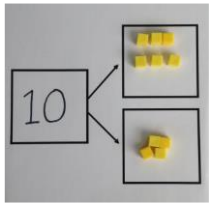
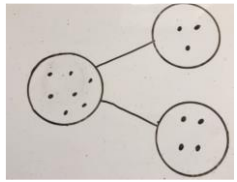
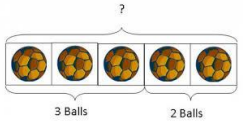
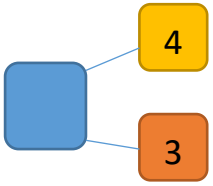
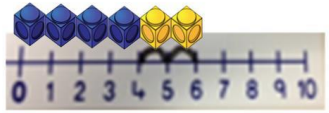
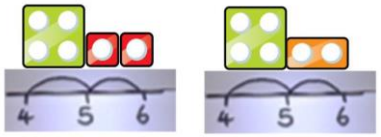
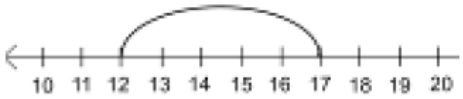
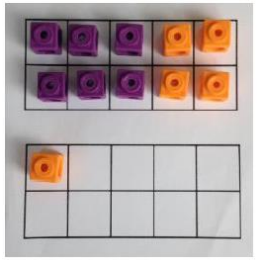
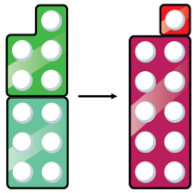
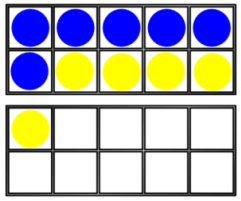
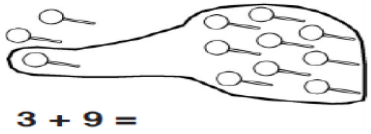
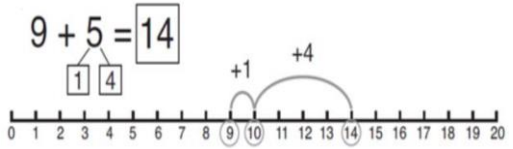
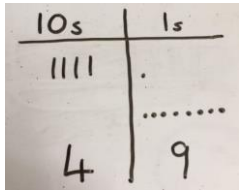
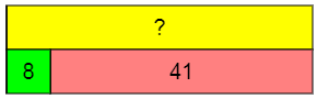
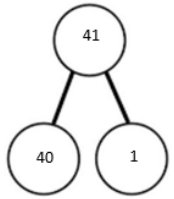
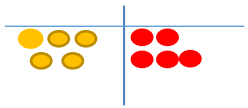
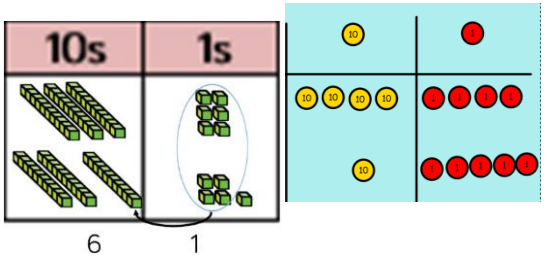
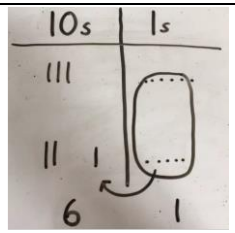
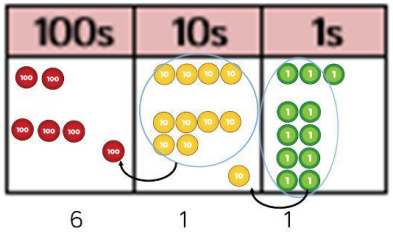
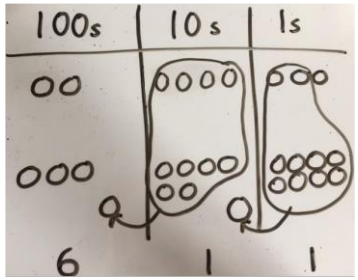
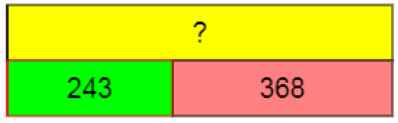
CALCULATION POLICY

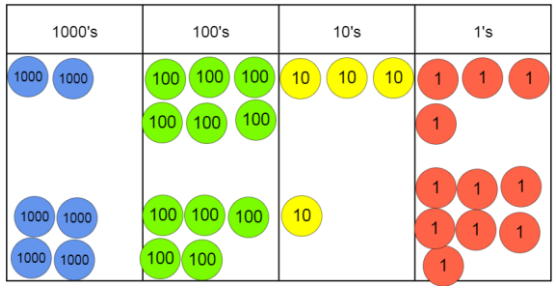
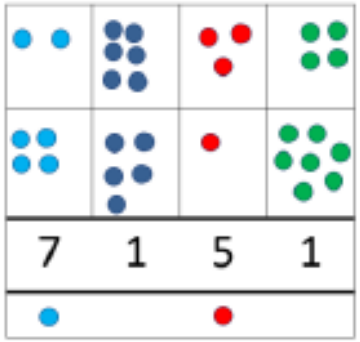
Progression in Addition

Key language: sum, total, parts and wholes, plus, add, altogether, more, 'is equal to' 'is the same as'.

