as augmentation and reduction. Children can start by counting on or back in ones, up or down the number line. This skill links directly to the use of the number track. Progressing further, children can add numbers by jumping to the nearest 10 and then jumping to the total. This links to the making 10 method which can also be supported by ten frames. The smaller number is partitioned to support children to make a number bond to 10 and to then add on the remaining part. Children can subtract numbers by firstly jumping to the nearest 10. Again, this can be supported by ten frames so children can see how they partition the smaller number into the two separate jumps.
Number Lines (blank)		Blank number lines provide children with a structure to add and subtract numbers in smaller parts. Developing from labelled number lines, children can add by jumping to the nearest 10 and then adding the rest of the number either as a whole or by adding the tens and ones separately. Children may also count back on a number line to subtract, again by jumping to the nearest 10 and then subtracting the rest of the number. Blank number lines can also be used effectively to help children subtract by finding the difference between numbers. This can be done by starting with the smaller number and then counting on to the larger number. They then add up the parts they have counted on to find the difference between the numbers.

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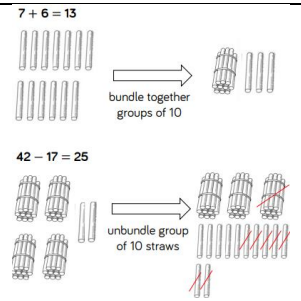
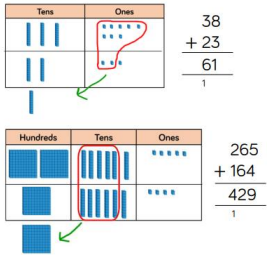
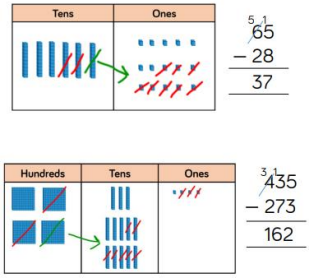
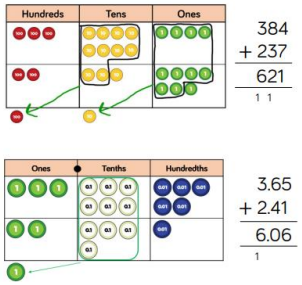
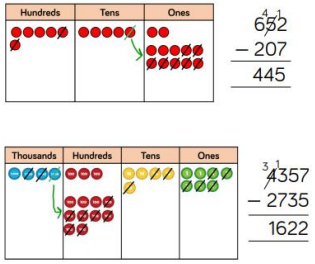
Straws		Straws are an effective way to support children in their understanding of exchange when adding and subtracting 2-digit numbers. Children can be introduced to the idea of bundling groups of ten when adding smaller numbers and when representing 2-digit numbers. Use elastic bands or other ties to make bundles of ten straws. When adding numbers, children bundle a group of 10 straws to represent the exchange from 10 ones to 1 ten. They then add the individual straws (ones) and bundles of straws (tens) to find the total. When subtracting numbers, children unbundle a group of 10 straws to represent the exchange from 1 ten to 10 ones. Straws provide a good stepping stone to adding and subtracting with Base 10/Dienes.
Base 10/Dienes (addition)		Using Base 10 or Dienes is an effective way to support children's understanding of column addition. It is important that children write out their calculations alongside using or drawing Base 10 so they can see the clear links between the written method and the model. Children should first add without an exchange before moving on to addition with exchange.. The representation becomes less efficient with larger numbers due to the size of Base 10. In this case, place value counters may be the better model to use. When adding, always start with the smallest place value column. Here are some questions to support children. How many ones are there altogether? Can we make an exchange? (Yes or No) How many do we exchange? (10 ones for 1 ten, show exchanged 10 in tens column by writing 1 in column) How many ones do we have left? (Write in ones column) Repeat for each column.
Base 10/Dienes (subtraction)		Using Base 10 or Dienes is an effective way to support children's understanding of column subtraction. It is important that children write out their calculations alongside using or drawing Base 10 so they can see the clear links between the written method and the model. Children should first subtract without an exchange before moving on to subtraction with exchange. When building the model, children should just make the minuend using Base 10, they then subtract the subtrahend. Highlight this difference to addition to avoid errors by making both numbers. Children start with the smallest place value column. When

