Wonder
Learning Partnership
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Calculation Policy

Primary

Draft 1

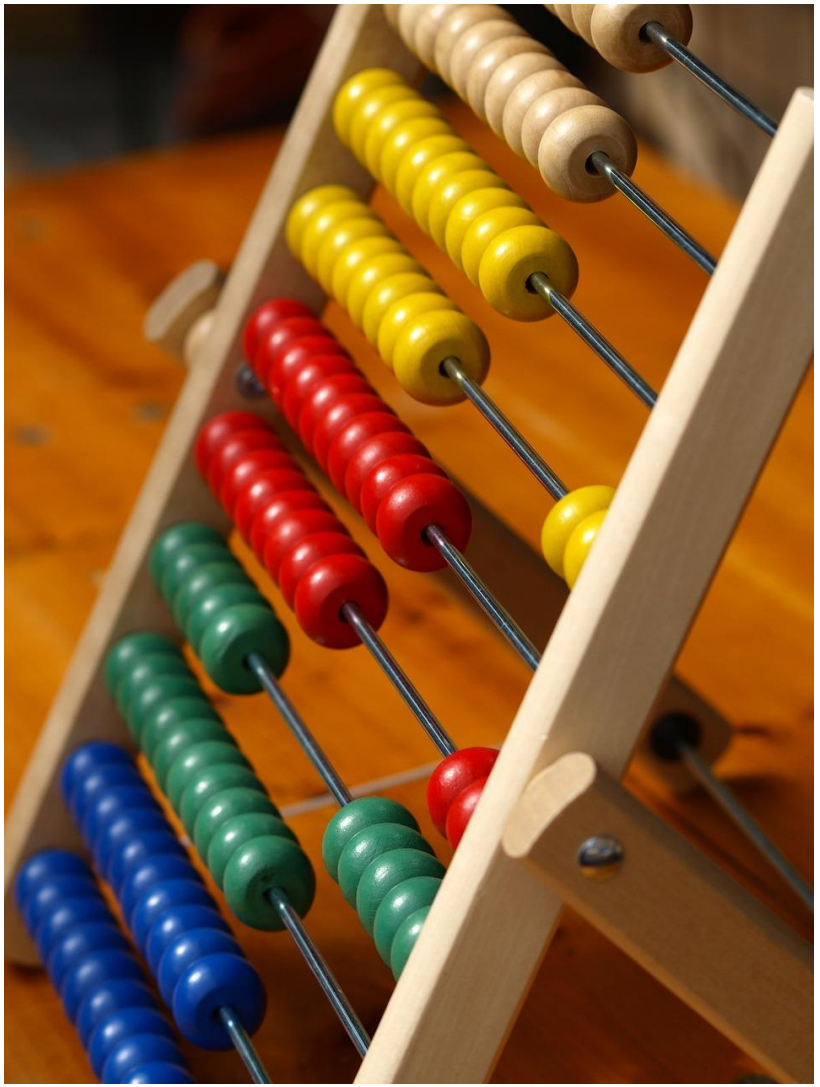
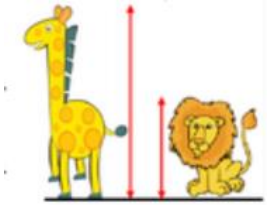
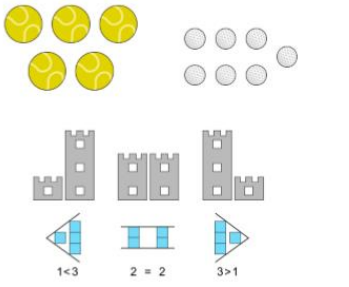
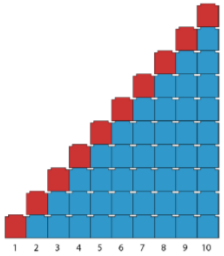
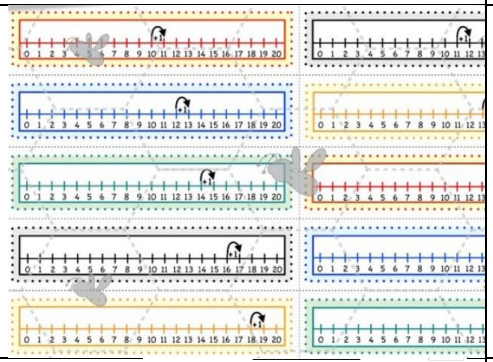
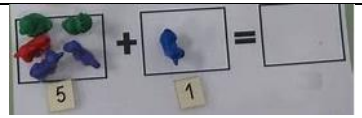
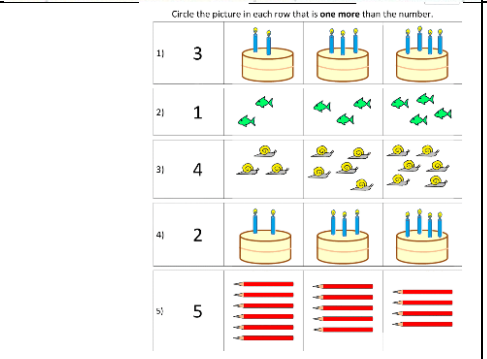
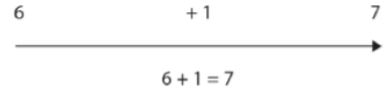
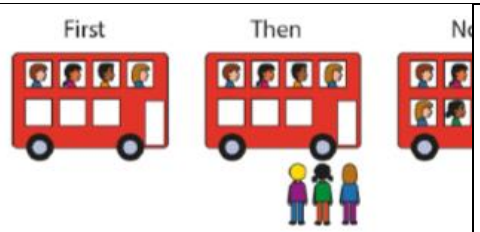
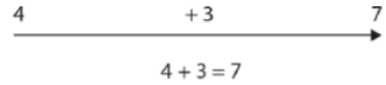
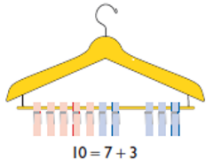
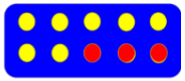
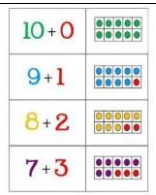


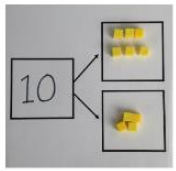
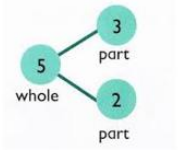
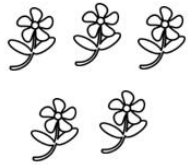
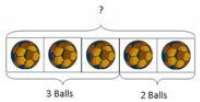
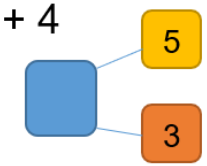
Table of Contents

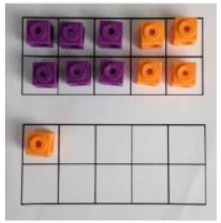
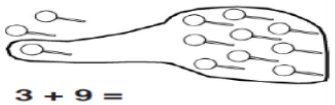
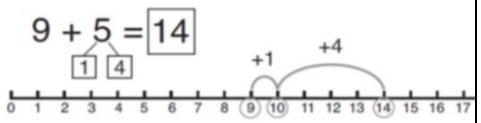
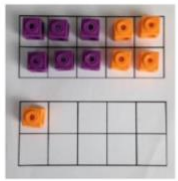
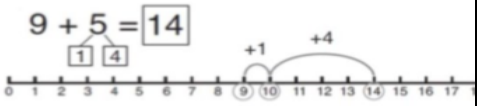
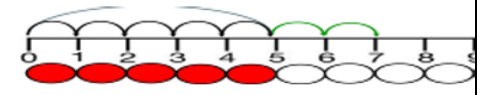
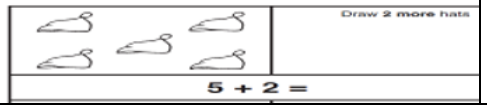
Addition

	Objective, strategy and key vocabulary.	Concrete	Pictorial	Abstract
Year 1	Comparing objects, groups of objects. Length, weight, mass, heavier, lighter, same, equal.	Compare children's height, compare distance, compare mass of objects. Compare multiple objects (use bears, jewels, cubes etc to create groups of different sizes to compare). Use of pan balance with numicon to show equivalence = < > 	 	
	Using < > and = Fewer, more, less than, more than, equal to, fewer than	Use multilink to create different amounts. 		Use variation with missing boxes:

				3 ◯ 4 4 > □ 2 ◯ 2 □ < 6
	Objective, strategy and key vocabulary.	**Concrete**	**Pictorial**	**Abstract**
Year 1 addition	Finding one more, finding one less More, less			One more/less sentences – example one: 1 more than 3 is □ 1 less than 2 is □ 1 more than □ is 1 1 less than □ is 1
	Adding 1 gives 1 more Add, more			Show variation in representations: 6 + 1 = 1 + 5 = 

	Augmentation—increasing an amount	Use FIRST, THEN, NOW and range of practical situations for showing augmentation. E.g. first there were three children on the carpet then 2 more came. Now there are 5 children on the carpet.		4 + 3 = 7 4 + ? = 7 
	Objective, strategy and key vocabulary.	**Concrete**	**Pictorial**	**Abstract**
	Stories of numbers within 10	Children work with tens frames (e.g. egg boxes of 10) and other practical apparatus to describe 'stories of ten'.  		Calculations within 10, e.g: 3 + 4 = 7 7 + 0 = 7 6 + 1 = 7 2 + 5 = 7 1 + 6 = 7 0 + 7 = 7 5 + 2 = 7 4 + 3 = 7

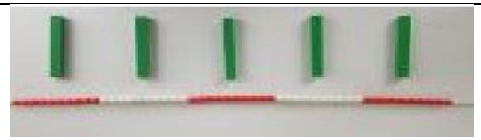
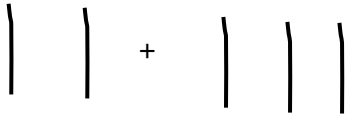
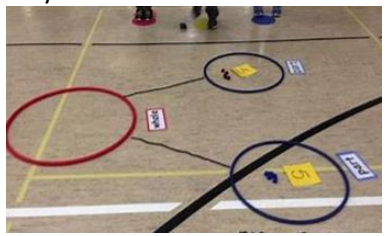
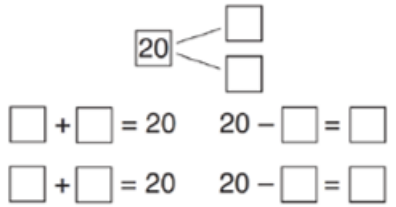
Year 1 addition	Combining two parts to make a whole: part- whole model	   Use cubes to add two numbers together as a group or in a bar. 	   Use pictures to add two numbers together as a group or in a bar. 	4 + 3 = 7 10= 6 + 4  Use the part-part whole diagram as shown above to move into the abstract.
	Objective, strategy and key vocabulary.	**Concrete**	**Pictorial**	**Abstract**

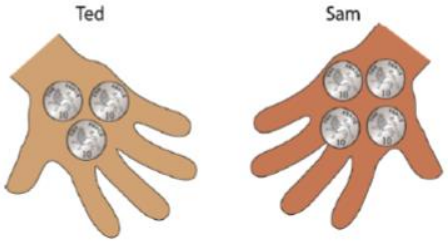
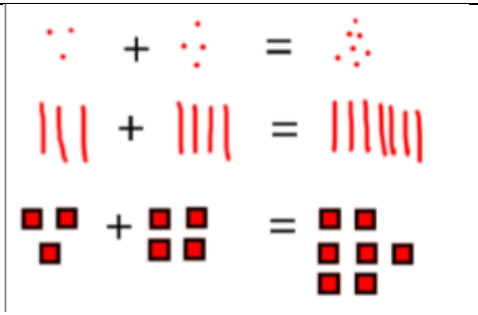
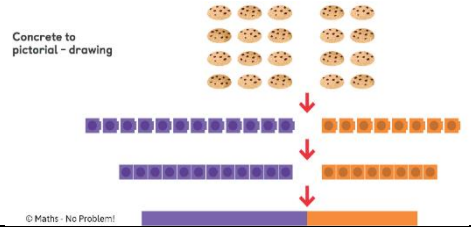
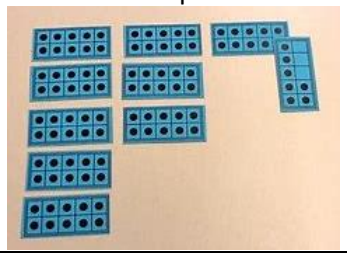
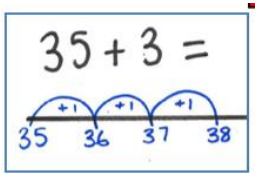
	Regrouping to make 10. (This skill will be essential when moving onto column addition later.) regroup	 6 + 5 = 11  Start with the bigger number and use the smaller number to make 10.	 3 + 9 = Use pictures number line. or partition t number to m  9 + 5 = 14 1 4 +1 +4	7 + 4= 11 If I am at seven, how many 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 Number bonds	 Start with the big-ger number and use the smaller number to make 10. Use ten frame 	Use pictures or a number line. Regroup o partition the smaller number using the pa part whole model to make 10.  9 + 5 = 14 1 4 +1 +4   Draw 2 more hats 5 + 2 =	Emphasis should be on the language ‘1 more than 6 is equal to 7.’ ‘5 more than 9 is equal to 14’ ‘2 more than 5 is equal to 7’