Objectives and strategies	Concrete	Pictorial	Abstract
Combining two parts to make a whole.	   Use resources (cubes, teddy bears, cars etc.) to add two numbers together as a group or in a bar. 	 Represent cubes as dots. They could create a part whole model. 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.
Counting on along a number line	  Start with the larger number and then count on to the smaller number 1 by 1 to find the answer.	A bar model encourages counting on rather than count all. 	5 + 12 = 17 What is 5 more than 12? What is the sum of 5 and 12? What is the total of 5 and 12? Place the larger number in your head and count on the smaller number to find your answer.  Start at the larger number on the number line and count on in ones or in one jump to find the answer.

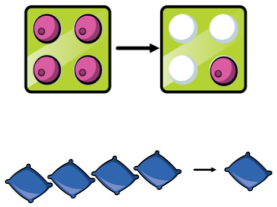
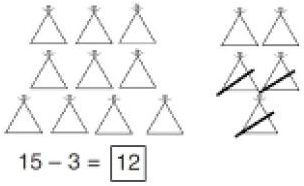
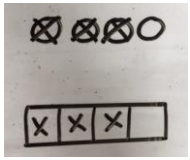
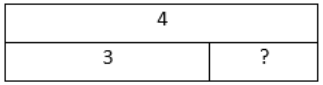
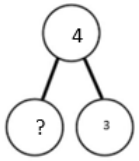
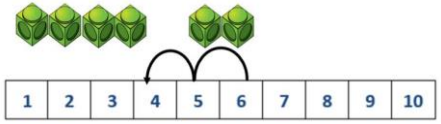
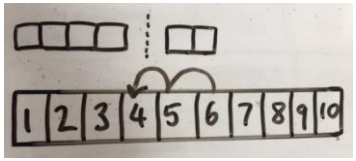
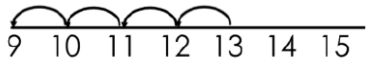
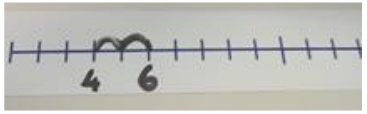
Regrouping to make 10.	Start with the bigger number and use the smaller number to make 10. Use tens frames and counters/ cubes or Numicon. 6+5=11  	Children to represent the tens frame.   3 + 9 = Regroup the smaller number to make 10.	Use a number line. Partition the smaller number to make 10.  Children to develop an understanding of equality e.g. 6 + □ = 11 6 + 5 = 5 + □
TO + O.	Using base 10, continue to develop the understanding of partitioning and place value.  	Children to represent the base 10 e.g. lines for tens and dots for ones.  Represent the calculation as a bar model.  	 Use part whole model to partition. 41 + 8 1 + 8 = 9 40 + 9 = 49 Children to record the family of facts.
TO + TO. Introducing the expanded column addition method.	Continue to develop the understanding of partitioning and place value. Use base 10 before moving on to place value counters.	Children to represent the base ten or counters in a place value chart.  	36 + 25 6 + 5 = 11 30 + 20 = 50 50 + 11 = 61 Begin to introduce expanded column addition.

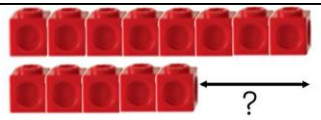
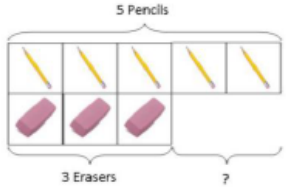
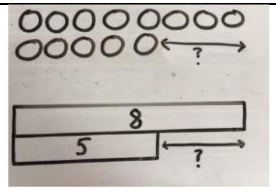
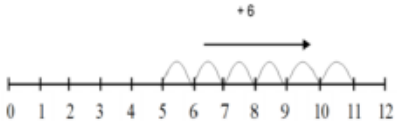
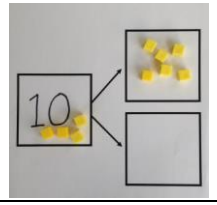
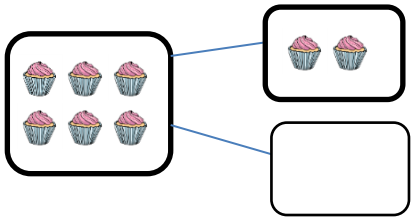
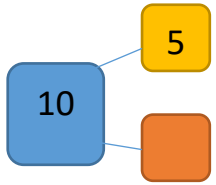
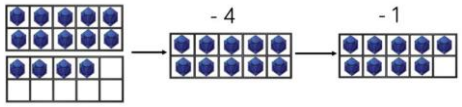
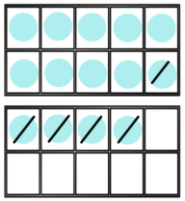
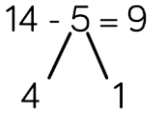
	36 + 25 44+15  	 Represent the calculation as a bar model.  	36 + 25 11 50 61 Children to record the family of facts.
HTO+HTO Expanded column addition method.	Use base 10 and place value counters. When there are 10 ones in the 1s column- we exchange for 1 ten, when there are 10 tens in the 10s column- we exchange for 1 hundred. 243+368  	Children to represent the counters or base 10 in a place value chart, circling when they make an exchange.  Represent the calculation as a bar model.  	Expanded column addition method. 243 + 368 11 100 500 611