		there are not enough ones/tens/hundreds to subtract in a column, children need to move to the column to the left and exchange e.g. exchange 1 ten for 10 ones. They can then subtract efficiently. This model is efficient with up to 4-digit numbers. Place value counters are more efficient with larger numbers and decimals.
Place Value Counters (addition)		Using place value counters is an effective way to support children's understanding of column addition. It is important that children write out their calculations alongside using or drawing counters so they can see the clear links between the written method and the model. Children should first add without an exchange before moving on to addition with exchange. Different place value counters can be used to represent larger numbers or decimals. If you don't have place value counters, use normal counters on a place value grid to enable children to experience the exchange between columns. When adding money, children can also use coins to support their understanding. It is important that children consider how the coins link to the written calculation especially when adding decimal amounts.
Place Value Counters (Subtraction)		Using place value counters is an effective way to support children's understanding of column subtraction. It is important that children write out their calculations alongside using or drawing counters so they can see the clear links between the written method and the model. Children should first subtract without an exchange before moving on to subtraction with exchange. If you don't have place value counters, use normal counters on a place value grid to enable children to experience the exchange between columns. When building the model, children should just make the minuend using counters, they then subtract the subtrahend. Children start with the smallest place value column. When there are not enough ones/tens/hundreds to subtract in a column, children need to move to the column to the left and exchange e.g. exchange 1 ten for 10 ones. They can then subtract efficiently.

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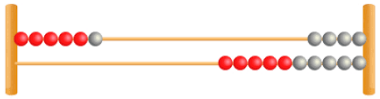
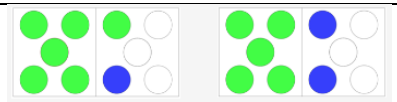
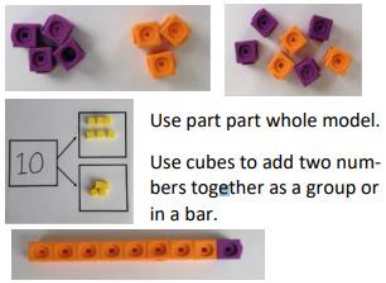
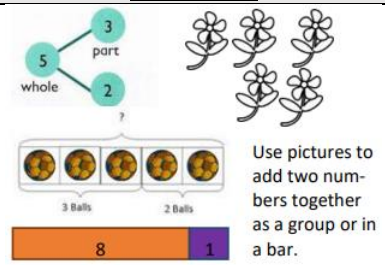
Rekenrek		Rekenreks build number sense and encourage students to subitize, visualize number relationships, strengthen counting proficiency, and use grouping to solve addition and subtraction problems. You can use Rekenreks to make groups of 5 and 10 and to teach additive strategies such as double-double strategy and near-5 strategy.
Hungarian ten frames		Making numbers on the Hungarian number frame promotes subitising and exposes different structures, allowing children to develop an appreciation of how numbers are composed. It is therefore a useful structure to aid in the development of number sense and may be useful to encourage children to progress from counting to calculating. The composition can also be linked to the fingers.

Calculation Policy – Addition

Year Group	Skill	Concrete	Pictorial	Abstract
	Combining two parts to make a whole: part- whole model	 Use part part whole model. Use cubes to add two numbers together as a group or in a bar.	 Use pictures to add two numbers together as a group or in a bar.	4 + 3 = 7  10= 6 + 4 Use the part-part whole diagram as shown above to move into the abstract.