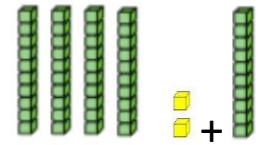
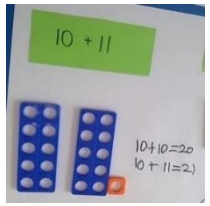
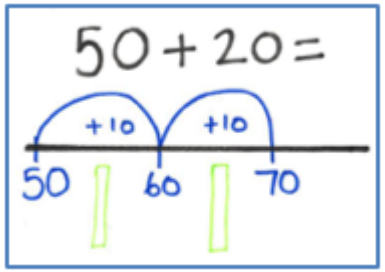
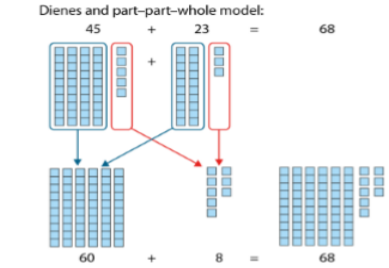
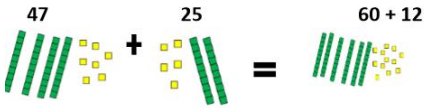
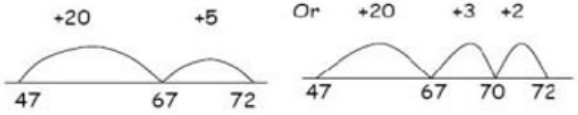
Adding 1 and 2 | Bonds to 10 | Adding 10 | Bridging/ compensating

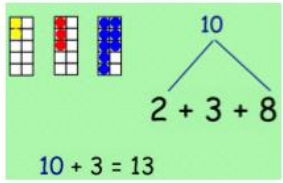
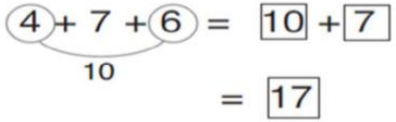
Doubles | Adding 0 | Near doubles

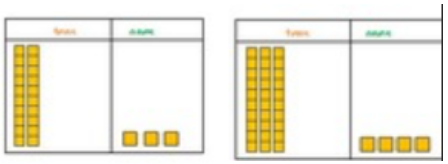
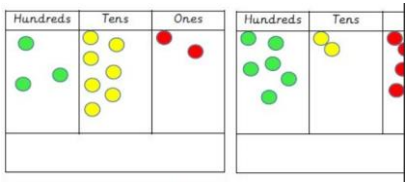
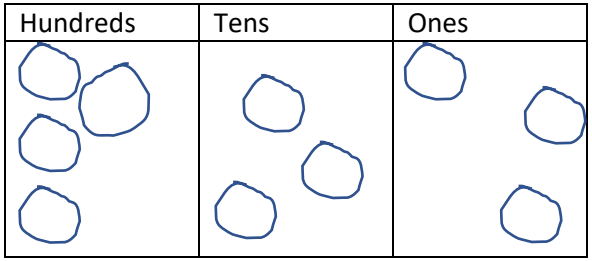
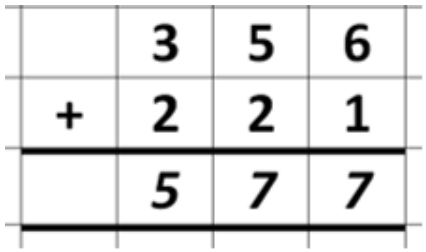
+	0	1	2	3	4	5	6	7	8	9	10
0	0 + 0	0 + 1	0 + 2	0 + 3	0 + 4	0 + 5	0 + 6	0 + 7	0 + 8	0 + 9	0 + 10
1	1 + 0	1 + 1	1 + 2	1 + 3	1 + 4	1 + 5	1 + 6	1 + 7	1 + 8	1 + 9	1 + 10
2	2 + 0	2 + 1	2 + 2	2 + 3	2 + 4	2 + 5	2 + 6	2 + 7	2 + 8	2 + 9	2 + 10
3	3 + 0	3 + 1	3 + 2	3 + 3	3 + 4	3 + 5	3 + 6	3 + 7	3 + 8	3 + 9	3 + 10
4	4 + 0	4 + 1	4 + 2	4 + 3	4 + 4	4 + 5	4 + 6	4 + 7	4 + 8	4 + 9	4 + 10
5	5 + 0	5 + 1	5 + 2	5 + 3	5 + 4	5 + 5	5 + 6	5 + 7	5 + 8	5 + 9	5 + 10
6	6 + 0	6 + 1	6 + 2	6 + 3	6 + 4	6 + 5	6 + 6	6 + 7	6 + 8	6 + 9	6 + 10
7	7 + 0	7 + 1	7 + 2	7 + 3	7 + 4	7 + 5	7 + 6	7 + 7	7 + 8	7 + 9	7 + 10
8	8 + 0	8 + 1	8 + 2	8 + 3	8 + 4	8 + 5	8 + 6	8 + 7	8 + 8	8 + 9	8 + 10
9	9 + 0	9 + 1	9 + 2	9 + 3	9 + 4	9 + 5	9 + 6	9 + 7	9 + 8	9 + 9	9 + 10
10	10 + 0	10 + 1	10 + 2	10 + 3	10 + 4	10 + 5	10 + 6	10 + 7	10 + 8	10 + 9	10 + 10

	Objective, strategy and key vocabulary.	Concrete	Pictorial	Abstract
Year 2	New vocab used for Y2 addition and subtraction: tens boundary			
	Adding multiples of ten	 Model calculation using dienes or beadstrings. 20 + 30 = 50	Draw representations for dienes to represent tens and ones, eg: 	20 + 30 = 50 30 + 20 = 50 ? + 20 = 50 50 = ? + 20
	Recall and use known number facts.	Children use the 'cherry' part-part-whole model to create concrete representations of 20 in different ways. 		

	Objective, strategy and key vocabulary.	Concrete	Pictorial	Abstract
Year 2 addition	Use related number facts.		 Draw representations of hundreds, tens and ones.	Show that: 3 + 4 = 7 30 + 40 = 70 300 + 400 = 700
	Use bar models.		Show that 12 + 8 = 20 using real-life objects, then cubes, then drawing the objects/cubes onto a bar model template.	Progress to using digits in the bar model template (showing proportion): **20** **8** | **12**
	Add a 2 digit number and ones.	Use tens frames to represent 'bridging' the ten with the ones. Use 'real life' egg box tens frames with concrete manipulatives. 	Use a number line: 	Explore related facts: 35 + 3 = ? ? + 3 = 38 38 = 35 + ? **38** **3** | **35**

	Objective, strategy and key vocabulary.	Concrete	Pictorial	Abstract
	Add a 2 digit number and tens.	Use dienes or numicon:  		Bar model – represent the commutative law: 21 / 10 | 11 10 + 11 = 21 21 / 11 | 10 11 + 10 = 21
Year 2	Add two 2 digit numbers.	Model using dienes (including exchanging ten ones for one ten):   Leading to exchanging: 72 	 Use number line and bridge ten using part whole if necessary.	Progress to expanded written method:  25 + 47 20 + 5 40 + 7 20 + 40 = 60 5+ 7 =12 60 + 12 = 72

	Y2 continued: Add three one digit numbers.	 First, look to find number bonds to 10.	Pictorial:  Use part part whole to show magic ten  	 Combine the two numbers that make/ bridge ten then add on the third.

	Objective, strategy and key vocabulary.	Concrete	Pictorial	Abstract
	New vocab used for Y3 addition and subtraction: increase, column addition, vertical, 'carry', expanded, compact, exchange, decrease, column subtraction, inverse.			
Year 3	Column addition (without regrouping)	Using a place value chart, model the tens and ones using dienes or numicon: 23 + 34  Add the ones first, then the tens. Progress to place value counters (developing the skill of unitising). 	Children progress to drawing the PV counters onto a place value chart. 	
	Objective, strategy and key vocabulary.	Concrete	Pictorial	Abstract

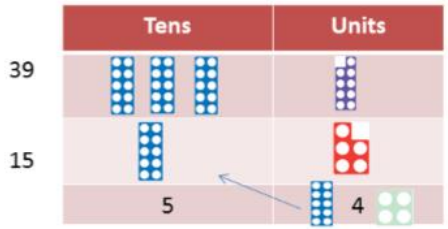
Year 3 addition

Column addition (with regrouping).
Formal column addition method.

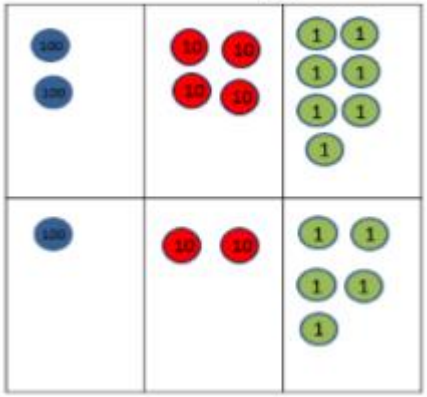
Carry figures

Expanded method

Compact method



Model using dienes or numicon.
Progress to place value counters:



Children are able to draw representations of a place value counter or dienes, using hand drawn circles or sticks/dots to represent amounts:

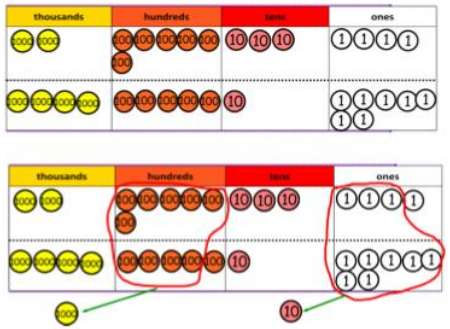
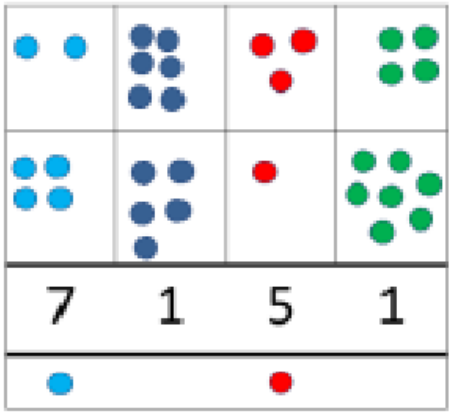
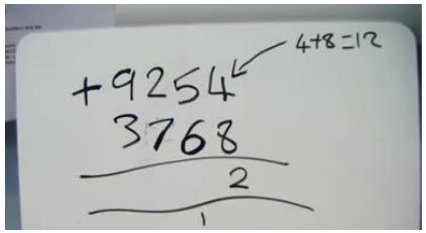
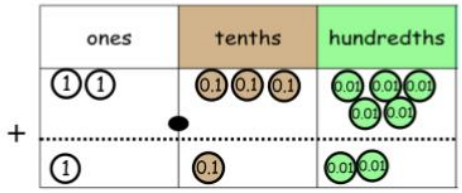
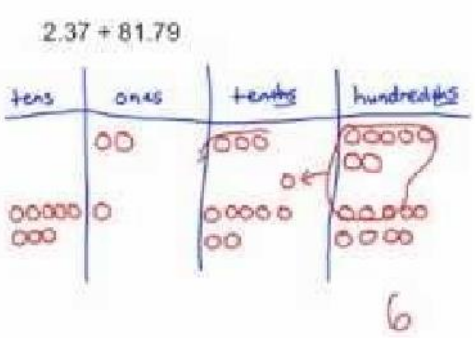
Expanded method is modelled first:

200 + 40 + 7
100 + 20 + 5
300 + 60 +12 = 372

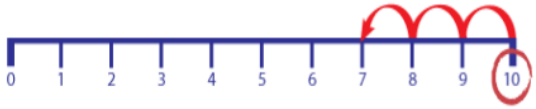
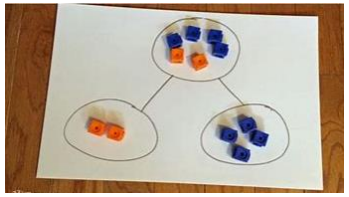
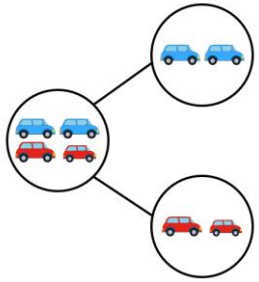
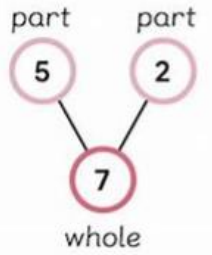
247
+125
12
60
300
372

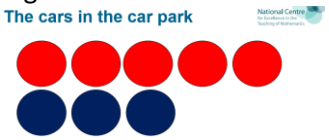
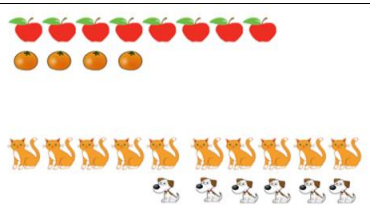
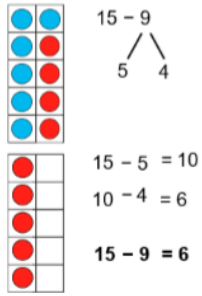
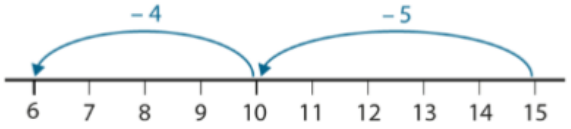
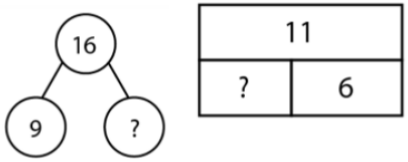
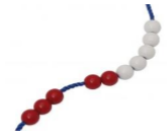
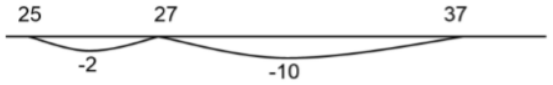
Progressing to formal column (compact) method:

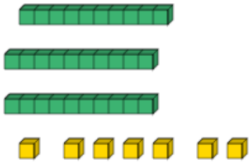
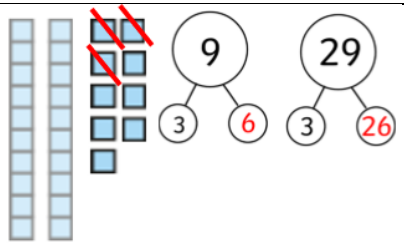
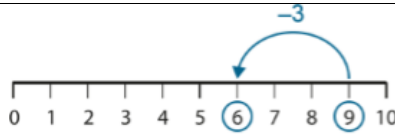
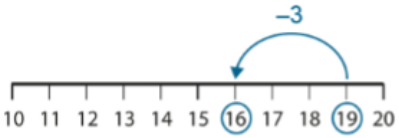
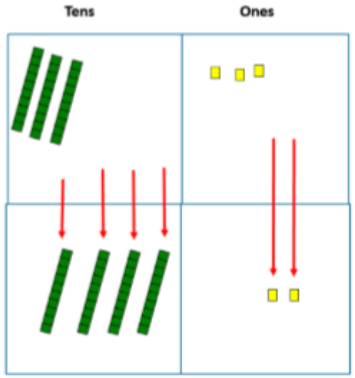
536
+ 85
621
1 1

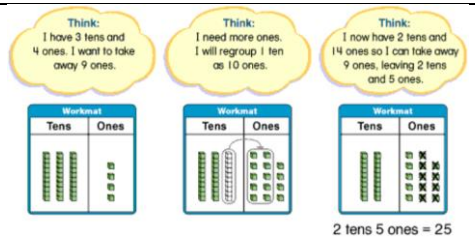
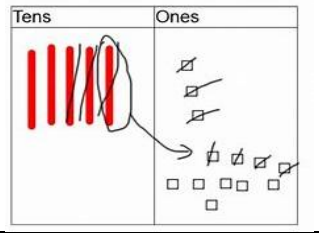
	Objective, strategy and key vocabulary.	Concrete	Pictorial	Abstract
	New vocab introduced for Y4-6 addition and subtraction: hundreds boundary, thousands boundary, tens of thousands boundary, BIDMAS.			
Years 4 - 6	Y4—add numbers with up to 4 digits	Children continue to use dienes or pv counters to add, 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 ones, tens and hundreds. Relate to measure and money.
	Y5—add numbers with more than 4 digits. Add decimals with 2 decimal places, including money Y6—add several numbers of increasing complexity Including adding money, measure and decimals with different numbers of decimal points.	 Introduce decimal place value counters		Y6: 22,634 + 15,673 38,207 1 1 £127.67 +£ 38.45 £166·12 1 1 1 89,472 63,673 + 3,016 156,161 1 1 1 1 1.437 0.600 +3.020 4·057 1 Insert zeros for place holders.

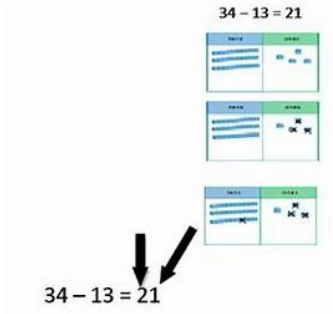
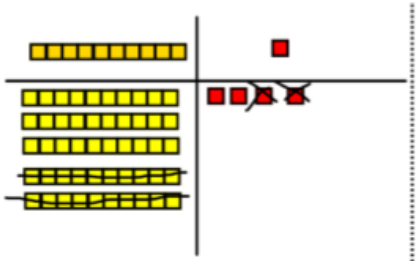
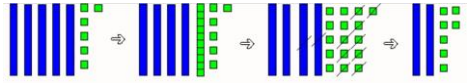
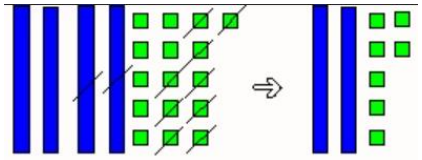
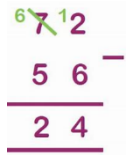
Subtraction

	Objective, strategy and key vocabulary.	Concrete	Pictorial	Abstract
Year 1	Read, write and interpret calculations involving the ' - ' sign.	Physically remove items to view subtraction as 'taking away', such as groups of bears: 	Cross out items represented pictorially:  Use a number line to count back: 	Use the – sign in written calculations: 9 – 3 = 6 10 – 3 = 7 Include the effect of subtracting zero.
	Represent and use number bonds and related subtraction facts within 20 Part-Part-Whole model	Link to addition with use of the part-whole model representation. 6 = 4+2 6-4 =2 Model using cubes and other manipulatives on large part-whole model templates 	 Extend to use of pictorial representations.	 Use numbers in the part-whole model; extend representation of part-whole 'cherry' model to various orientations.

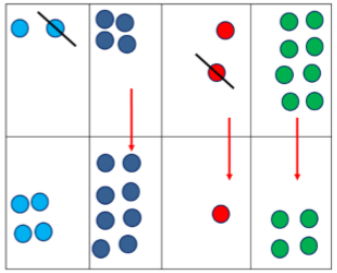
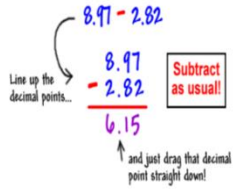
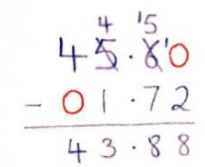
	Compare numbers by finding the difference	Use counters to represent difference, e.g: The cars in the car park 	 Represent structures using comparative models.	Introduce numbers to the concept of finding the difference, e.g. The difference between 10 and 6 is 4. The part that is the same is 6, the part that is different is 4 (demonstrated by the pictorial representation).
	Objective, strategy and key vocabulary.	**Concrete**	**Pictorial**	**Abstract**
Year 2	Subtract efficiently by making ten.	Make 15 on the ten frame. Take 5 away to make ten, then take 4 more away so that you have taken 9. 15 - 9 =  15 – 9 5 4 15 – 5 = 10 10 – 4 = 6 **15 – 9 = 6**	15 - 9 =  Jump back 5 first, then another 4. Use ten as the stopping point.	16 - 9 = How many do we take off first to get to 10? How many left to take off? 
	Counting on to next ten (Progression - crossing one ten, crossing more than one ten, crossing the hundreds.)	Use beadstrings to model taking ten, then the remaining amount. E.g. 37 - 12 	**e.g. 37 – 12 = 25**  ***NB: The second number has been partitioned and subtracted separately in tens and ones.***	37 – 12 = ? 37 - ? = 25 25 = 37 - ? Children are encouraged to use the inverse to recognise the relationship between addition and subtraction.

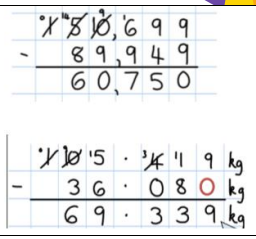
	Subtracting a multiple of 10	Dienes are used to model physically taking away ten. 	Children draw representation of dienes (and cross out the correct amount to take away): 	32 – 10 = ? 22 = ? – 10 32 – 20 = 32 – 30 =
	Objective, strategy and key vocabulary.	**Concrete**	**Pictorial**	**Abstract**
	Subtract a single digit from a two digit number (No regrouping)	 Explore that 9 - 3 = 6 so 29 - 3 = 26 etc	 9 – 3 = 6  19 – 3 = 16	9 – 3 = 6 19 - 6 = 13 29 - 6 = 23 and so on…
Year 2	Partitioning two digit numbers to subtract without regrouping.		Children draw pictorial representations of this, crossing out the tens and ones: 	70 5 -40 2 30 3

	Regroup a ten into ten ones.		Children draw pictorial representations of this: 	42 – 27 = ? 27 + ? = 42 - ? = 27 The inverse relationship between addition and subtraction continues to be reinforced.

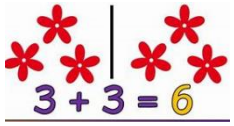
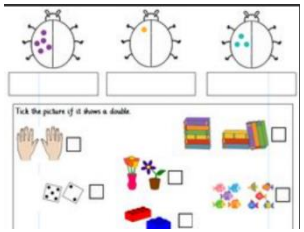
Year 3	**Objective, strategy and key vocabulary.**	**Concrete**	**Pictorial**	**Abstract**
	Column subtraction without regrouping	Use dienes or numicon to model: 	Draw representations to support independent understanding: 	Use extra 'expanded' step if necessary to support understanding: 90 + 8 - 30 + 6 60 + 2 
	Column subtraction with regrouping	Use dienes to model exchanging one ten for ten ones, for example in the calculation: 56 – 29 	Draw representations to support: 	Use formal written representations.  Move to three digit subtraction:

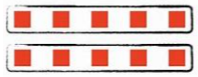
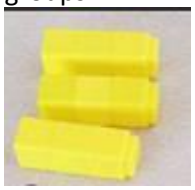
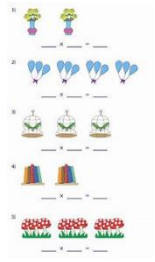
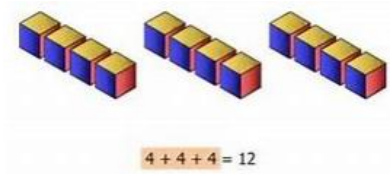
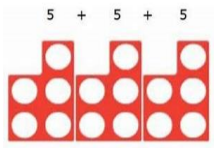
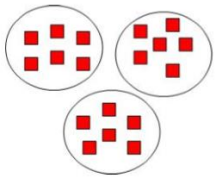
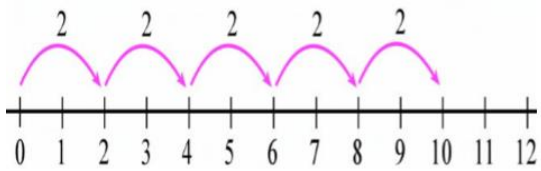
				8 1 9 ~~4~~ 8 -2 6 3 6 8 5 (The digits in the right hand column are subtracted first and children continue to work from right to left.)

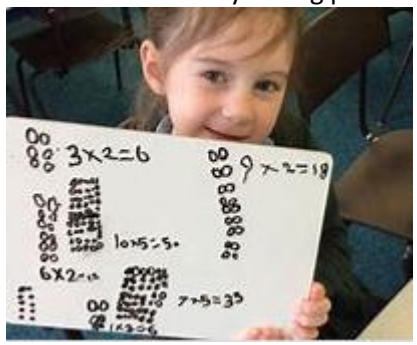
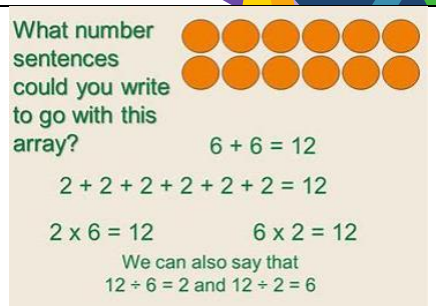
	Objective, strategy and key vocabulary.	Concrete	Pictorial	Abstract
Years 4 - 6	Subtracting tens and ones. Year 4 subtract with up to 4 digits. Introduce decimal subtraction through context of money.	Place value counters are used to secure understanding: 	Children draw representations of these (or dienes) to exchange/'cross out' on a place value chart.	5 1 2 1 ~~6~~ ~~2~~ ~~3~~ 2 - 4 8 1 4 1 4 1 8 
	Year 5- Subtract with at least 4 digits, including money and measures	Children can continue to use PV counters/dienes to support calculations.	As year 4.	7 9 9 1 8 ~~0~~ ~~0~~ ~~0~~ - 6 7 3 7 3 2 7 Children are encouraged to **fill any empty decimal places with zero** to show the place value in each column. (See right.) 

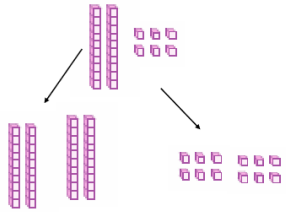
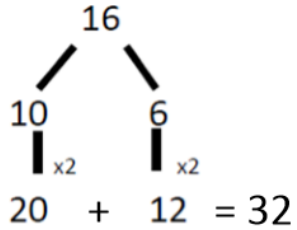
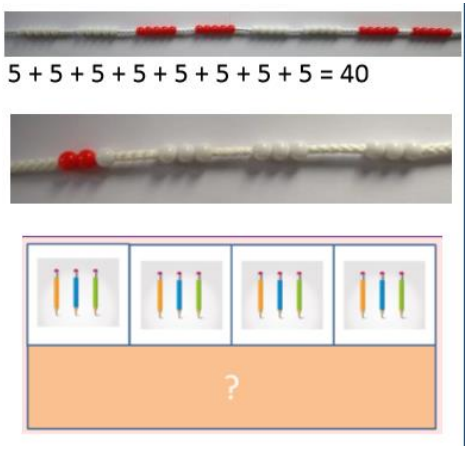
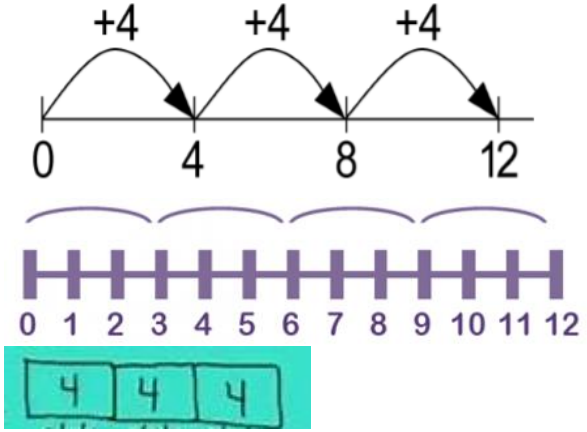
	Year 6—Subtract with increasingly large and more complex numbers and decimal values.	As above.	As above.	