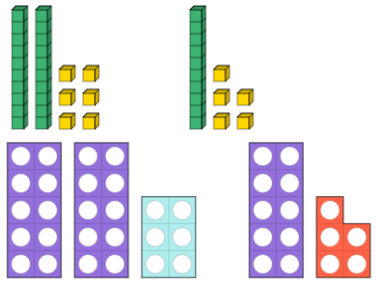
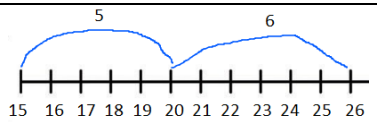
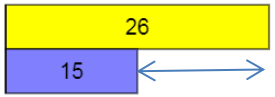
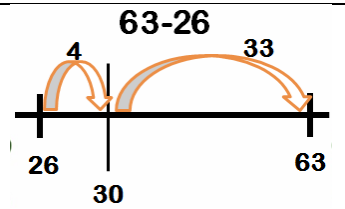
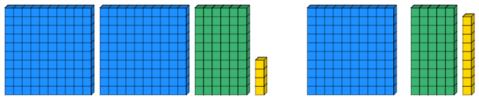
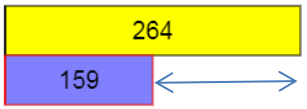
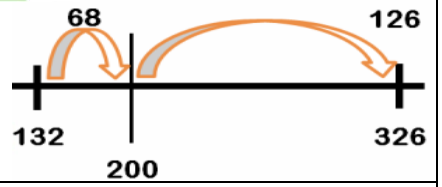
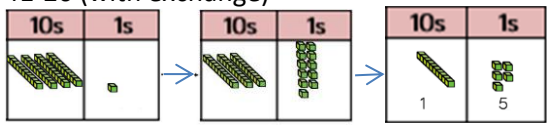
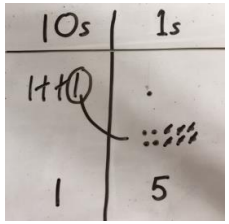
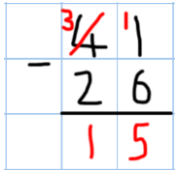
HTO + TO, ThHTO + ThHTO etc. Progressing to addition of decimals. Column addition method.	2634 + 4517  This can also be done with Base 10 to help children clearly see that 10 ones equal 1 ten and 10 tens equal 100. As children move on to decimals, money and decimal place value counters can be used to support learning.	Children can draw a pictoral representation of the columns and place value counters or base 10 to further support their learning and understanding.  Represent the calculation as a bar model.  	$\begin{array}{r} 536 \\ +\ 85 \\ \hline 621 \\ \hline 1\ 1 \end{array}$ As the children move on, introduce decimals with the same number of decimal places and different. Money can be used here. $\begin{array}{rrrrrrr} & £ & 2 & 3 & . & 5 & 9 \\ + & £ & & 7 & . & 5 & 5 \\ \hline & £ & 3 & 1 & . & 1 & 4 \\ & & 1 & 1 & & 1 & \end{array}$ $\begin{array}{rrrrrr} 2 & 3 & . & 3 & 6 & 1 \\ & 9 & . & 0 & 8 & \mathbf{0} \\ 5 & 9 & . & 7 & 7 & \mathbf{0} \\ + & 1 & . & 3 & \mathbf{0} & \mathbf{0} \\ \hline 9 & 3 & . & 5 & 1 & 1 \\ 2 & 1 & & 2 & & \end{array}$

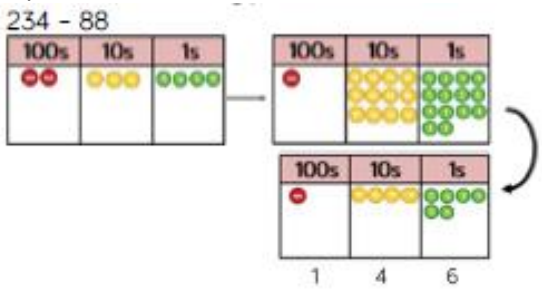
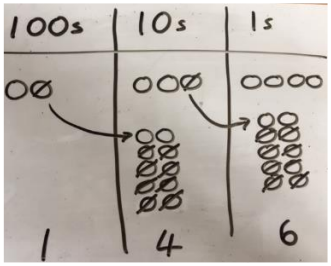
Progression in Subtraction

Key language: take away, less than, the difference, subtract, minus, fewer, decrease.

Objectives and strategies	Concrete	Pictorial	Abstract
Taking away ones.	Use physical objects, counters, cubes, numicon etc. to show how objects can be taken away. 4-3=1  4-2=2 	Cross out drawn objects to show what has been taken away.   The bar model can also be used.	4 – 3 = ☐ = 4-3  
Counting back.	Using number lines or number tracks, children start with the number and count back. 6 – 2= 4  	Children to represent this pictorially.  	Children to represent the calculation on a number line and show their jumps. Children encouraged to use an empty number line. 13 – 4 =  6 – 2 = 
Finding the difference.	Use cubes, Numicon, Cuisenaire rods or other resources to compare the amounts to find the difference.	Children to draw cubes/ other concrete resources used or use a bar model to illustrate what they need to calculate.	Find the difference between 8 and 5. 8- -5, the difference is ☐

