MARSTON MORETEYNE VC SCHOOL

1847

Calculation Policy

In all our maths work we are using **a CPA approach** within our maths lessons.

At Marston Moreteyne School, we aim to:

- provide the children with the skills and strategies necessary to develop into confident, collaborative, systematic mathematicians.
- ensure that all children make sufficient progress to meet or exceed age-related expectations.
- promote enjoyment and enthusiasm for maths through practical activity, exploration and discussion.
- ensure children make useful connections; noticing patterns between mathematical ideas and practical real life problems.
- promote confidence and fluency with numbers and the number system.
- build resilient mathematicians who recognise that maths is an exciting journey of discovery and understanding
- understand the importance of mathematics in everyday life.
- provide opportunities for children to model deeper reasoning; recalling and applying knowledge rapidly and accurately

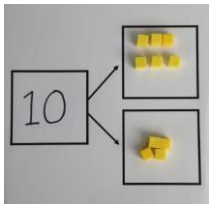
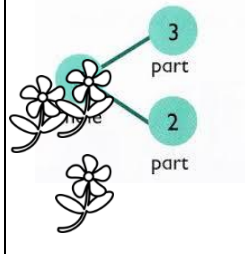
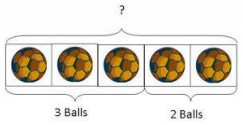
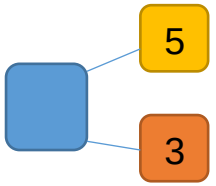
'For I know the plans I have for you,' declares the LORD, 'plans to prosper you and not to harm you, plans to give you hope and a future.' Jeremiah 29:11

This policy has been largely adapted from the White Rose Maths Hub Calculation Policy with further material added. To ensure consistency for pupils, it is important that that the mathematical language used in maths lessons reflects the vocabulary used throughout this policy. It is a working document and will be revised and amended as necessary. (Jan 2022)

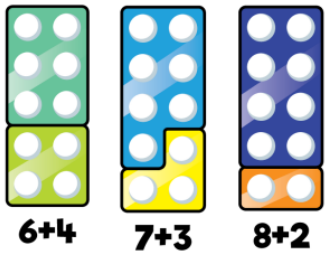
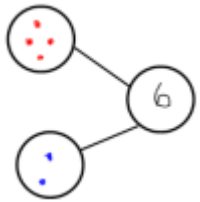
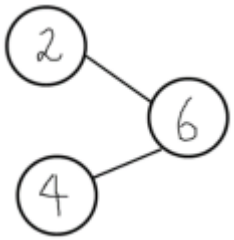
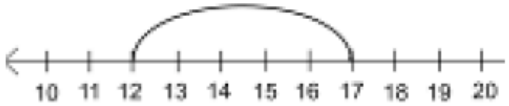
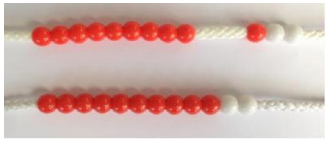
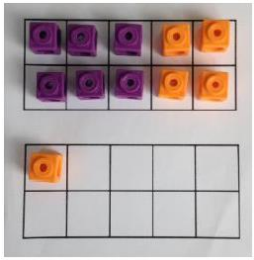
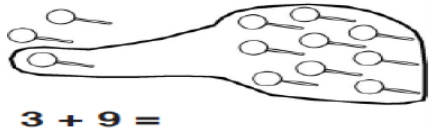
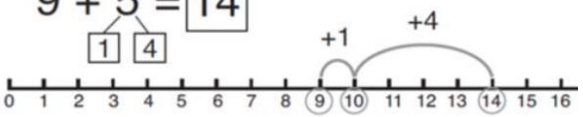
Addition

Key words:

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

Objective and Strategies	Concrete	Pictorial	Abstract
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 whole diagram as shown above to move into the abstract. 

'For I know the plans I have for you,' declares the LORD, 'plans to prosper you and not to harm you, plans to give you hope and a future.' Jeremiah 29:11

Explore number bonds (inc. subitising)	Using any resources including a range of manipulatives such as cubes and numicon.  	Children to use marks to explore number bonds.  	Explore written pa rt whole models. 
Starting at the bigger number and ing on	 Start with the larger number on the bead string and then count on to the smaller number 1 by 1 to find the answer.	12 + 5 = 17  Start at the larger number on the number line and count on in ones or in one jump to find the answer.	5 + 12 = 17 Place the larger number in your head and count on the smaller number to find your answer.
Regrouping to make 10.	6 + 5 = 11  Start with the bigger number and use the smaller number to make 10. 	Use pictures or a number line. Regroup or partition the smaller number to make 10.  3 + 9 = 9 + 5 = 14 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?