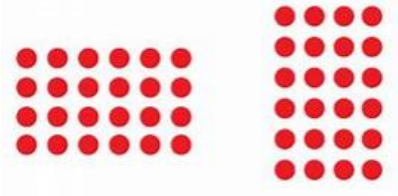
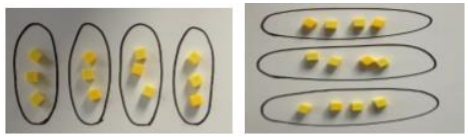
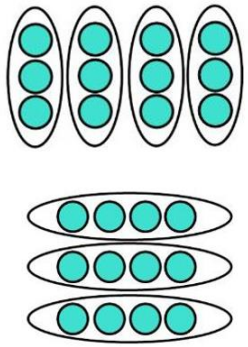
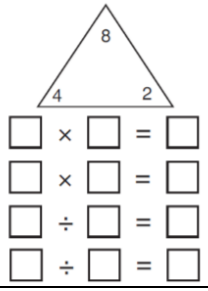
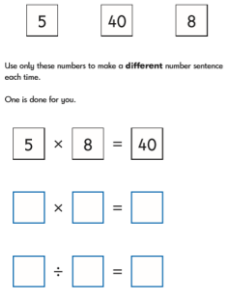
Multiplication

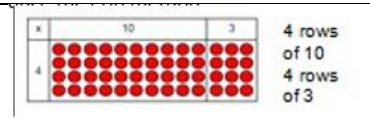
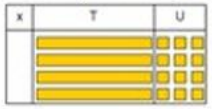
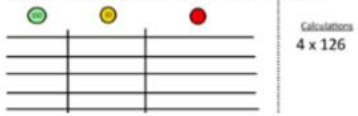
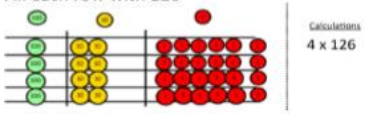
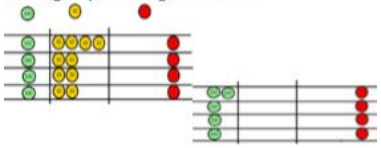
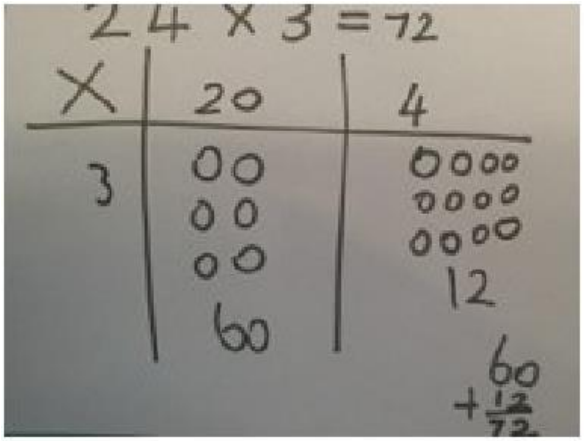
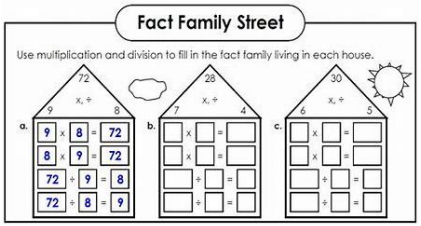
Year 1	Objective, strategy and key vocabulary.	Concrete	Pictorial	Abstract
	Key vocabulary used in Y1 multiplication and division: share, share between, share equally, group, groups of, lots of, array.			
	Doubling.	Use numicon, cubes and other manipulatives to demonstrate the concept of doubling: 	Use pictures as a method of calculating and representing doubles:  	Use numbers and symbols, extending to ‘one more than double’: 

	Counting in multiples.	Children 'skip count' as teacher models this using a beadstring or groups of cubes/objects. 	Children use/make pictorial representations. They can create these themselves and teachers can provide images to support understanding.  	Children count aloud in multiples (teacher can use counting stick/hoop to support). Children can write number sequences in multiples: 2,4,6,8…. 5,10,15,20
	Make equal groups and count the total.	Use concrete resources to make equal groups. 	 Use representations to show equal groups: Children solve problems using pictures, e.g. Joe thinks that 2 x 2 = 5. Use ★ to prove your answer and say whether you think Joe is right or wrong.	2 x 5 = 10 10 = 5 x 2 Double 5 is 10 2 x ? = 8
Year 1	**Objective, strategy and key vocabulary.**	**Concrete**	**Pictorial**	**Abstract**
	Repeated addition.	  	 Use hops along a number line:  	**2 + 2 + 2 + 2 +2 = 10** **5 hops of 2 = 10**

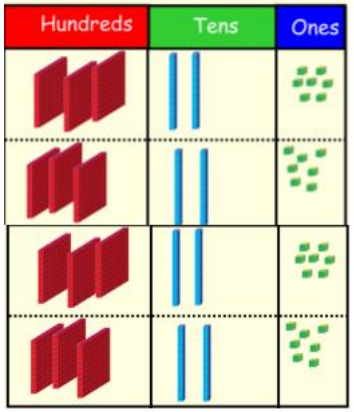
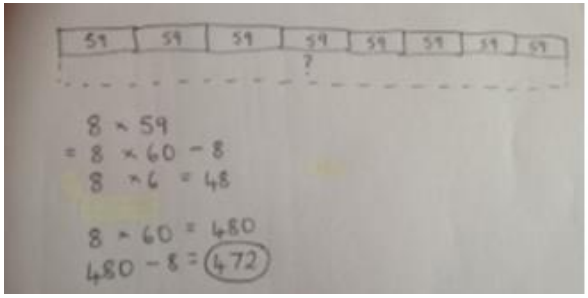
	Understanding arrays.	Children use resources to physically make arrays to represent multiplication: 	Children draw arrays using pictures/shapes: 	

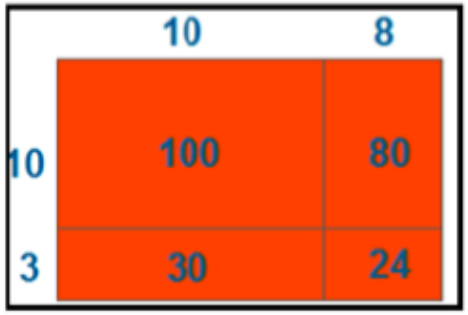
	Objective, strategy and key vocabulary.	Concrete	Pictorial	Abstract
Year 2	New vocab for Y2 multiplication and division: divide, divided by, divided into, division, left, left over.			
	Doubling two digit numbers.	Model doubling using dienes/PV counters/numicon; partition to reinforce understanding of place value.  40 + 12 = 52	Children draw representations of dienes to support calculations for doubling.	Partition a number, then double each part before recombining to total. 
	Counting in multiples of 2, 3, 4, 5, 10 from 0 (repeated addition)	Count the groups as children are skip counting, children may use their fingers as they are skip counting. Use bar models.  	Children use number lines, 'empty' number lines and bar models:  	Count in multiples of a number aloud. Write sequences with multiples of numbers. 0, 2, 4, 6, 8, 10 0, 3, 6, 9, 12, 15 0, 5, 10, 15, 20, 25 , 30 $4 \times 3 = \square$

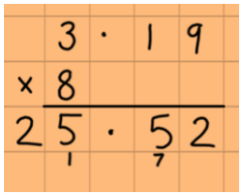
Year 2 multiplication	Objective, strategy and key vocabulary.	Concrete	Pictorial	Abstract
	Multiplication is commutative.	Make arrays using different concrete resources (e.g. counters, cubes):  Pupils should understand that an array can represent different equations and that, as multiplication is commutative, the order of the multiplication does not affect the answer. 	Children create representations of arrays to support calculations and develop understanding of commutativity: 	7 x □ = 14 □ x 2 = 14 □ x ◯ = 14 14 = □ x 7 14 = 2 x □ 14 = □ x ◯
	Using the Inverse *(This should be taught alongside division, so pupils learn how they work alongside each other.)*	Use representations of arrays as above.		

	Objective, strategy and key vocabulary.	Concrete	Pictorial	Abstract
	New vocabulary introduced in Y3 for multiplication and division: grid method, multiple, product, inverse short division, 'carry', remainder.			
Year 3	Grid method Show the links to arrays when introducing grid method.	 Move onto base ten to move towards a more compact method.  Move on to place value counters to show how we are finding groups of a number. We are multiplying by 4 so we need 4 rows  Fill each row with 126  Add up each column, starting with the ones making any exchanges needed  Then you have your answer.	Children can represent their work with place value counters in a way that they understand. They can draw the counters using colours to show different amounts or just use the circles in the different columns to show their thinking as shown below. 	Children continue to explore fact families:  They continue to count on regularly, now including multiples of 4, 8, 50 and 100, and in steps of 1/10. Children work on achieving instant recall of the 3, 4 and 8 multiplication tables. They use these facts to derive associated facts: e.g. If we know 4 x 3 = 12… … then we know that 4 x 30 = 120 Missing number problems continue to be used to further strengthen understanding of the inverse relationship between multiplication and division.

	Objective, strategy and key vocabulary.	Concrete	Pictorial	Abstract
Year 4	New vocab introduced in 4 for multiplication and division: factor, quotient, divisor.			
	Recap grid method from Year 3 extending to multiply a 3 digit number by a 1 digit number.	See above (grid method Y3)		

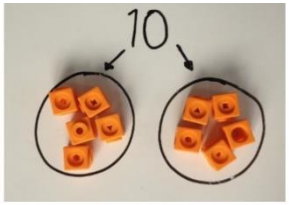
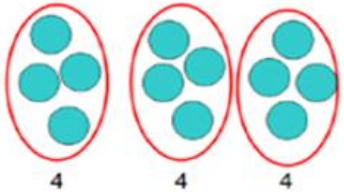
	Extend to: Column multiplication	Children use dienes/PV counters to support calculations, beginning with calculations requiring no regrouping:  The teacher models the long multiplication alongside the concrete representation.	Bar modelling and number lines can support learners when solving problems with multiplication alongside the formal written methods.  Children may continue to write out the grid method to support understanding: 123 × 5 × | 100 | 20 | 3 5 | 500 | 100 | 15 500 + 100 + 15 615	**Short multiplication method:** 123 × 5 1st Step: 123 × 5 = 5 (1) 2nd Step: 123 × 5 = 15 (1 1) 3rd Step: 123 × 5 = 615 (1 1) Before undertaking calculations such as these, children are reminded and encouraged to approximate/estimate before they undertake the calculation. They then look back at this to check the reasonableness of their answer. e.g. 346 x 9 is approximately… 350 x 10 = 3500 Children continue to count on regularly, now including multiples of 6, 7, 9, 25 and 100 and steps of 1/1000. They work on achieving instant recall of all multiplication tables up to 12 x 12. Practical problems, which involve scaling up, are undertaken: e.g. 'How tall would a 25cm sunflower be if it grew 6 times taller?' 
Year 5	**Objective, strategy and key vocabulary.**	**Concrete**	**Pictorial**	**Abstract**
	New vocabulary introduced in Y5 for multiplication and division: square number, cube number, prime number, common factor, composite (non-prime) number, power of.			
	As Y4, extending to multiplying a 4 digit number by a 1 digit number.	See above (progression to formal column method)		Children are introduced to written methods for long multiplication, multiplying by two digit numbers:

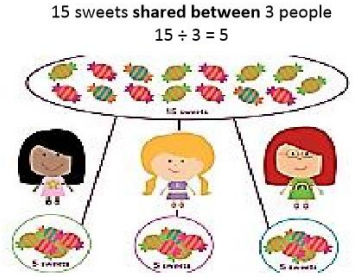
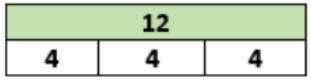
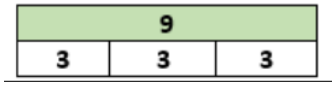
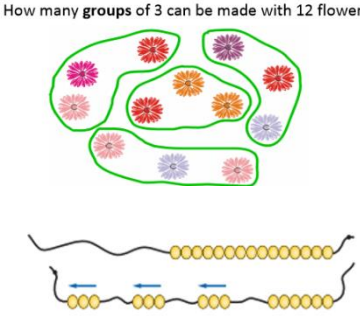
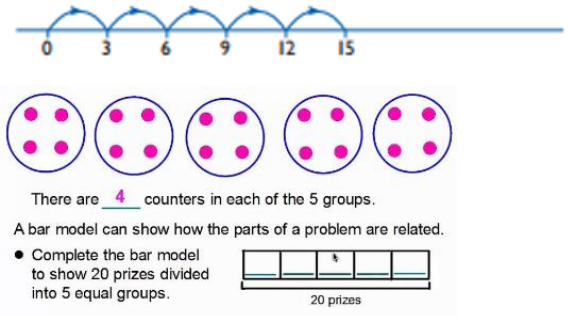
	Column multiplication	Manipulatives may still be used with the corresponding long multiplication modelled alongside.		123 x 45 1st step 123 x 45 615 (123 x 5) 2nd step 123 x 45 615 0 (because we are multiplying tens) 3rd step 123 x 45 615 (123 x 5) 4920 (123 x 40) 5535 (615 + 4920) Children continue to count on regularly, including steps of powers of 10. (They multiply whole numbers by 10, 100 and 1000, including decimals.) Understanding that the scaling of multiples of 10 can be used to convert between units of measure is explored (e.g. metres to kilometres means multiply by 1000.) Pupils use practical resources and jottings to explore equivalent statements: e.g. 4 x 35 = 2 x 2 x 35
Year 6	**Objective, strategy and key vocabulary.**	**Concrete**	**Pictorial**	**Abstract**
	Continue to use methods for long division as Y5.	See Y5.		