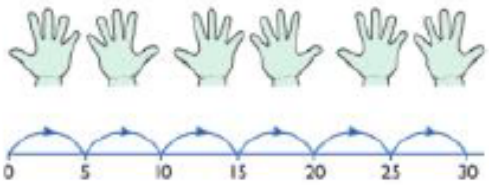
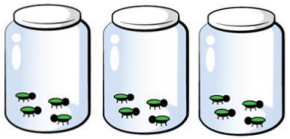
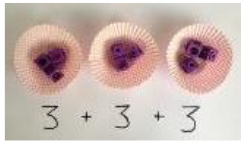
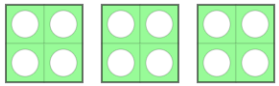
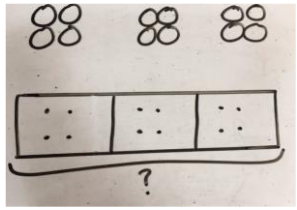
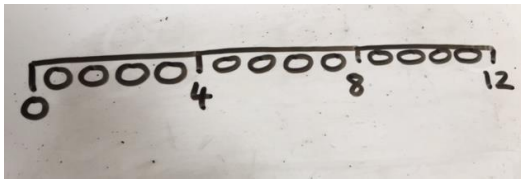
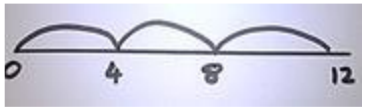
	 Use basic bar models with items to find the difference  	 Use a number line to count on the difference.  	Hannah has 23 sandwiches, Helen has 15 sandwiches. Find the difference between the number of sandwiches.
Part Part Whole Model	Link to addition- use the part whole model to help explain the inverse between addition and subtraction.  If 10 is the whole and 6 is one of the parts. What is the other part? 10 - 6 =	Use a pictorial representation of objects to show the part part whole model. 	 Move to using numbers within the part whole model.
Making 10	14 -5 =  Make 14 on the ten frame. Take away the four first to make 10 and then takeaway one more so you have taken away 5. You are left with the answer of 9.	Children to present the ten frame pictorially and discuss what they did to make 10. 	16 – 8= How many do we take off to reach the next 10? How many do we have left to take off? 14 – 4 = 10 10 – 1 = 9 
Finding the difference. TO – TO. HTO – HTO.	Compare the two numbers using resources e.g. base 10 and Numicon. 26 – 15 =	Compare on a marked number line using two jumps. Jump from the lowest number to the next multiple of 10 then to the target number.	Children to show their jumps on a number line to find the difference. Encourage children to use an empty number line.

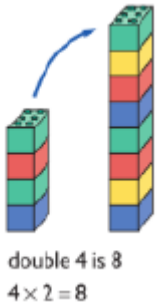
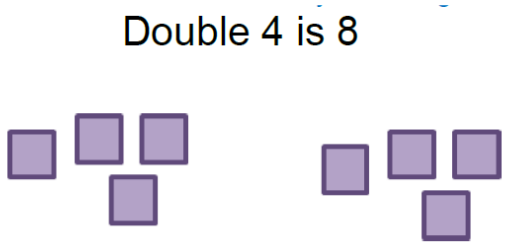
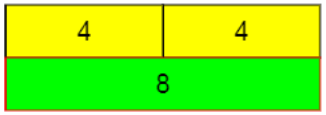
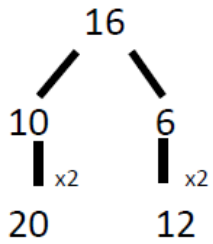
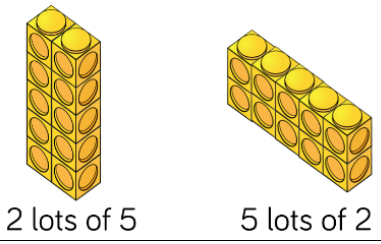
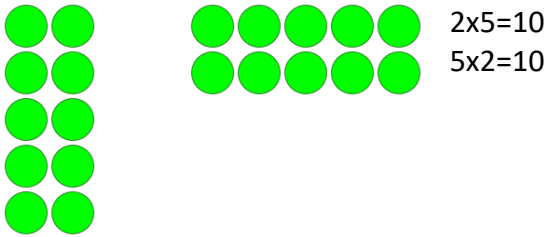
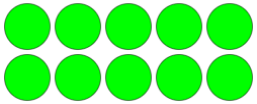
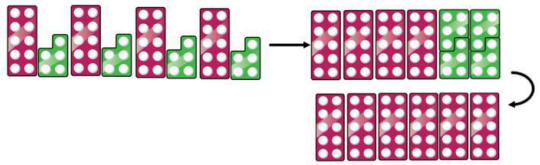
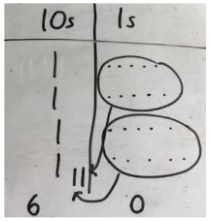
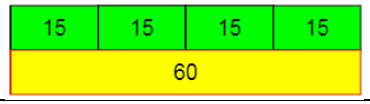
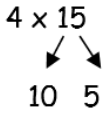
		 = 11 Use a bar model to represent the calculation.  ?	 = 37
Finding the difference. HTO – HTO, HTO – TO etc.	Compare the two numbers using resources e.g. base 10. 	Use a bar model to represent the calculation.  ?	Children to show their jumps on a number line to find the difference. Encourage children to use an empty number line. Use two jumps. Jump to the next multiple of 100 using jigsaw numbers then jump to the target number.  
Column subtraction.	Use Base 10 or other resources to model taking away. Make the bigger number, exchange where necessary, and then take away the smaller number. 41-26 (with exchange)  Use Base 10 to start with before moving on to place value counters. Start with one	Represent the base 10 pictorially, remembering to show the exchange.  Draw the counters onto a place value grid and show what you have taken away by	Formal column method. Children must understand that when they have exchanged the 10 they still have 41 because 41 = 30 + 11.  As well as understanding the exchange, children must understand the place value of

	exchange before moving onto subtractions with 2 exchanges. Make the larger number with the place value counters. Start with the ones, can I take away 8 from 4 easily? I need to exchange one of my tens for ten ones. Now I can subtract my ones. Repeat with the hundreds.  Show children how the concrete method links to the written method alongside your working. Cross out the numbers when exchanging and show where we write our new amount.	crossing the counters out as well as clearly showing the exchanges you make.  	the numbers involved to ensure digits are lined up correctly in the place value columns. $\begin{array}{r} {}^{2}{\not 3}^{1}4 \\ -\ 88 \\ \hline 6 \end{array}$ This will lead to an understanding of subtracting any number including decimals. 263 – 26.5 $\begin{array}{r} {}^{5}{\not 2}{}^{12}{\not 6}{\not 3}^{1}.0 \\ -\ \ 2\ 6\ .\ 5 \\ \hline 2\ 3\ 6\ .\ 5 \end{array}$

Progression in Multiplication

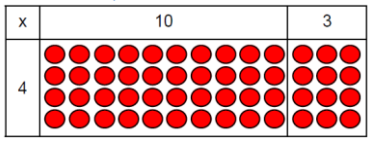
Key language: double, times, multiplied by, the product of, groups of, lots of, equal groups, repeated addition.