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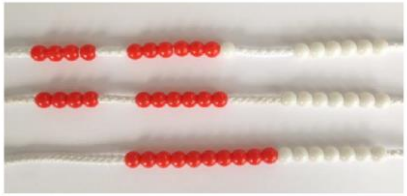
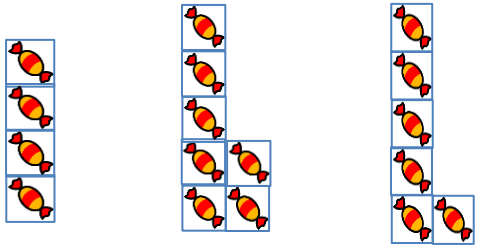
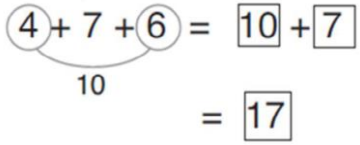
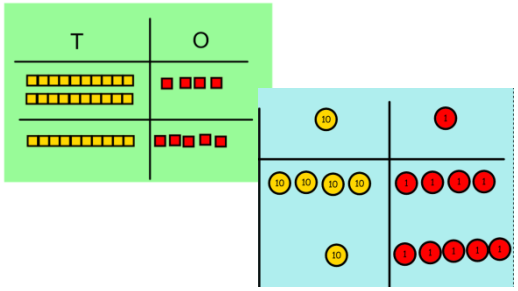
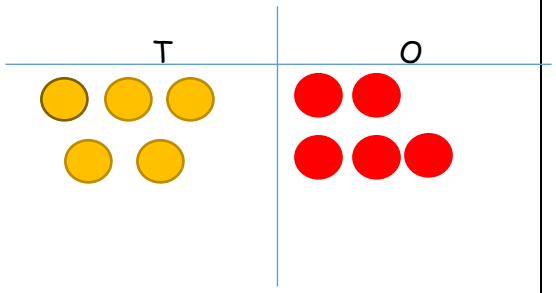
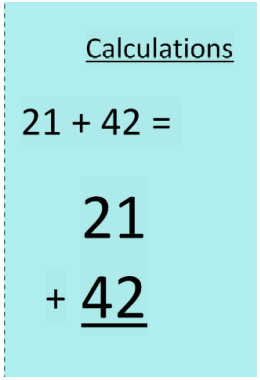
Adding three single digits	4 + 7 + 6= 17 Put 4 and 6 together to make 10. Add on 7.  Following on from making 10, make 10 with 2 of the digits (if possible) then add on the third digit.	4 + 7 + 6  Or regroup into 10 + 7  Add together three groups of objects. Draw a picture to recombine the groups to make 10.	 Combine the two numbers that make 10 and then add on the remainder.
Column method- no regrouping	24 + 15= Add together the ones first then add the tens. Use the Base 10 blocks first before moving onto place value counters.  Using base 10 to continue to develop partitioning and place value. 41 + 8	After practically using the base 10 blocks and place value counters, children can draw the counters to help them to solve additions.  Children to represent the base 10 e.g. lines for tens and dots/crosses for ones	 41 + 8 =