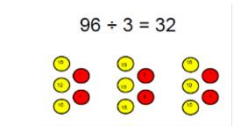
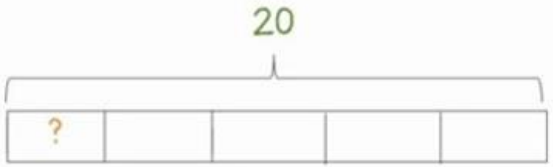
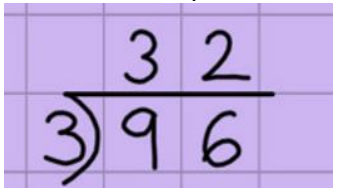
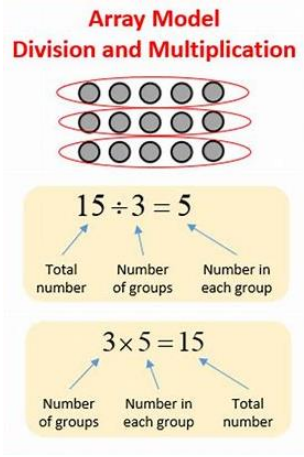
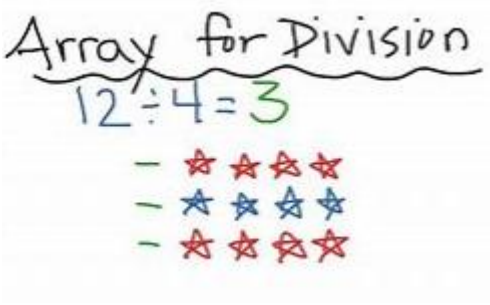
	Multiplying decimals up to 2 decimal places by a single digit.			Children are also introduced to multiplication of numbers with up to two decimal places by one-digit and two-digit numbers. They begin by starting with simple cases, such as: 0.4 x 2 = 0.8 They then move on to more complex problems: e.g.  Line up the decimal points in the question and the answer Remember that the single digit belongs in the 'ones' column NB: This method works well for multiplying money (£.p) and other measures. Children experiment with order of operations 'BIDMAS'.

Division

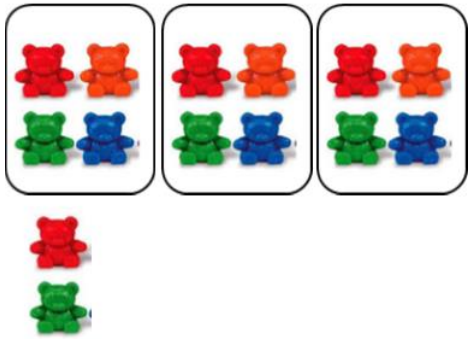
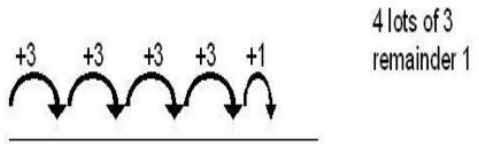
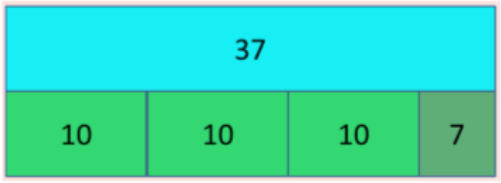
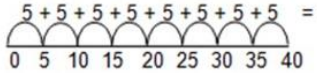
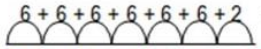
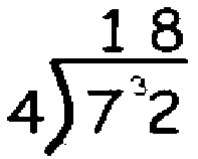
Year 1	Objective, strategy and key vocabulary.	Concrete	Pictorial	Abstract

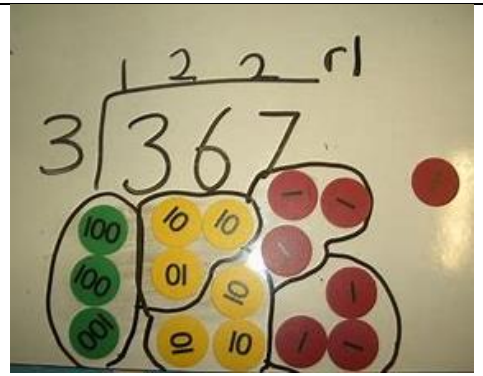
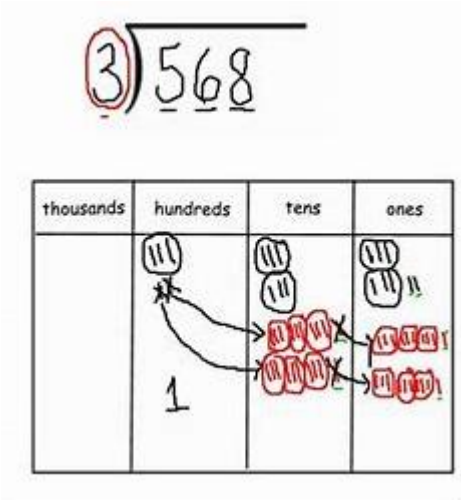
	Division as sharing.	   I have 10 cubes, can you share them equally in 2 groups?	Children use pictures or shapes to share quantities.  8 shared between 2 is 4 Sharing:  12 shared between 3 is 4	"10 shared between 2 is 5." "12 shared between 3 is 4."

	Objective, strategy and key vocabulary.	Concrete	Pictorial	Abstract
Year 2	Division as sharing.	"I have 15 cubes. Can you share them equally between 3 friends?" 	Children use pictures to support understanding of sharing:  Children use bar models to support conceptual understanding:  	12 ÷ 3 = 4 9 ÷ 3 = 3
	Division as grouping.	Divide objects into equal groups. 	Use number lines and bar models for grouping: 	20 ÷ 5 = ?

	Objective, strategy and key vocabulary.	Concrete	Pictorial	Abstract
Year 3	Division as grouping.	PV counters/numicon can be used to demonstrate grouping:  24 divided into groups of 6 = 4  96 ÷ 3 = 32	Continue to use bar modelling, to represent division and to show the relationship between division and multiplication:  20 ? 20 ÷ 5 = ?	96 ÷ 3 = 32 There are 96 cars. There are three car parks. How many cars can park in each car park? 
	Division with arrays.	Use concrete resources to demonstrate, using arrays, the relationship between multiplication and division:  Array Model Division and Multiplication 15 ÷ 3 = 5 Total number / Number of groups / Number in each group 3 × 5 = 15 Number of groups / Number in each group / Total number	Draw an array and use lines to split the array into groups to make multiplication and division sentences :  Array for Division 12 ÷ 4 = 3 12 ÷ 3 = 4 3 x 4 = 12 4 x 3 = 12	Find the inverse of multiplication and division sentences by creating eight linking number sentences. 7 x 4 = 28 4 x 7 = 28 28 ÷ 7 = 4 28 ÷ 4 = 7 28 = 7 x 4 28 = 4 x 7 4 = 28 ÷ 7 7 = 28 ÷ 4

Year 3 division

Objective, strategy and key vocabulary.	Concrete	Pictorial	Abstract
Division with remainders.	14 ÷ 3 = Divide objects between groups and see how much is left over: 	Use number lines, bar models and pictures to support understanding:    Example without remainder: 40 ÷ 5 Ask "How many 5s in 40?"  = 8 fives 0 5 10 15 20 25 30 35 40 Example with remainder: 38 ÷ 6  = 6 sixes with a remainder of 2 0 6 12 18 24 30 36 38 For larger numbers, when it becomes inefficient to count in single multiples, bigger jumps can be recorded using known facts.	Complete written divisions and show the remainder using r.  

	Objective, strategy and **key vocabulary.**	Concrete	Pictorial	Abstract
Years 4 - 6	Divide at least 3 digit numbers by 1 digit. Short division.		Children can replace PV counters/dienes for pictorial representations (which they may draw or may be provided for them). 	Begin with divisions that divide equally with no remainder. 2 1 8 3 4 8 7 2 Move onto divisions with a remainder. 8 6 r 2 3 5 4 3 2 Finally move into decimal places to divide the total accurately. 1 4 . 6 16 21 3 5 5 1 1 . 0

Year 6	Year 6 Long Division - **Use the formal long division method – either DMSB or chunking**

	Step 1 – A remainder in the ones.	h t o 0 4 1 R1 4) 1 6 5 4 does not go into 1 (hundred). So combine the 1 hundred with the 6 tens (160). 4 goes into 16 four times. 4 goes into 5 once, leaving a remainder of 1. th h t o 0 4 0 0 R7 8) 3 2 0 7 8 does not go into 3 of the thousands. So combine the 3 thousands with the 2 hundreds (3,200). 8 goes into 32 four times (3,200 ÷ 8 = 400) 8 goes into 0 zero times (tens). 8 goes into 7 zero times, and leaves a remainder of 7. h t o 0 6 1 4) 2 4 7 − 4 3 When dividing the ones, 4 goes into 7 one time. Multiply 1 × 4 = 4, write that four under the 7, and subract. This finds us the remainder of 3. Check: 4 × 61 + 3 = 247 th h t o 0 4 0 2 4) 1 6 0 9 − 8 1 When dividing the ones, 4 goes into 9 two times. Multiply 2 × 4 = 8, write that eight under the 9, and subract. This finds us the remainder of 1. Check: 4 × 402 + 1 = 1,609

Long Division

Step 2 – A remainder in the tens.

1. Divide.	2. Multiply & subtract.	3. Drop down the next digit.
t o 2 2) 5 8	t o 2 2) 5 8 - 4 1	t o 2 9 2) 5 8 - 4 ↓ 1 8
Two goes into 5 two times, or 5 tens ÷ 2 = 2 whole tens -- but there is a remainder!	To find it, multiply 2 × 2 = 4, write that 4 under the five, and subtract to find the remainder of 1 ten.	Next, drop down the 8 of the ones next to the leftover 1 ten. You combine the remainder ten with 8 ones, and get 18.

1. Divide.	2. Multiply & subtract.	3. Drop down the next digit.
t o 2 9 2) 5 8 - 4 1 8	t o 2 9 2) 5 8 - 4 1 8 - 1 8 0	t o 2 9 2) 5 8 - 4 1 8 - 1 8 0
Divide 2 into 18. Place 9 into the quotient.	Multiply 9 × 2 = 18, write that 18 under the 18, and subtract.	The division is over since there are no more digits in the dividend. The quotient is 29.

Year 6 division

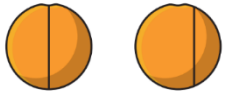
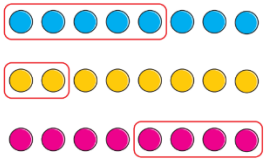
Long Division

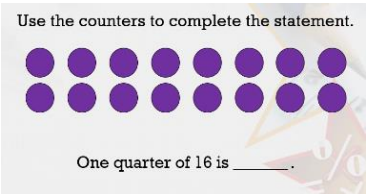
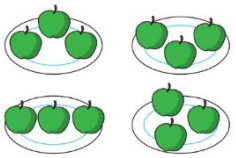
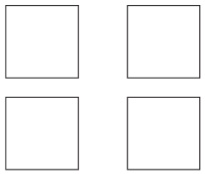
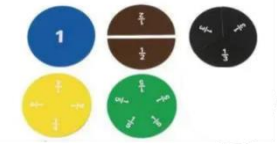
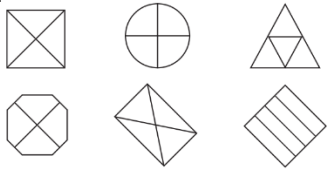
Step 2 – A remainder in any of the place values.

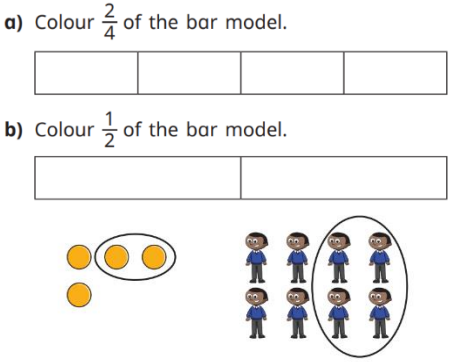
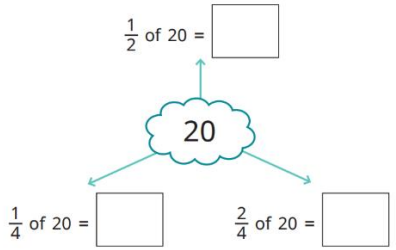
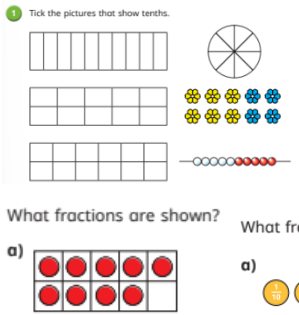
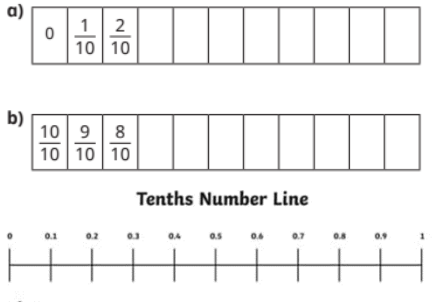
1. Divide.	2. Multiply & subtract.	3. Drop down the next digit.
h t o 1 2)2 7 8 Two goes into 2 one time, or 2 hundreds ÷ 2 = 1 hundred.	h t o 1 2)2 7 8 -2 0 Multiply 1 × 2 = 2, write that 2 under the two, and subtract to find the remainder of zero.	h t o 1 8 2)2 7 8 -2 ↓ 0 7 Next, drop down the 7 of the tens next to the zero.
Divide.	**Multiply & subtract.**	**Drop down the next digit.**
h t o 1 3 2)2 7 8 -2 0 7 Divide 2 into 7. Place 3 into the quotient.	h t o 1 3 2)2 7 8 -2 0 7 - 6 1 Multiply 3 × 2 = 6, write that 6 under the 7, and subtract to find the remainder of 1 ten.	h t o 1 3 2)2 7 8 -2 0 7 - 6 1 8 Next, drop down the 8 of the ones next to the 1 leftover ten.
1. Divide.	**2. Multiply & subtract.**	**3. Drop down the next digit.**
h t o 1 3 9 2)2 7 8 -2 0 7 - 6 1 8 Divide 2 into 18. Place 9 into the quotient.	h t o 1 3 9 2)2 7 8 -2 0 7 - 6 1 8 -1 8 0 Multiply 9 × 2 = 18, write that 18 under the 18, and subtract to find the remainder of zero.	h t o 1 3 9 2)2 7 8 -2 0 7 - 6 1 8 -1 8 0 There are no more digits to drop down. The quotient is 139.