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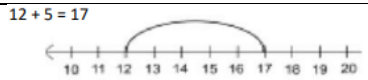
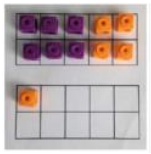
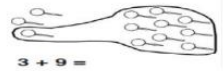
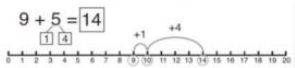
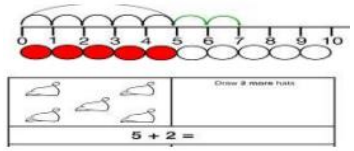
Year 1	Counting on from the greatest number	 Start with the larger number on the bead string and then count on to the smaller number 1 by 1 to find the answer.	 Start at the larger number on the number line and count on in ones or in one jump to find the answer.	5 + 12 = 17 Place the larger number in your head and count on the smaller number to find your answer.
	Regrouping to make 10. *(This is an essential skill for column addition later)*	  Start with the bigger number and use the smaller number to make 10. Use ten frames.	 Use pictures or a number line. Regroup or partition the smaller number using the part part whole model to make 10. 	7 + 4= 11 If I am at seven, how many more do I need to make 10. How many more do I add on now?
	Represent & use number bonds and related subtraction facts within 20	 2 more than 5.		Emphasis should be on the language '1 more than 5 is equal to 6.' '2 more than 5 is 7.' '8 is 3 more than 5.'

Year Group	Skill	Concrete	Pictorial	Abstract

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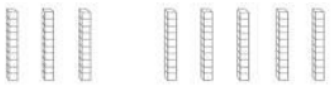
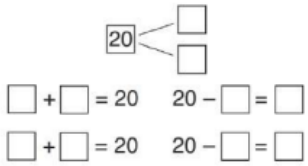
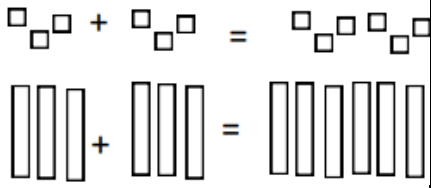
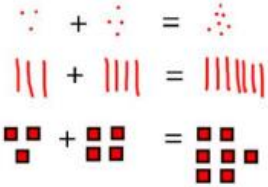
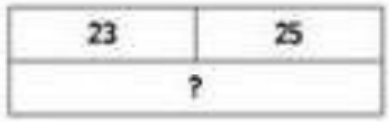
Year 2	Adding multiples of ten	50= 30 = 20  Model using dienes and bead strings	 3 tens + 5 tens = ____ tens 30 + 50 = ____ Use representations for base ten.	20 + 30 = 50 70 = 50 + 20 40 + □ = 60
	Use known number facts Part part whole	 Children explore ways of making numbers within 20	 20 □ + □ = 20 20 − □ = □ □ + □ = 20 20 − □ = □	___ + 1 = 16 1 + ___ = 16 16 – 1 = ____ 16 - ____ = 1
	Using known facts		 Children draw representations of H,T and O	3 + 4 = 7 Children can use known facts to find unknown facts. What is 10x bigger? 30 + 40 = 70
	Bar model	 3 + 4 = 7	 7 + 3 = 10	 23 25 ? 23 + 25 = 48