Objectives and strategies	Concrete	Pictorial	Abstract
Counting in multiples	Count in multiples supported by concrete objects in equal groups. 	Use a number line or pictures to continue support in counting in multiples. 	Count in multiples of a number aloud. Write sequences with multiples of numbers. 2, 4, 6, 8, 10 5, 10, 15, 20, 25 , 30
Repeated grouping/ repeated addition	Use different objects to show equal groups. e.g. 3 x 4 4 + 4 + 4 There are 3 equal groups with 4 in each group.   	Children can represent the practical resources in a picture and use a bar model.  Children can represent pictorially against a numberline. 	An abstract number line to show three jumps of four.  Write addition sentences to describe objects and pictures. 

Doubling	Use practical activities to show how to double a number.  	Draw pictures to show how to double a number.  Children can represent this in a bar model.  	 Partition a number and then double each part before recombining it back together.
Arrays- showing commutative multiplication	Create arrays using counters/ cubes to show multiplication sentences. 2 x 5 = 5 x 2  	Draw arrays in different rotations to find **commutative** multiplication sentences.  	Children to use an array to write a range of calculations.  2 x 5 = 10 5 x 2 = 10 5+5=10 2+2+2+2+2=10
Partition to multiply	Partition to multiply using Numicon, base 10 or Cuisenaire rods. 4 × 15 	Children to represent the concrete manipulatives pictorially.  Children can also represent on a bar model.  	Children to be encouraged to show the steps they have taken. Use of smile multiplication for multiples of 10.  10 x 4 = 40 5 x 4 = 20 40 + 20 = 60

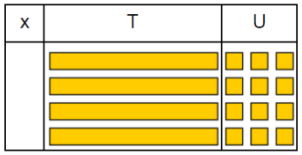
Grid Method

Show the link with arrays to first introduce the grid method.



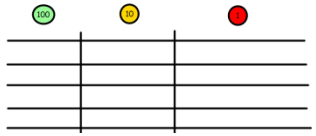
4 rows of 10
4 rows of 3

Move on to using Base 10 to move towards a more compact method.



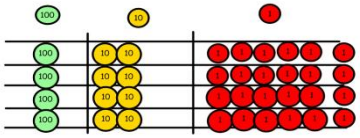
4 rows of 13

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.



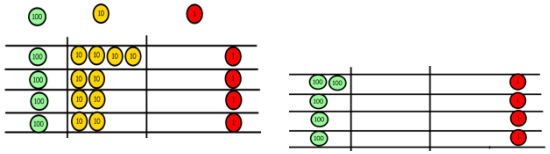
Calculations
4 x 126

Fill each row with 126.



Calculations
4 x 126

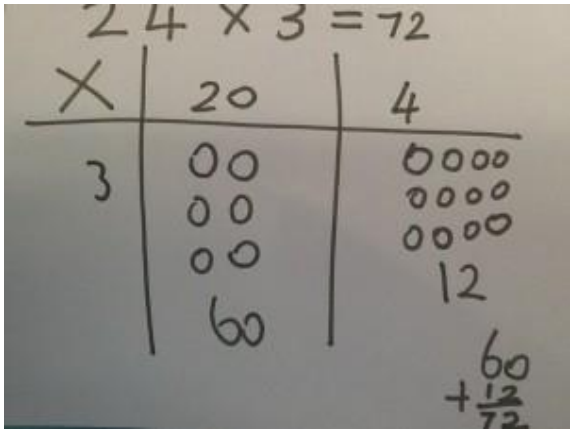
Add up each column, starting with the ones making any exchanges needed.



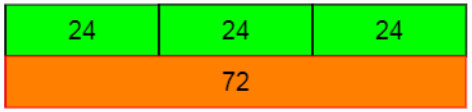
Then you have your answer.

Children can represent the work they have done with place value counters in a way that they understand.

They can draw the counters, using colours to show different amounts or just use circles in the different columns to show their thinking as shown below.



Children can also represent this in a bar model.



Start with multiplying by one digit numbers and showing the clear addition alongside the grid. Remind the children of smile multiplcation for mulitples of 10.

e.g. 84 x 3 = 252

x 3	80	4
	240	12

= 240 + 12 = 252

Moving forward, multiply by a 2 digit number showing the different rows within the grid method.