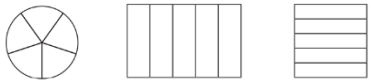
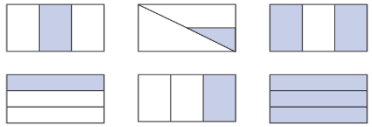
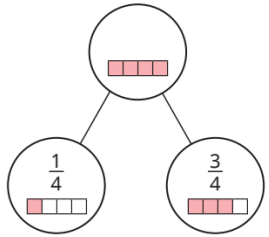
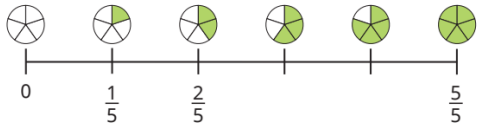
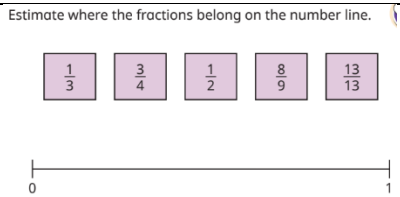
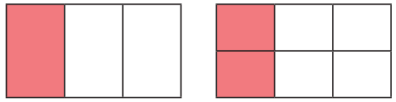
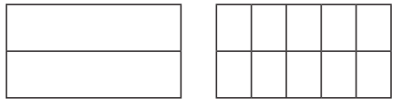
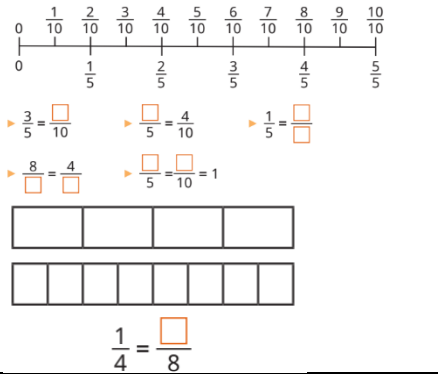
The following sections are ideas of how the CPA can be used to support learners within different national curriculum objectives. The list of ideas is not exhaustive.

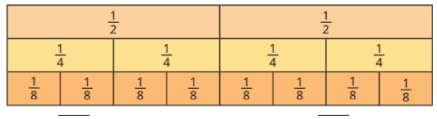
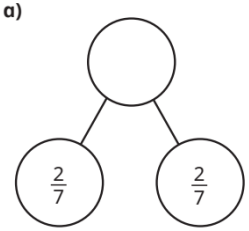
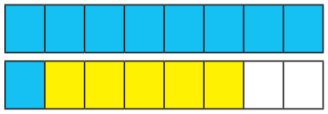
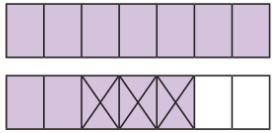
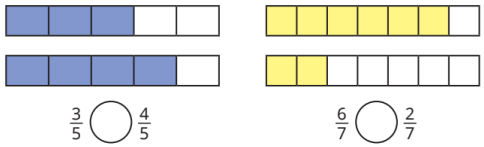
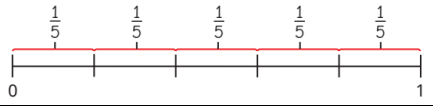
Fractions, Decimals and Percentages

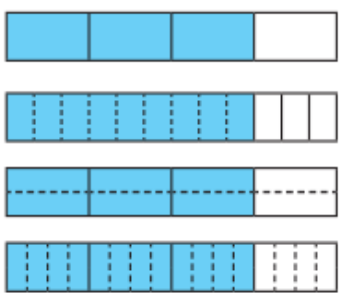
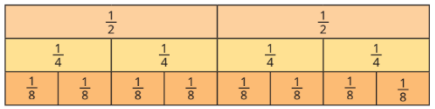
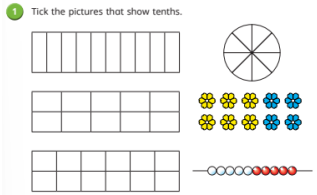
	Objective, strategy and key vocabulary.	Concrete	Pictorial	Abstract
Year 1	Recognise, find and name a half as one of two equal parts of an object, shape or quantity.	Pupils can use fraction pizzas/shapes to recognise a half.  	Pupils can recognise a half of a shape, objects and quantities by drawing them or seeing them drawn with potential lines drawn on.   Pupils can use pre-drawn or drawn shapes to find a half of a shape/objects. Show one half in three different ways. 	Pupils can find a half of a quantity and are secure in doing this using concrete and pictorial resources. 

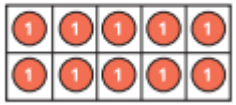
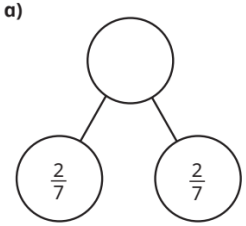
	Recognise, find and name a quarter as one of four equal parts of an object, shape or quantity.	Pupils can use counters to recognise/find a quarter.  Use counters to complete the sentences. A quarter of 4 is ☐ A quarter of 8 is ☐ 1 is one quarter of ☐ 3 is one quarter of ☐	Pupils can use pictures drawn or pre - drawn to recognise/find a quarter of objects and shapes.  Show a quarter in four different ways. 	Once secure, pupils can find a quarter of objects and amounts. Share each quantity into four equal groups.  There are ___ cakes. There is ___ cake in each quarter. A quarter of ___ is ___  There are ___ sweets. There are ___ sweets in each quarter. A quarter of ___ is ___  There are ___ peaches. There are ___ peaches in each quarter. A quarter of ___ is ___ ¼ of 8 = ¼ of 20 = ¼ of 16 = ¼ of 12 =
Year 2	Recognise, find, name and write fractions 1/3, ¼, 2/4 and 3/4 of a length, shape, set of objects or quantity.	Pupils can use fraction tiles, fraction pizzas to recognise a 1/3, ¼, 2/4 and 3/4.  	Pupils can recognise/find 1/3, ¼, 2/4 and ¾ from their drawings or from pictures.  	Pupils can find 1/3. ¼, 2/4 and ¾ of amounts and present this in words/numbers. Number | $\frac{1}{2}$ of number | $\frac{1}{4}$ of number 8 20 24

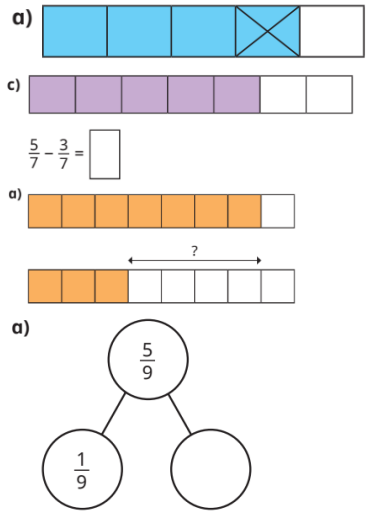
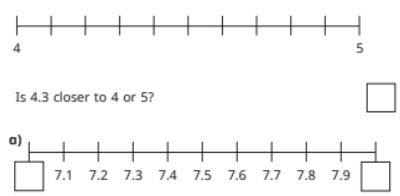
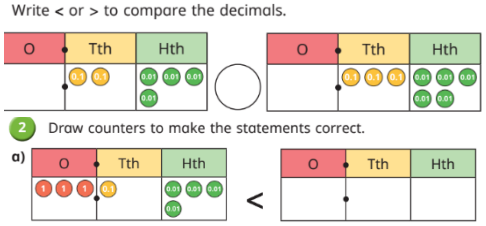
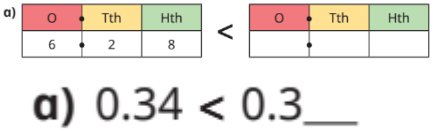
	Write simple fractions for example, ½ of 6 = 3 and recognise the equivalence of 2/4 and ½.	Pupils can use Numicon to show simple fractions and recognise equivalence.  	Pupils can use bar models to show and recognise equivalence.  	Pupils can write simple fractions and find equivalence. 
Year 3	count up and down in tenths; recognise that tenths arise from dividing an object into 10 equal parts and in dividing one-digit numbers or quantities by 10	 Use counters on tens frames to make 1 whole. Use 0.1 counters as decimals and tenths as fractions.	 Children use tens frames to represent fractions as tenths. They can use visual representations of tenths in a tens frame find fractions.	

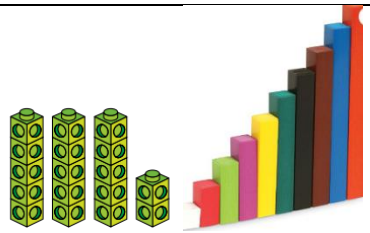
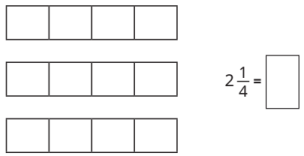
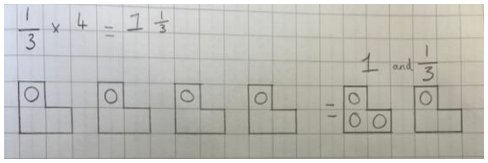
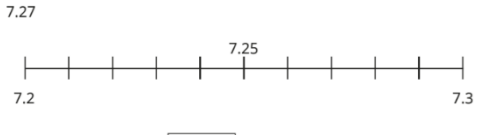
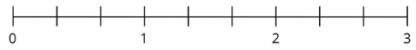
	recognise, find and write fractions of a discrete set of objects: unit fractions and non-unit fractions with small denominators		Shade $\frac{2}{5}$ of each shape.  Tick the shapes that have $\frac{1}{3}$ shaded. 	
	recognise and use fractions as numbers: unit fractions and non-unit fractions with small denominator		Count forwards to complete the number lines. 	Estimate where the fractions belong on the number line. 
	recognise and show, using diagrams, equivalent fractions with small denominators		Shade the diagrams to help you complete the equivalent fractions. The first one has been done for you. a)  b) 	Use the double number line to complete the equivalent fractions. 

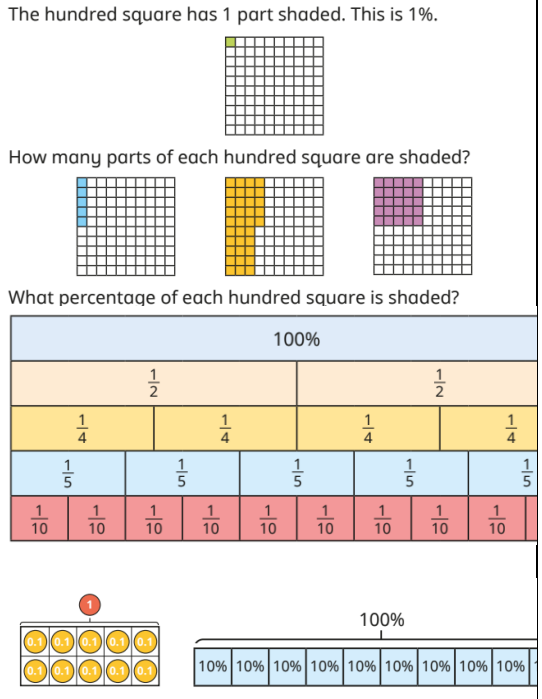
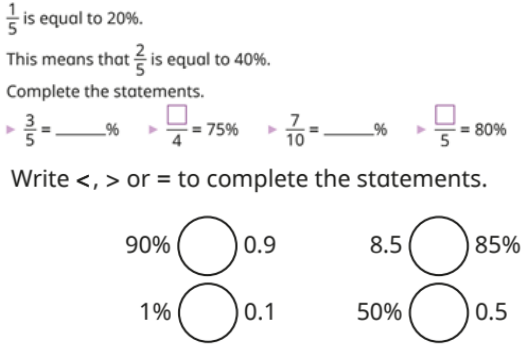
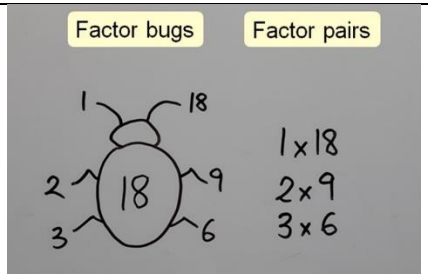
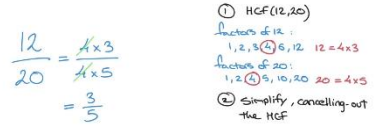
			Use the fraction wall to complete the equivalent fractions. 	
	add and subtract fractions with the same denominator within one whole		a)  Use the bar models to work out the additions. a)  Subtraction a) 	a) $\frac{3}{7} + \frac{3}{7} = \square$ $\frac{4}{5} - \frac{1}{5} = \square$
	compare and order unit fractions, and fractions with the same denominators		Write <, > or = to compare the fractions. 	Write < or > to compare the fractions. $\frac{3}{10} \bigcirc \frac{7}{10}$ $\frac{5}{6} \bigcirc \frac{4}{6}$ $\frac{0}{5} \bigcirc \frac{3}{5}$ $\frac{8}{9} \bigcirc \frac{1}{9}$ $\frac{5}{23} \bigcirc \frac{1}{23}$ $\frac{5}{7} \bigcirc 1$ Brett labels a number line to show fractions. 