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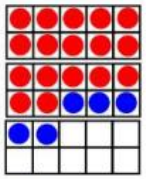
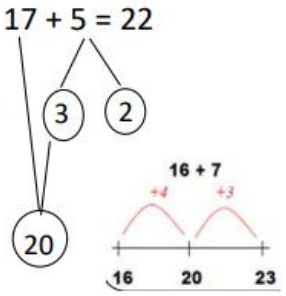
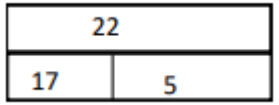
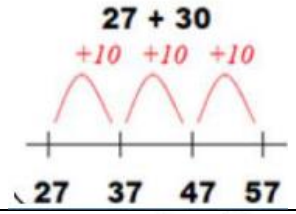
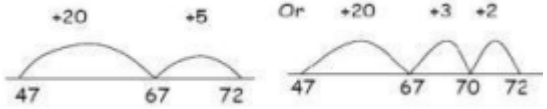
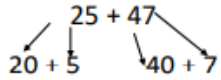
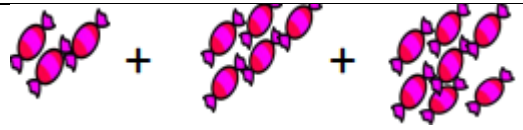
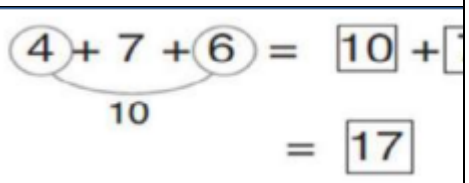
	Add a two digit number and ones	 17 + 5 = 22 Children explore the pattern. 17 + 5 = 22 27 + 5 = 32	Use part part whole and number line to model. 	17 + 5 = 22  Explore related facts 17 + 5 = 22 5 + 17 = 22 22—17 = 5 22—5 = 17
	Add a 2 digit number and tens	 25 + 10 = 35 Explore that the ones digit does not change		27 + 10 = 37 27 + 20 = 47 27 + □ = 57
	Add two 2-digit numbers	 Model using base ten, place value counters and numicon.	 Use number line and bridge ten using part whole if necessary.	 20 + 40 = 60 5+ 7 =12 60 + 12 = 72
	Add three 1-digit numbers		 Regroup and draw the representation.	

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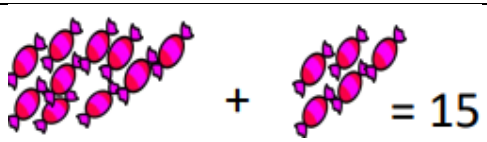
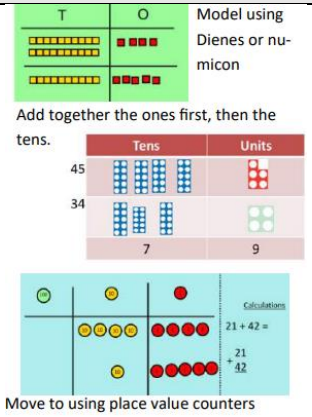
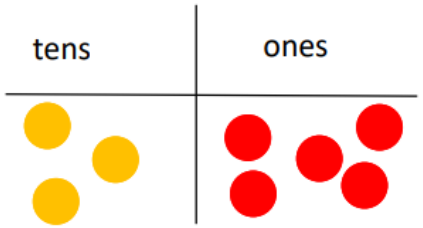
		Combine to make 10 first if possible, or bridge 1o then add third digit		Combine the two numbers that make/ bridge ten then add on the third.
Year Group	**Skill**	**Concrete**	**Pictorial**	**Abstract**
	Column Addition—no regrouping (friendly numbers) Add two or three 2 or 3-digit numbers.		Children move to drawing the counters using a tens and one frame. 	Add the ones first, then the tens, then the hundreds. 2 2 3 + 1 1 4 3 3 7

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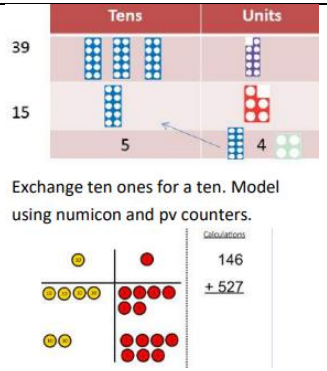
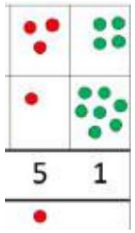
Year 3	Column Addition with regrouping.		Children can draw a reprepresentation of the grid to further support their understanding, carrying the ten underneath the line. 	Start by partitioning the numbers before formal column to show the exchange. 20 + 5 40 + 8 60 + 13 = 73 536 + 85 621 1 1