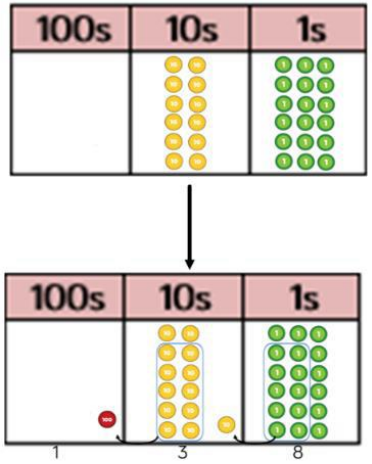
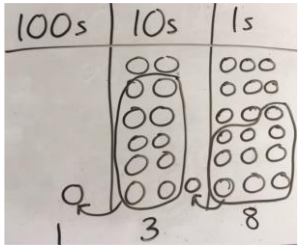
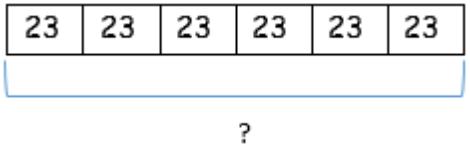
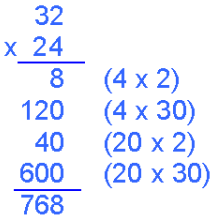
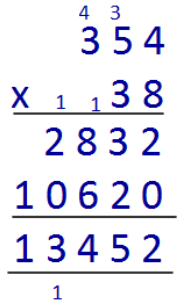
e.g. 72 x 24

x	20	4
70	1400	280
2	40	8

1680
+ 48

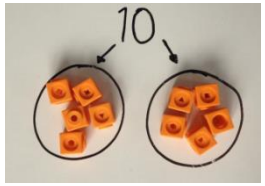
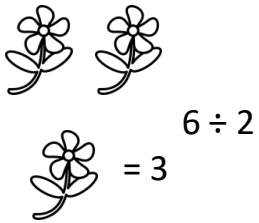
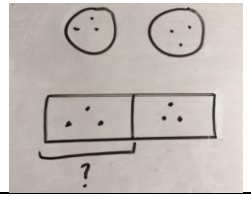
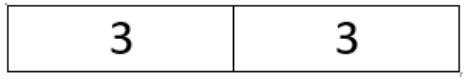
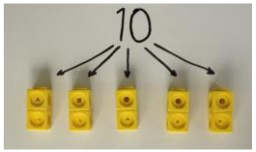
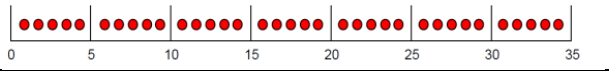
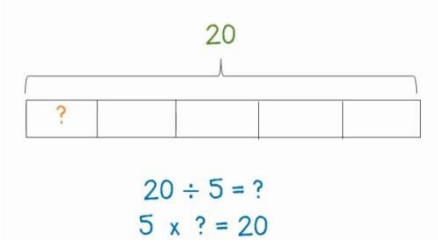
1680
+ 48
8
120
600
1000
1728

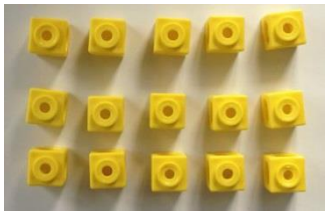
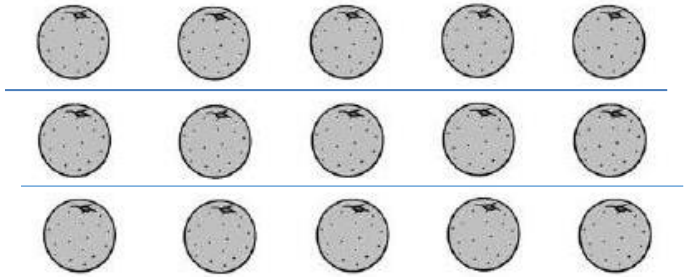
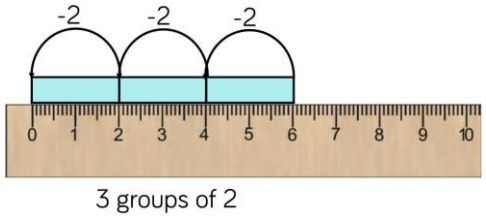
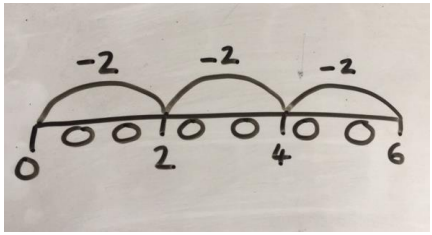
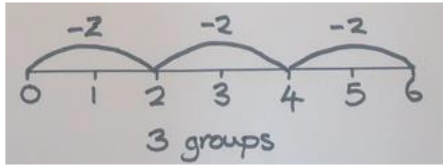
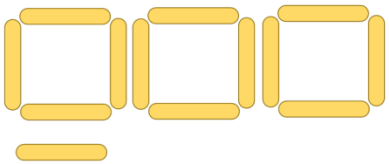
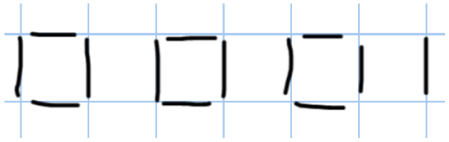
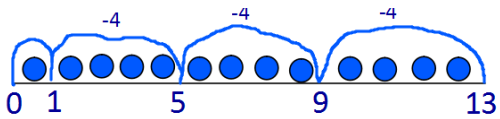
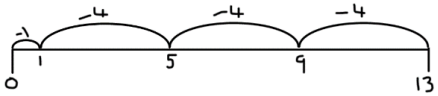
X	1000	300	40	2
10	10000	3000	400	20
8	8000	2400	320	16