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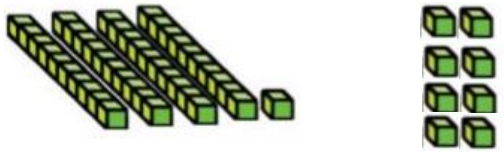
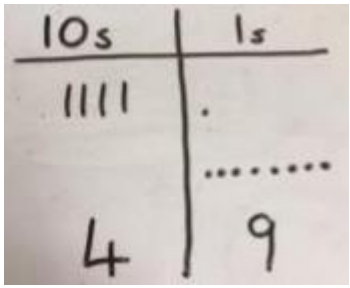
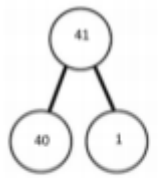
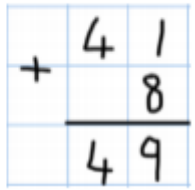
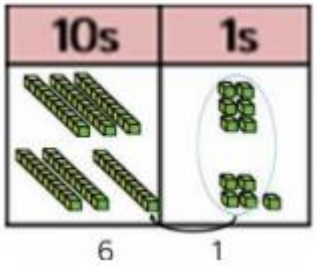
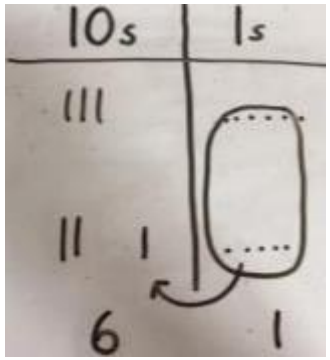
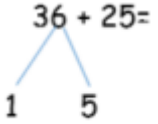
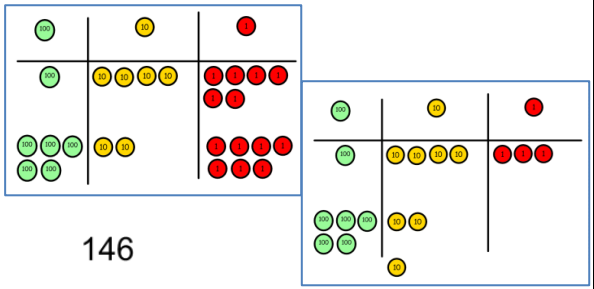
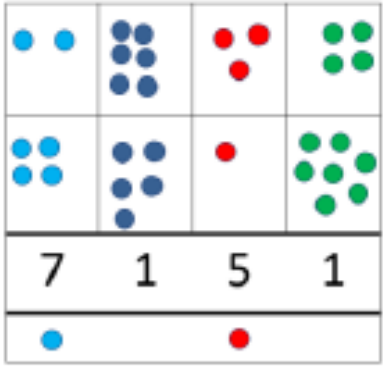
			 1 + 8 = 9 40 + 9 = 49 
Column method- regrouping	TO + TO using base 10 Continue to develop understanding of partitioning and place value 36 + 25 	Children to represent base 10 in a place value ch art 	Look for ways to make ten before moving onto the formal method, using column addition.  30 + 20 = 50 5 + 5 = 10 50 + 10 + 1 = 61 36 +25 61 1
Column method- regrouping	Make both numbers on a place value grid.  146 + 527 Add up the ones and exchange 10 ones for one 10.	Children can draw a pictoral representation of the columns and place value counters to further support their learning and understanding. 	Start by partitioning the numbers before moving on to clearly show the exchange below the addition. 20 + 5 40 + 8 60 + 13 = 73 536 + 85 621 1 1

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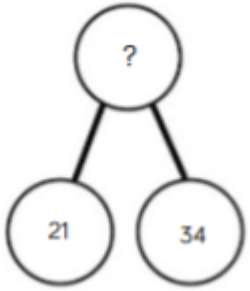
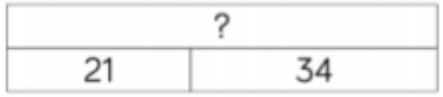
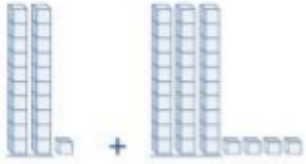
	Add up the rest of the columns, exchanging the 10 counters from one column for the next place value column until every column has been added. This can also be done with Base 10 to help children clearly see that 10 ones equal 1 ten and 10 tens equal 100. As children move on to decimals, money and decimal place value counters can be used to support learning.		As the children move on, introduce decimals with the same number of decimal places and different. Money can be used here. 72.8 + 54.6 127.4 1 1 £ 2 3 . 5 9 + £ 7 . 5 5 £ 3 1 . 1 4 1 1 1
Conceptual variation- Different ways to ask children to solve 21 + 34	 Word problems: In year 3, there are 21 children and in year 4, there are 34 children. How many children in total? 21 + 34 = 55. Prove it Missing digit problems:    21 +34 ___ 21 + 34 = ☐ = 21 + 34 Calculate the sum of twenty-one and thirty-four.	

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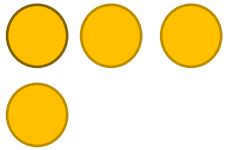
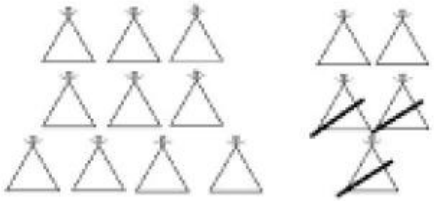
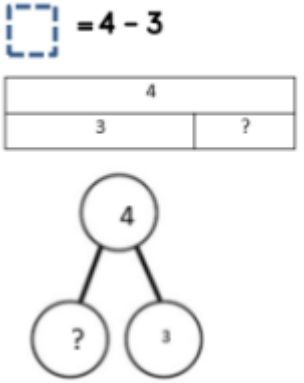
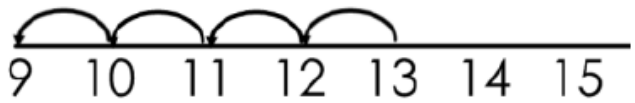
Subtraction