Year Group	Skill	Concrete	Pictorial	Abstract

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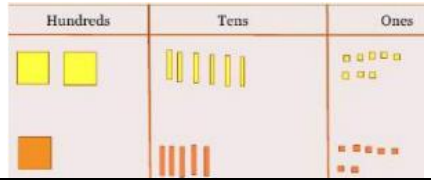
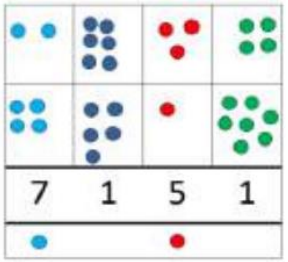
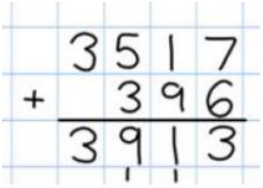
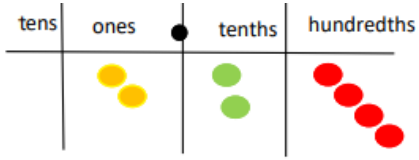
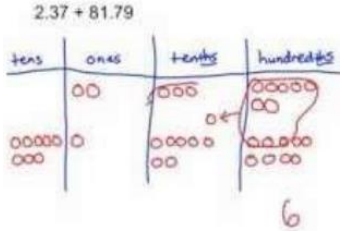
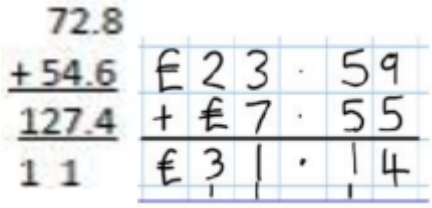
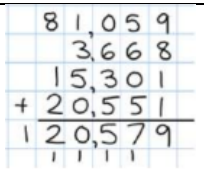
Year 4	Y4—add numbers with up to 4 digits	Children continue to use base ten or pv counters to add, exchanging ten ones for a ten and ten tens for a hundred and ten hundreds for a thousand. 	Draw representations using pv grid 	Continue from previous work to carry hundreds as well as tens. Relate to money and measures 
Year 5	Y5—add numbers with more than 4 digits. Add decimals with 2 decimal places, including money.	As Year 4.  Introduce decimal place value counters and model exchange for addition.		
Year 6	Y6—add several numbers of increasing complexity Including adding money, measure and decimals	As year 5.	As year 5.	 Insert zeros for place holders.

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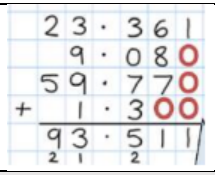
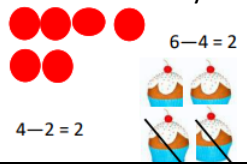
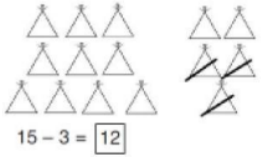
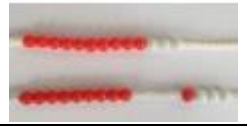
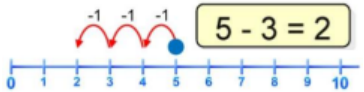
	with different numbers of decimal points.			

Calculation Policy – Subtraction

[redacted]

Year Group	Skill	Concrete	Pictorial	Abstract
Year 1	Taking away ones.	Use physical objects, counters , cubes etc to show how objects can be taken away. 	Cross out drawn objects to show what has been taken away. 	7—4 = 3 16—9 = 7
	Counting back	Move objects away from the group, counting backwards.  Move the beads along the bead string as you count backwards. 	Count back in ones using a number line. 	Put 13 in your head, count back 4. What number are you at?