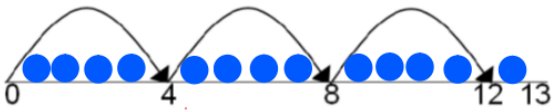
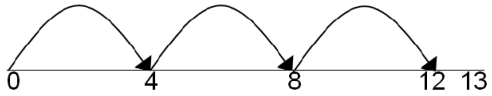
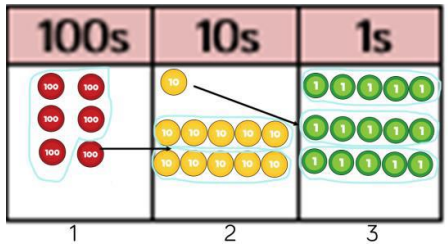
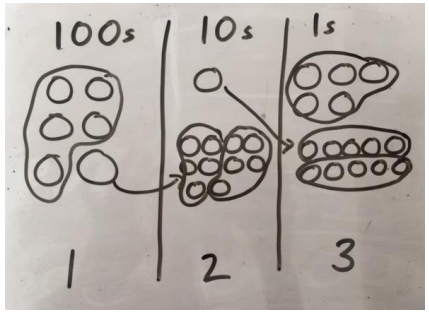
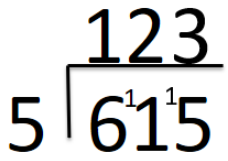
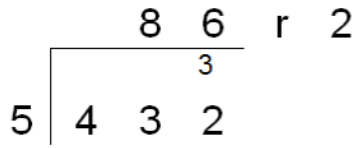
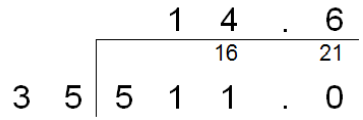
Column multiplication	Children will continue to use place value counters or base 10.  It is important at this stage that they always multiply the ones first and note down their answer followed by the tens which they note below.	Children to represent the counters / base 10 pictorially.  Bar modelling can support learners when solving problems with multiplication alongside the formal written methods.  	Remind children about lining up their numbers clearly in columns. If it helps, initially children can write out what they are solving next to their answer. Show the relation to the grid method.   This can then move to the more compact method.  Children will use this method to multiply 3D x 3D, 4D x 2 D etc. and decimal numbers.

Progression in Division

Key language: share, group, divide, divided by, half, and repeated subtraction.

Objectives and strategies	Concrete	Pictorial	Abstract
Division as sharing	Sharing into equal groups using a range of objects.   	Children use pictures or shapes to share quantities.   Represent the sharing pictorially. 	6 ÷ 2 = 3  Share 9 buns between three people. 9 ÷ 3 = 3
Division as grouping	Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.  	Think of the bar as a whole. Split it into the number of groups you are dividing by and work out how many would be within each group. 	35 ÷ 5 = 7 Divide 35 into 5 groups. How many are in each group?

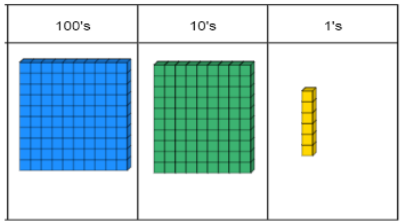
Division within an array (fact families).	 Link division to multiplication by creating an array and thinking about the number sentences that can be created (fact family). Eg 15 ÷ 3 = 5 5 x 3 = 15 15 ÷ 5 = 3 3 x 5 = 15	 Draw an array and use lines to split the array into groups to make multiplication and division sentences.	Find the inverse of multiplication and division sentences by creating four linking number sentences (fact family). 7 x 4 = 28 4 x 7 = 28 28 ÷ 7 = 4 28 ÷ 4 = 7
Division as repeated subtraction.	Use of Cuisenaire rods above a ruler or take away lots of a number from a set of objects. 6 ÷ 2  3 groups of 2	Children to represent repeated subtraction pictorially. 	Abstract numberline to represent the equal groups that have been subtracted. Jump back along the numberline taking away lots of the number. 
Division as repeated subtraction with remainders.	Using lollipop sticks. Cuisenaire rods, above a ruler can also be used. 13 ÷ 4 Use of lollipop sticks to form wholes- squares are made because we are dividing by 4.  There are 3 whole squares, with 1 left over.	Children to represent pictorially.  Children to represent on a numberline. 	Complete written divisions and show the remainder using r. Children to represent repeated subtraction on a numberline jumping back to take away lots of a number. This leaves the remainder.  13 ÷ 4 = 3 r 1

		Alternatively, model jumping forward on a number line in jumps of multiples of the divisor until just below the target number (relate to Where's Mully). The left over is the remainder.  	Alternatively, children can jump forwards therefore using the multiples they know, count the jumps and use calculate what is left over (or remaining) to get to the target number. Relate this to Where's Mully. 
Short division.	Use place value counters to divide using the bus stop method alongside. 615 ÷ 5  1. Make 615 with place value counters. 2. How many groups of 5 hundreds can you make with 6 hundred counters? 3. Exchange 1 hundred for 10 tens. 4. How many groups of 5 tens can you make with 11 ten counters? 5. Exchange 1 ten for 10 ones. 6. How many groups of 5 ones can you make with 15 ones?	Children to represent this pictorially.  	Children to calculate using the short division method. Begin with divisions that divide equally with no remainder.  Move onto divisions with a remainder.  Alternatively, the remainder can be recorded as a fraction of the divisor. Finally move into decimal places to divide the total accurately. 

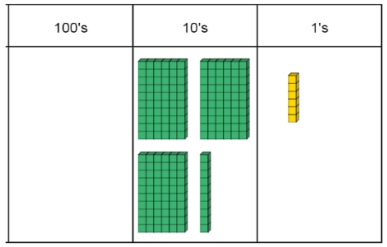
Repeated subtraction using chunking.

Children to use base 10 or place value counters to model taking 'chunks' of a number away. Firstly make the number on a place value chart.