Key words:

take away, less than, find the difference between, subtract, minus, fewer, decrease

Objective and Strategies	Concrete	Pictorial	Abstract
Taking away ones	Use physical objects, counters, cubes etc to show how objects can be taken away.  6 – 2 = 4 4 – 2 = 4 	Cross out drawn objects to show what has been taken away.  15 – 3 = 12	18 -3= 15 
Counting back	Make the larger number in your subtraction. Move the beads along your bead string as you count backwards in ones.  13 – 4	Count back on a number line or number track  Start at the bigger number and count back the smaller number showing the jumps on the number line.	Put 13 in your head, count back 4. What number are you at? Use your fingers to help.

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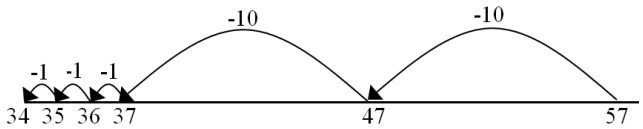
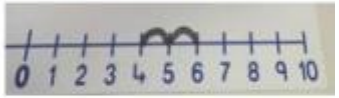
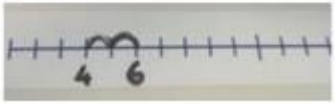
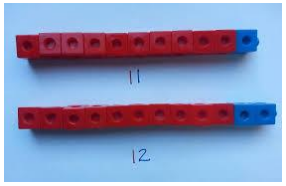
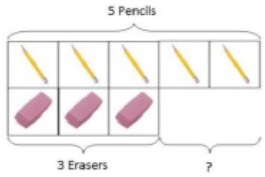
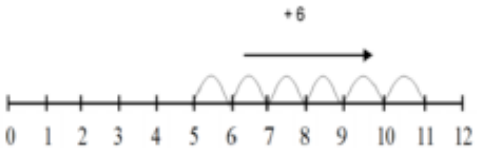
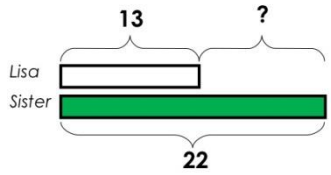
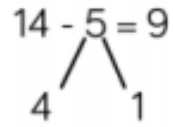
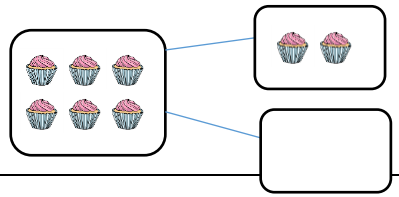
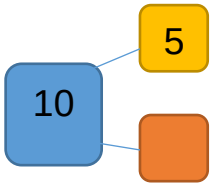
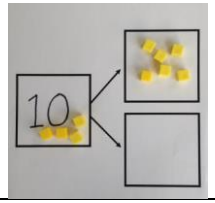
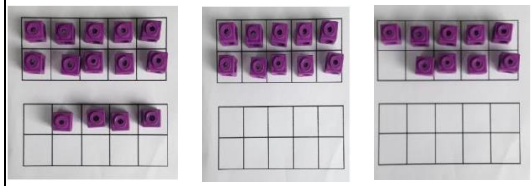
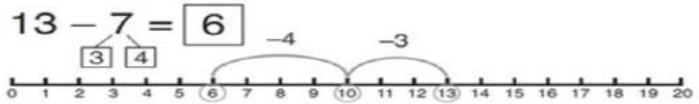
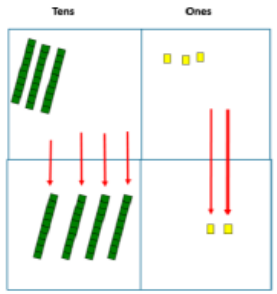
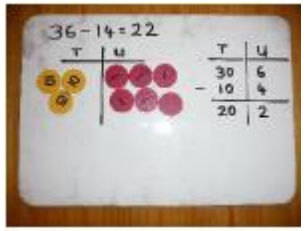
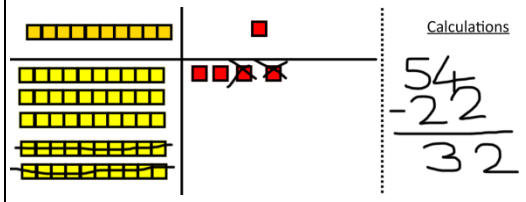
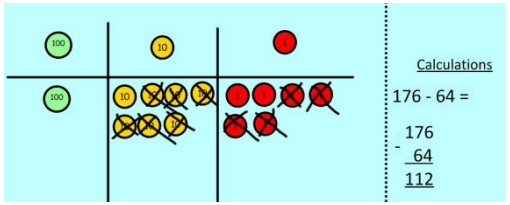
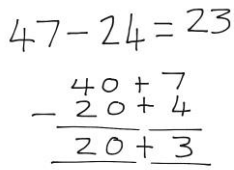
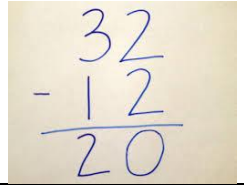
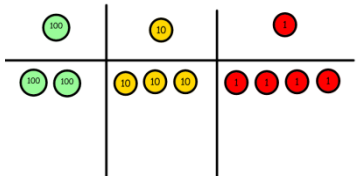
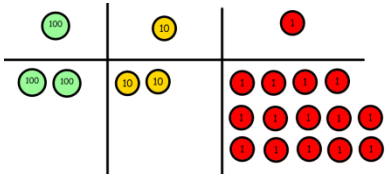
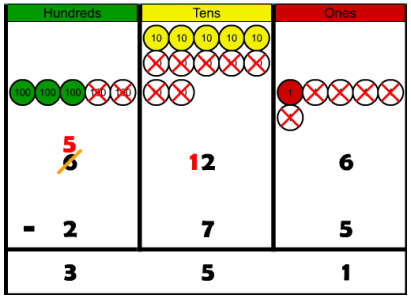
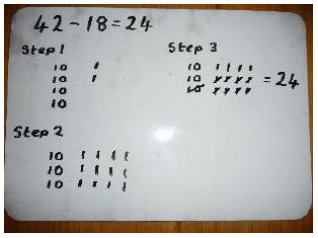
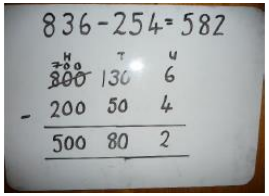
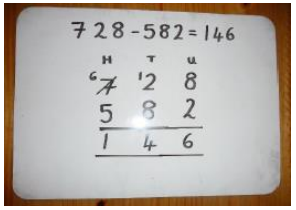
	Use counters and move them away from the group as you take them away counting backwards as you go. 	 This can progress all the way to counting back using two 2 digit numbers.	Children to represent the calculation on a number line or number track and show their jumps. Encourage children to use an empty number line  
Find the difference	Compare amounts and objects to find the difference.  Use cubes to build towers or make bars to find the difference  Use basic bar models with items to find the difference.	Children can use 'counting on' to find the difference 11- 5 =  Count on to find the difference. Draw bars to find the difference between 2 numbers. **Comparison Bar Models** *Lisa is 13 years old. Her sister is 22 years old. Find the difference in age between them.*  	Hannah has 23 sandwiches, Helen has 15 sandwiches. Find the difference between the number of sandwiches. Children can show how they can make ten by partitioning the subtrahend.  14 – 4 = 10 10 – 1 = 9
Part Whole Model	Link to addition- use the part whole model to help explain the inverse between addition and subtraction.	Use a pictorial representation of objects to show the part whole model. 	