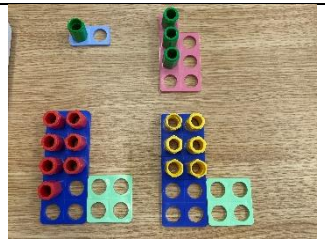
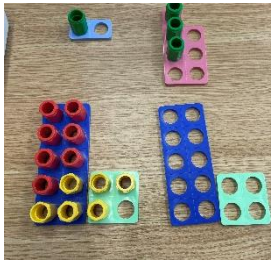
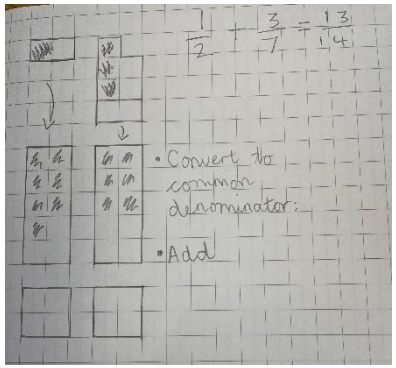
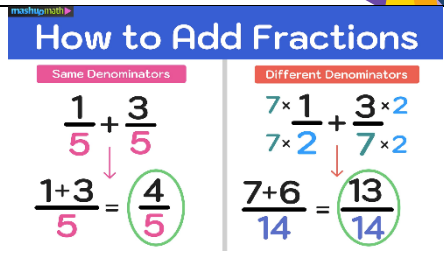
Year 4	recognise and show, using diagrams, families of common equivalent fractions	 Children start by folding strips of paper and shading the equal parts.	a) $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{6}$ $\frac{1}{6}$ $\frac{1}{6}$ $\frac{1}{6}$ $\frac{1}{6}$ $\frac{1}{6}$ b) $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{4}$ 	Use the fraction wall to complete the equivalent fractions.  a) $\frac{1}{2} = \frac{\square}{4}$ c) $\frac{2}{4} = \frac{4}{\square}$ e) $\frac{\square}{8} = \frac{3}{4}$ b) $\frac{1}{2} = \frac{\square}{8}$ d) $\frac{2}{8} = \frac{\square}{4}$ f) $\frac{2}{2} = \frac{\square}{4} = \frac{\square}{8}$
	count up and down in hundredths; recognise that hundredths arise when dividing an object by a 100 and dividing tenths by 10.	Use 10ths counters in tens frames to manipulate numbers, 	Tenths 1 Tick the pictures that show tenths.  Hundredths a) $\frac{3}{10} = \frac{\square}{100}$ b) $\frac{7}{10} = \frac{\square}{100}$	Tenths Mo has a bag of sweets. $\frac{4}{10}$ of his sweets are red. The rest are green or yellow. What fraction of Mo's sweets could be green? What fraction could be yellow? How many possible answers can you find? Hundredths

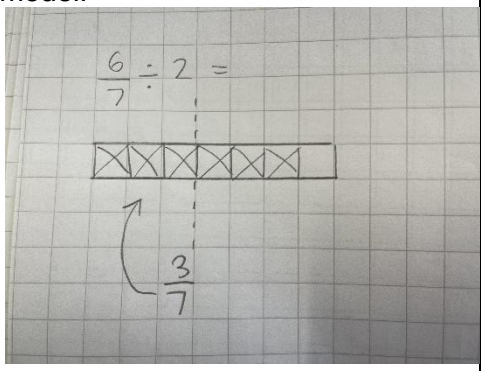
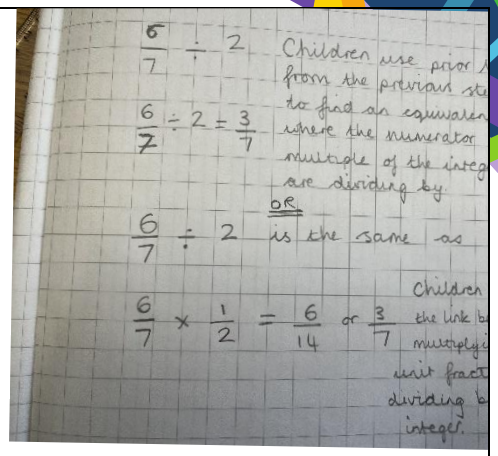
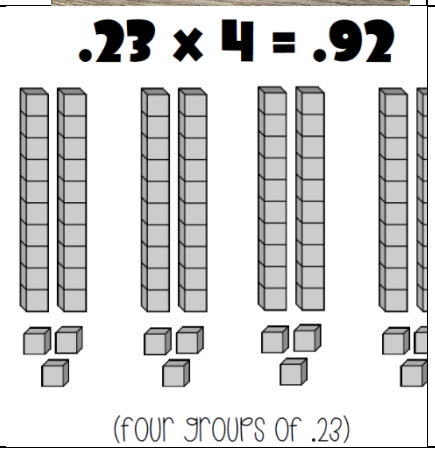
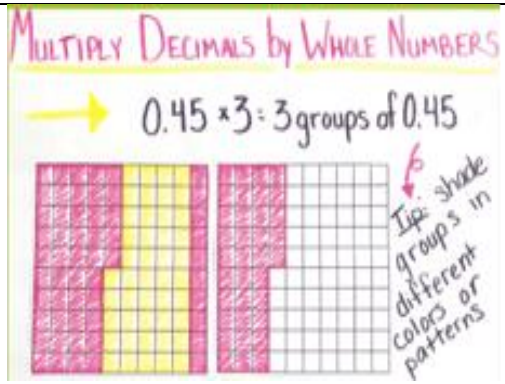
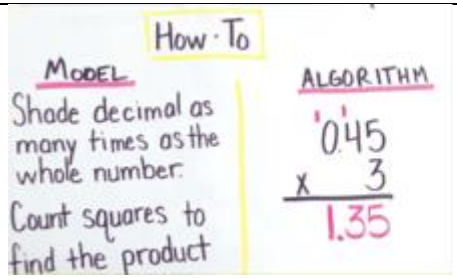
			Divide by 10 and 100 Look at the ten frames. a) 	a) $\frac{3}{10} = \frac{\square}{100}$ b) $\frac{7}{10} = \frac{\square}{100}$ d) $\frac{20}{100} = \frac{\square}{10}$ e) $\frac{27}{100} = \frac{\square}{10} + \frac{\square}{100}$ Divide by 10 and 100 $\square \div 10 = \square$ $\square \div 10 = \square$ $\square$ ones divided by ten is equal to $\square$ tenths.
	add and subtract fractions with the same denominator.	Add Fractions 	Add Fractions  a)  Use the bar models to work out the additions. a) 	Add Fractions a) $\frac{3}{7} + \frac{3}{7} = \square$ b) $\frac{3}{7} + \frac{4}{7} = \square = \square$ $\frac{\square}{4} + \frac{\square}{4} = \frac{9}{4}$ $2\frac{6}{9} + \frac{8}{9} = \square$ Subtract fractions

			Subtract fractions 	$\frac{4}{5} - \frac{1}{5} = \square$ f) $\frac{11}{4} - \frac{3}{4} = \frac{11}{3} - \frac{\square}{3}$
	round decimals with 1 decimal place to the nearest whole number			4.3 rounds to ☐ to the nearest whole number. 4.9 rounded to the nearest whole number is ☐ 8.3 rounded to the nearest whole number is ☐
	compare numbers with the same number of decimal places up to 2 decimal places	Use counters to compare the decimals on a place value grid. 		 **a)** 0.34 < 0.3__

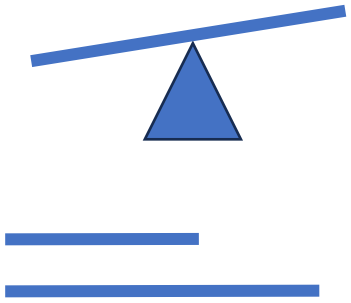
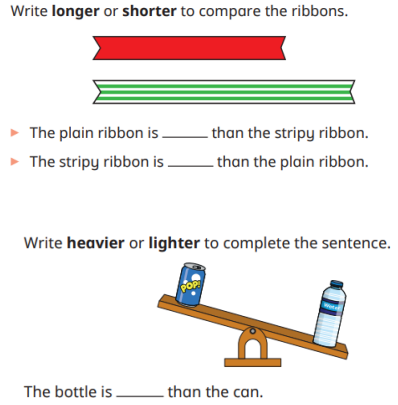
Year 5	• recognise mixed numbers and improper fractions and convert from one form to the other. • add and subtract fractions. • multiply proper fractions and mixed numbers by whole numbers. • round decimals with two decimal places to the nearest whole number and to one decimal place	 Cubes can be used to show whole and improper fractions. See year 4. 1/3 x 4= 1 1/3  	Each circle represents one whole.  ▸ What mixed number does the diagram show? ▸ What improper fraction does the diagram show? Convert the mixed numbers to improper fractions. Shade the bar models to help you. a)  1/3x4=1 1/3  What is 7.25 rounded to one decimal place? 	Show $1\frac{2}{3}$ and $2\frac{1}{3}$ on the number line.  Write each mixed number as an improper fraction. Use number lines to convert $3\frac{3}{4}$ and $3\frac{3}{5}$ to improper fractions. a) $11 \times \frac{1}{10} = \square = \square$ Round each number to 1 decimal place. 1.33 ☐ 4.03 ☐ 1.34 ☐ 4.04 ☐ 1% = 1/100 = 0.01

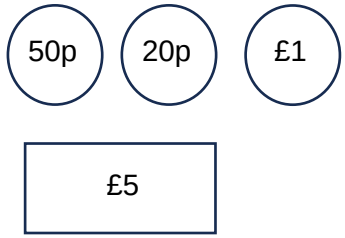
	• recognise the per cent symbol (%) and understand that per cent relates to 'number of parts per hundred', and write percentages as a fraction with denominator 100, and as a decimal			
Year 6	use common factors to simplify fractions; use common multiples to express fractions in the same denomination			

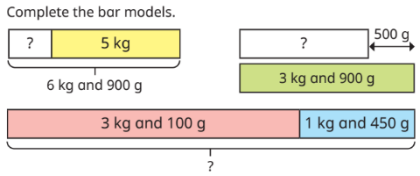
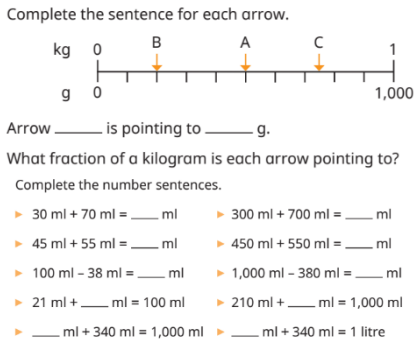
	add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions	 		
	multiply simple pairs of proper fractions, writing the answer in its simplest form [for example, 4 1 × 2 1 = 8 1]	See Year 5	See Year 5	See Year 5

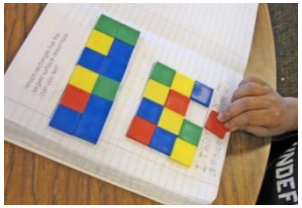
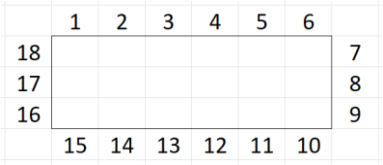
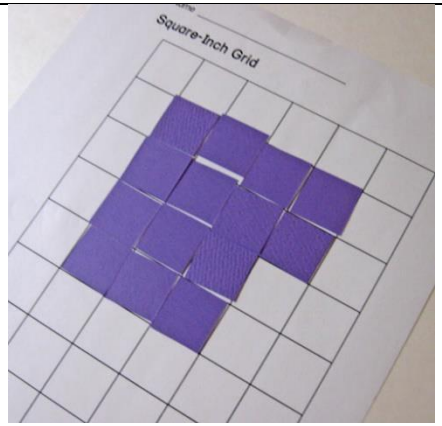
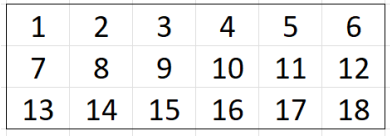
	divide proper fractions by whole numbers [for example, 3 1 ÷ 2 = 6 1]		Bar model: 	
	multiply one-digit numbers with up to two decimal places by whole numbers			

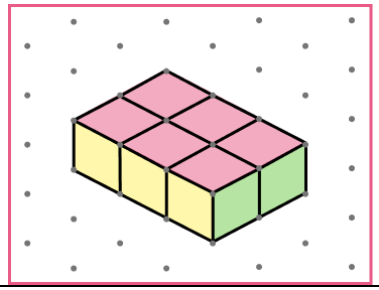
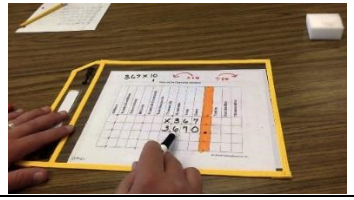
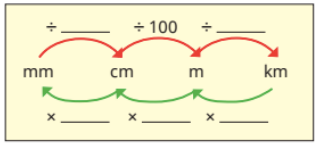
Measure

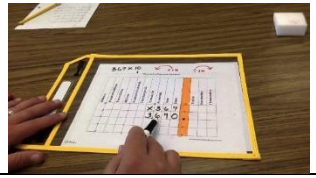
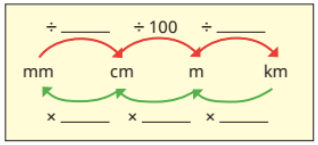
	Objective, strategy and key vocabulary.	Concrete	Pictorial	Abstract
Year 1	Compare, describe and solve **practical** problems for: • lengths and heights [for example, long/short, longer/shorter, tall/short, double/half] • mass/weight [for example, heavy/light, heavier than, lighter than] • capacity and volume [for example, full/empty, more than, less than, half, half full, quarter] • time [for example, quicker, slower, earlier, later]	Pupils can use a **variety of measuring equipment**, scales, cups/jugs and clocks/stop watches to describe and compare measurements.  	Use representations like below: 	Pupils can use the vocabulary taught to compare and describe measurements. 