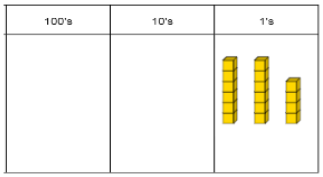
196 ÷ 6



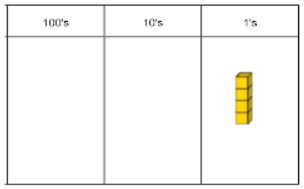
Children to take the largest chunk away that that can. Exchange may be needed.



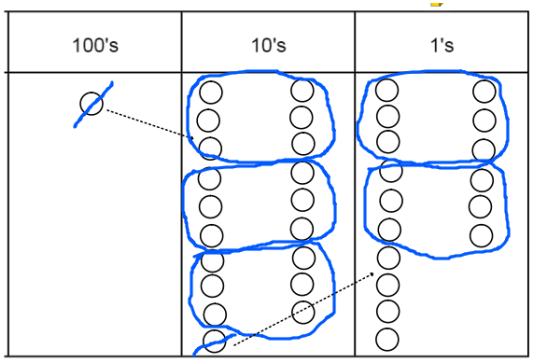
After the 180 (30 x 6) has been subtracted, the remaining 10 needs to be exchanged.



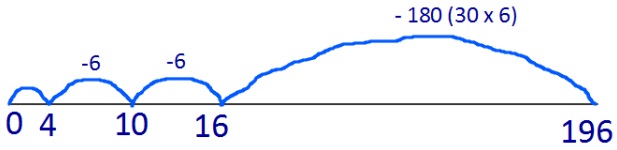
Once the 12 (2 x 6) has been subtracted, the 4 that are left over are the remainder.



Children can represent this pictorially and show the exchange.



Represent the repeated subtraction on a numberline.



Children to record the calculation using the written chunking method. Encourage children to write out a coin card for the divisor in order to spot the highest multiples that can be subtracted.

Where's Mully can also be used to look for the highest multiple of the largest place value digits without going past the number being divided.

6	1	9	6	
-	1	8	0	30 x
		1	6	
-		1	2	2 x
			4	

196 ÷ 6

= 32 r 4

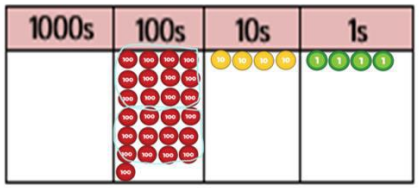
```
   2 3 r 4
24 5 5 6
  -4 8 0     24 x 20
     7 6
    -7 2     24 x 3
       4
```

Long division.

Use of place value counters to model.

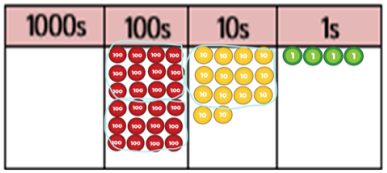
2544 ÷ 12

We can't group 2 thousands into 12s so we exchange them.



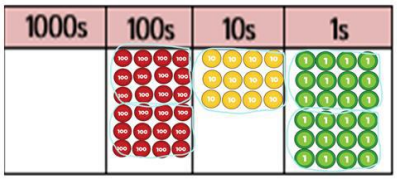
$$\begin{array}{r} 02 \\ 12\overline{)2544} \\ 24 \\ \hline 1 \end{array}$$

We can group 24 hundreds into groups of 12 which leaves 1 hundred.



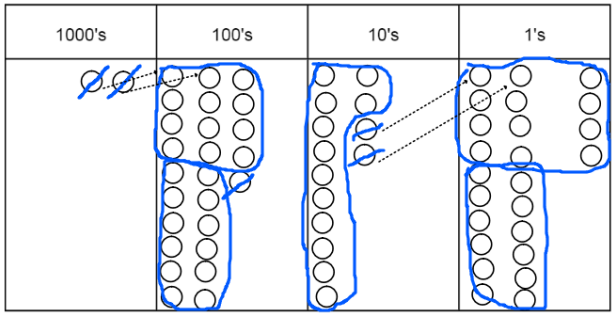
$$\begin{array}{r} 021 \\ 12\overline{)2544} \\ 24 \\ \hline 14 \\ 12 \\ \hline 2 \end{array}$$

After exchanging the hundred we have 13 tens. We can group 12 tens into a group of 12, which leaves 2 tens.



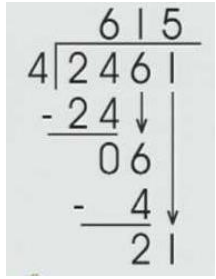
$$\begin{array}{r} 0212 \\ 12\overline{)2544} \\ 24 \\ \hline 14 \\ 12 \\ \hline 24 \\ 24 \\ \hline 0 \end{array}$$

Children to represent the place value counters pictorially. Children to show where the exchanges have occurred.



The standard long division method should be taught after chunking and when the children have a good knowledge of place value and multiplication.

Begin with divisions that divide equally with no remainder.



$$\begin{array}{r} 615 \\ 4\overline{)2461} \\ -24\downarrow \\ \hline 06 \\ -\ 4\downarrow \\ \hline 21 \end{array}$$

Move on to division with a remainder.

$$\begin{array}{r} 26\text{ r }3 \\ 17\overline{)445} \\ -34\downarrow \\ \hline 105 \\ -102 \\ \hline 3 \end{array}$$

$$\begin{array}{r} 24.3 \\ 13\overline{)315.9} \\ -26 \\ \hline 55 \\ -52 \\ \hline 39 \\ -\ 39 \\ \hline 0 \end{array}$$

Alternatively, the remainder can be recorded as a fraction of the divisor. Finally move into decimal places to divide the total accurately.

	After exchanging the 2 tens, we have 24 ones. We can group 24 ones into groups of 12, which leaves no remainder. Show children how the calculation builds up alongside the place value counters.		