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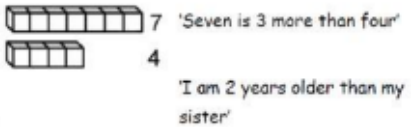
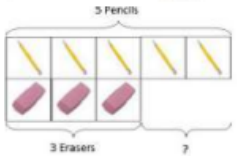
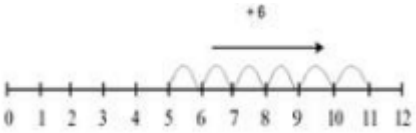
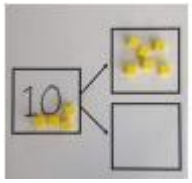
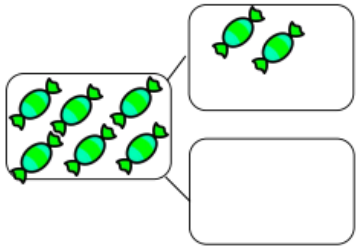
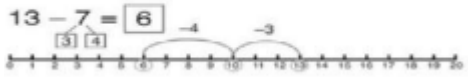
	Find the Difference	Compare objects and amounts.  Lay objects to represent bar model 	Count on using a number line to find the difference. 	Hannah has12 sweets and her sister has 5. How many more does Hannah have than her sister.?
	Represent and use number bonds and related subtraction facts within 20 Part Part Whole model	Link to addition. Use PPW model to model the inverse.  If 10 is the whole and 6 is one of the arts, what are the other part? 10—6 = 4	Use pictorial representations to show the part. 	Move to using numbers within the part whole model. 
	Make 10	14—9  Make 14 on the ten frame. Take 4 away to make ten, then take one	Jump back 3 first, then another 4. Use ten as the stopping point. 13—7 	**16-8=** How many do we take off first to get to 10? How many left to take off?

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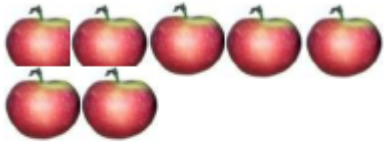
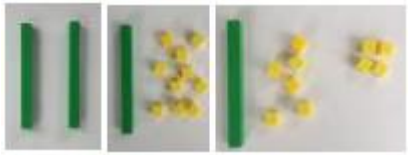
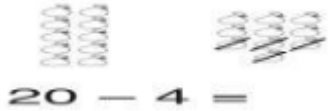
		more away so that you have taken 5.		
	Bar model	 5—2 = 3		8 | 2 **10 = 8 + 2** **10 = 2 + 8** **10—2 = 8** **10—8 = 2**

Year Group	Skill	Concrete	Pictorial	Abstract
	Regroup a ten into ten ones	Use a PV chart to show how to change a ten into ten ones, use the term 'take and make' . 	 20 — 4 =	20—4 = 16

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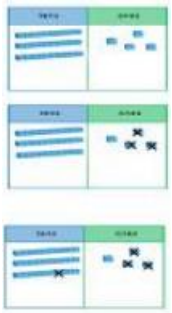
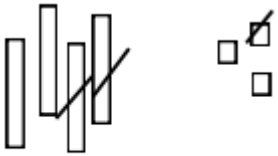
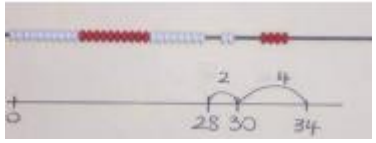
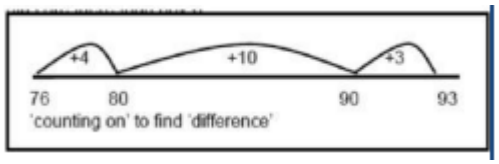
Year 2	Partitioning to subtract without re-grouping.	34—13 = 21  Use base ten to show how to partition the number when subtracting without regrouping.	Children draw representations of base ten and cross off.  43—21 = 22	43—21 = 22
	Make ten strategy Progression should be crossing one ten, crossing more than one ten, crossing the hundreds.	34—28  Use a bead bar or bead strings to model counting to next ten and the rest.	Use a number line to count on to next ten and then the rest.  	93—76 = 17
Year Group	**Skill**	**Concrete**	**Pictorial**	**Abstract**