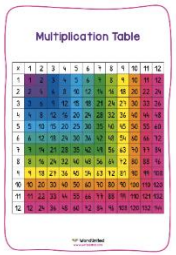
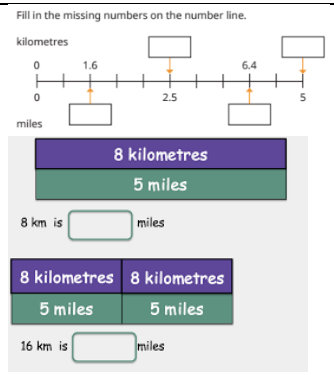
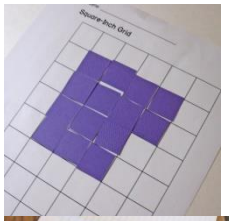
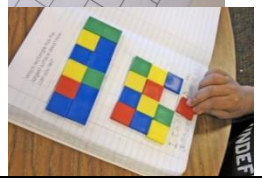
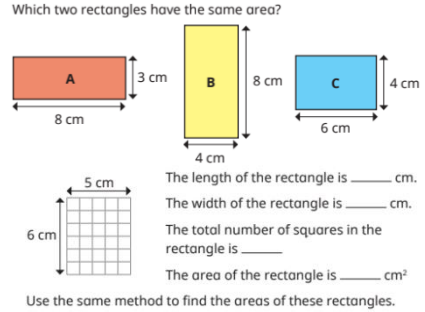
Year 2	• recognise and use symbols for pounds (£) and pence (p); combine amounts to make a particular value. • find different combinations of coins that equal the same amounts of money.	Use toy money. 	Draw coins/notes. 	
	• tell and write the time to five minutes, including quarter past/to the hour and draw the hands on a clock face to show these times.	Use clocks. 	Draw clocks/use clock stamps or blank worksheets. 	

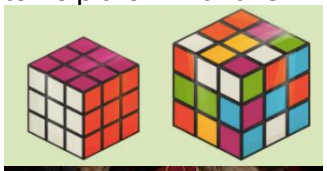
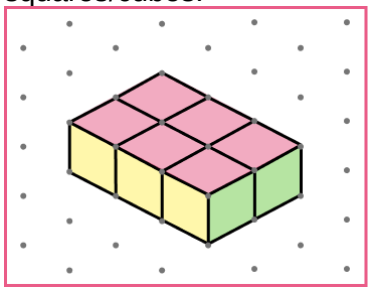
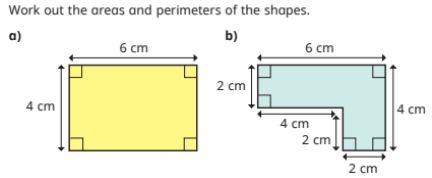
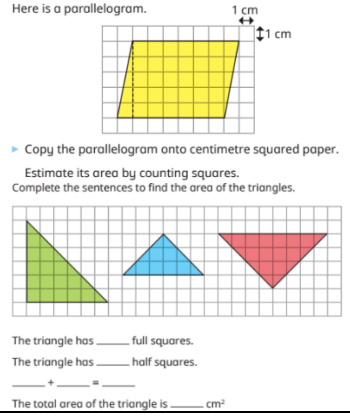
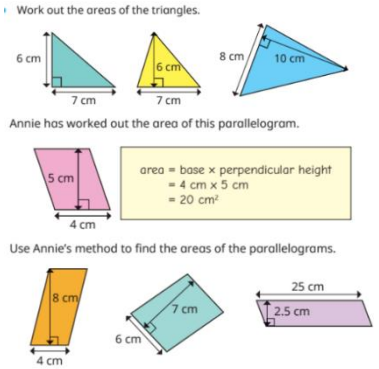
Year 3	measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)	Children to use and **<u>handle a range of measure resources</u>** to aid learning.   		If the mass of two apples is 50g, what is the mass of one apple? 
	add and subtract amounts of money to give change, using both £ and p in practical contexts	Use **<u>physical coins</u>** and **<u>notes</u>** to aid learning. **As Year 2**		
	tell and write the time from an analogue clock, including using Roman numerals from I to XII, and 12-hour and 24-hour clocks estimate and read time with increasing	To use **<u>analogue</u>** **<u>clocks</u>** to manipulate numerals and roman numerals. **As Year 2**		

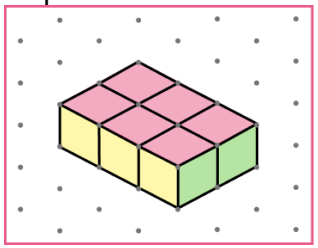
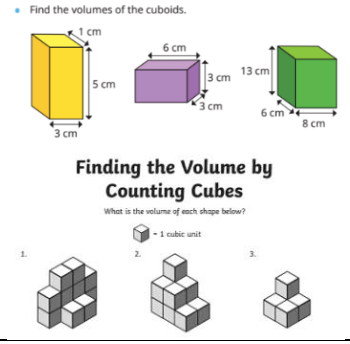
	accuracy to the nearest minute.			
Year 4	measure and calculate the perimeter of a rectilinear figure (including squares) in centimetres and metres.	Use squares to create the shape. 	Draw the shape in books using the squares. 	
	find the area of rectilinear shapes by counting squares.		Draw the shape in books using the squares. 	

Year 5	measure and calculate the perimeter of composite rectilinear shapes in centimetres and metres	**As year 4.**		
	calculate and compare the area of rectangles (including squares), and including using standard units, square centimetres (cm2) and square metres (m2) and estimate the area of irregular shapes	**As year 4.**		
	estimate volume [for example, using 1 cm3 blocks to build cuboids (including cubes)] and capacity [for example, using water]	Use building blocks. 	Use dotted paper to support. 	L x W x H =
Year 6 Equal to, approximately equal to	Solve problems involving the calculation and conversion of units of measure, using decimal notation up to 3 decimal places where appropriate.	Pupils can use PV charts and PV counters to help them with x and dividing by 10, 100 and 1000 in converting units of measure. Pupils will need the conversion charts to help remind them. 	Pupils exposed to tables, bar models, conversion charts and PV charts help them convert between different units of measure. Complete the diagram to show the conversions. 	Pupils are secure in multiplying and dividing by 10, 100 and 1000 and can do this without using the PV chart to help them convert.

	Use, read, write and convert between standard units, converting measurements of length, mass, volume and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation to up to 3 decimal places	Pupils should be able to handle and have access to concrete examples of items which show units of measure e.g. rulers of various sizes, measure tapes, measuring scales and weights, containers etc.  Pupils can use PV charts and PV counters to help them with x and dividing by 10, 100 and 1000 in converting units of measure. Pupils will need the conversion charts to help remind them. 	Pupils use tables, bar models, conversion charts and PV charts help them convert between different units of measure. Complete the diagram to show the conversions. 	Pupils can read, write and convert between units of measure. Write <, > or = to compare the measurements. 100 ml ◯ 0.1 l 15 cm ◯ 1.5 m 25 l ◯ 2,500 ml 1,500 mm ◯ $1\frac{1}{2}$ m 4,020 ml ◯ 4.2 l 1.5 km ◯ 150 m A bag of flour has a mass of 200 g. Scott uses 3 bags of flour when baking. How much flour does he use? Write your answer in kilograms. 
	Convert between miles and kilometres	Pupils could make groups of 5 and groups of 8 to help them convert between miles and kilometres using the fact that 5 miles is approximately equal to 8 kilometres.	Pupils can use bar models and number lines to help them understand the relationship between miles and kilometres	Pupils recall the conversions between miles and kilometres and use these to convert – need to be secure in multiplying and dividing. Complete the conversions. ▸ 7.5 miles ≈ ____ km ▸ ____ km ≈ 55 miles ▸ 160 km ≈ ____ miles ▸ ____ miles ≈ 320 km ▸ 96 miles ≈ ____ km ▸ ____ km ≈ 250 miles

		 Pupils might also be able to look at maps to conceptualise the difference between a mile and a kilometre. Use a map of your local area. Find something that is approximately: • 1 mile away from your school • 1 km away from your school • 2 miles away from your school • 2 km away from your school		
	Recognise that shapes with the same areas can have different perimeters and vice versa.	Pupils may use equipment to calculate area and perimeter of different shapes in order to identify the differences.  	Pupils can look at pictorial drawings of shapes to calculate area and perimeter and compare the appearance of the shapes. 	Pupils use their knowledge of factor pairs to help them calculate the area of shapes and then draw them to understand that they may look different. Draw as many rectangles as possible that have these areas. All the side lengths should be whole numbers. ▸ 36 cm² ▸ 16 cm² ▸ 17 cm²

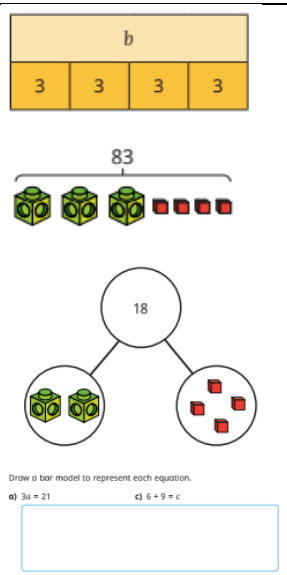
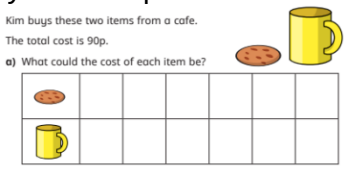
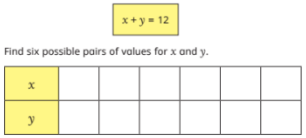
	Recognise when it is possible to use formulae for area and volume of shapes	Pupils may experiment with counting squares or cubes or using the formulae to see which method is most appropriate. Pupils may use dienes cubes, multilink, 3d and 2d shapes etc to help them with this.  	Pupils can use isometric paper or squared paper to help them draw 2d and 3d shapes to help them decide whether to use a formulae or count squares/cubes. 	Pupils are secure in the knowledge that area of a shape is the space inside and the perimeter is the distance around the outside. Pupils no longer need to count squares but can apply the formulae to rectilinear and composite shapes. 
	Calculate the area of parallelograms and triangles		Pupils can count squares to help them calculate the area of triangles and parallelograms. 	Pupils can use the formulaes to help them calculate the area of triangles and parallelograms. 

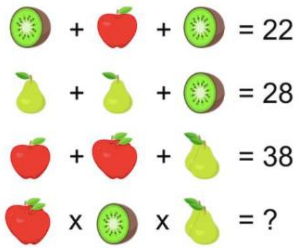
	Calculate, estimate and compare volume of cubes and cuboids using standard units, including cubic centimetres (cm^3) and cubic metres (m^3), and extending to other units [for example, mm^3 and km^3]	Pupils can use multilink to help them conceptualise volume and then count the cubes. 	Pupils can use isometric paper to help them draw 3d shapes to help them calculate the volume. 	Pupils can use their knowledge of the formulae to find the volume of shapes where they can and can't count the cubes. 

Algebra

Input, Output, Function, Rule, Inverse Operations

	Objective, strategy and key vocabulary.	Concrete	Pictorial	Abstract
Year 6	Use simple formulae	Represent each person's age using cuisenaire rods, place each person above each other to show comparisons. Andy Bella Colin Using Algebra Tiles to represent the expression Students should lay tiles on a **mini-whiteboard** so that students can write down their process. Students should then use the idea of zero-pairs to eliminate ones on one side.	Represent each person's age using cuisenaire rods, place each person above each other to show comparisons. Students should draw the x tiles first and then work in columns to add the ones, as shown below:	Students should represent each person's age as an algebraic expression. **A** x **B** x+2 **C** x-1 **D** 2x+4 *This could be represented as 2(x+2) depending on student's ability* $3x - 1 = 5$ $3x = 6$ $x = 2$ $x = 2$
	Generate and describe linear number sequences	It will be beneficial if students use the manipulatives on top of a whiteboard for this stage. Students should identify that the sequence increases by 3 each time. 4 , 7 , 10 , 13 . . . +3 +3 +3 Students should then know that the sequence is linked to the 3 times table. Students should then represent this using the manipulative. Since the sequence increases by 3, the 3 block will be needed.	Term (n) It may be useful for weaker students to shade in the term-to-term blocks to make them easier to count and distinguish.	Students however MUST be able to clearly justify why by explaining that is the sequence is "one more than the three times table, therefore the rule is 3n+1."
	Express missing number problems algebraically	Create a representation to show the equation 2m + 2 = 6 Pupils could begin by handling a range of physical objects and	Bar models, part-whole models and pictorial drawings of concrete objects	Pupils can expressing missing number problems using numbers and symbols, as well

		then using representations to show expressions and then create and solve equations.		as being able to solve them from word problems. The total cost of a scarf and a book is £17 Form an equation to represent this information.
	Find pairs of numbers that satisfy an equation with 2 unknowns.	Pairs of values are represented using 2D shapes or other concrete resources e.g. circle + square = 5. What could the pairs of values be? 	Pupils can then start using strategies such as a table to efficiently find the pairs of numbers that satisfy an equation. They could also draw their pairs of numbers using symbols or pictures. 	Pairs of values are represented in abstract form using numbers. Missing numbers are represented using algebraic symbols. 
	Enumerate possibilities of combinations of 2 variables	Possibilities are represented by pupils using 2D shapes and other concrete resources, same as in the previous objective.	Pupils continue to use a table to efficiently find possibilities of combinations of different	Pupils start to enumerate possibilities mentally e.g. by using knowledge of number bonds, times tables etc. They can then apply this objective to real-life problems such as finding the lengths of shapes –

			numbers. a and b are whole numbers. $2a + b = 14$ Complete the table to show different possible values for a and b. a: 0 1 2 3 4 5 6 7 $2a$: 0 2 b: 14 $2a + b$: 14 14 14 14	necessary for calculating area and perimeter. x and y are both multiples of 5 less than 100 If $2x = y$, circle the possible values of x and y. $x = 20, y = 20$ $x = 10, y = 20$ $x = 20, y = 10$ $x = 35, y = 70$ $y = 90, x = 45$ Here is a rectangle. x and y are both integers. The rectangle has a perimeter of 28 cm. a) Write an equation to represent the perimeter of the rectangle.