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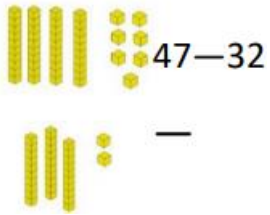
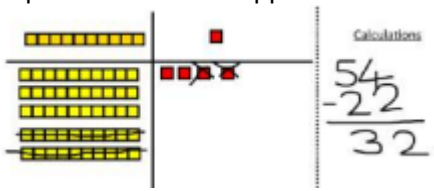
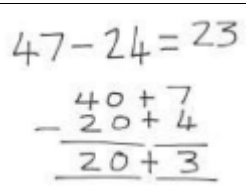
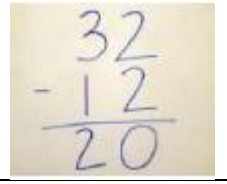
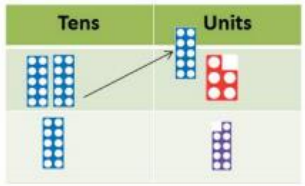
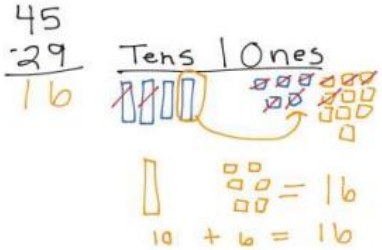
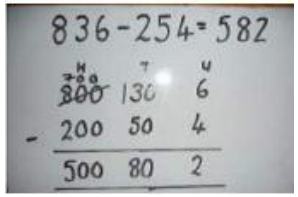
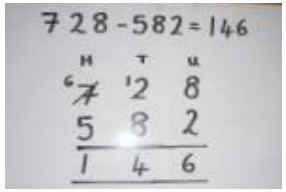
Year 3	Column subtraction without regrouping (friendly numbers)	Use base 10 or Numicon to model . 	Draw representations to support understanding. 	 Another step may be needed to lead to support subtraction understanding 
	Column subtraction with regrouping	Begin with base 10 or Numicon. Move to pv counters, modelling the exchange of a ten into ten ones. Use the phrase 'exchange'. 	Children may draw base ten or PV counters and cross off. 	Begin by partitioning into pv columns  Then move to formal method 

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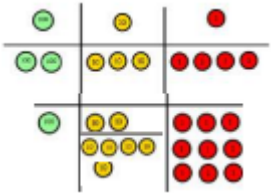
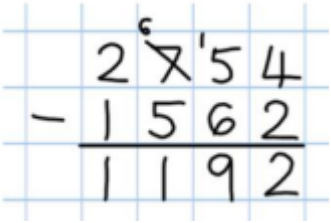
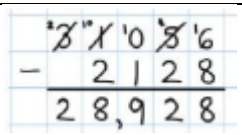
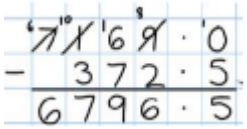
Year Group	Skill	Concrete	Pictorial	Abstract
Year 4	Subtracting tens and ones Year 4 subtract with up to 4 digits.	Model process of exchange using Numicon, base ten and then move to PV counters. 234 – 179= 	Children to draw pv counters and show their exchange—see Y3	
Year 5	Subtract with at least 4 digits, including money and measures.	As year 4.	Children to draw pv counters and show their exchange—see Y3	 Use zeros for placeholders. 

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Year 6	Subtract with increasingly large and more complex numbers and decimal values.