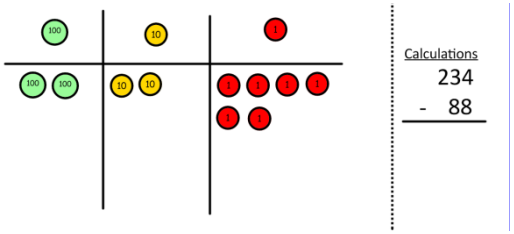
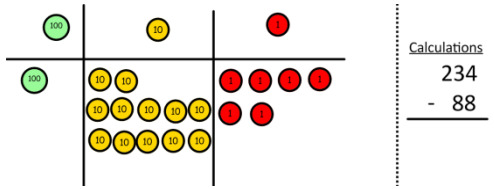
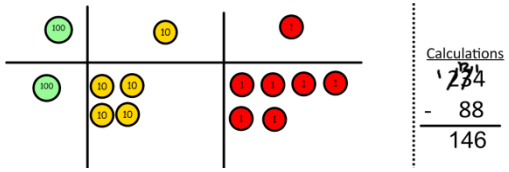
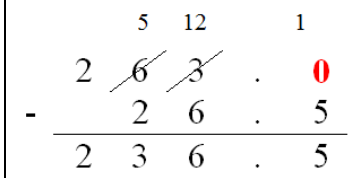
'For I know the plans I have for you,' declares the LORD, 'plans to prosper you and not to harm you, plans to give you hope and a future.' Jeremiah 29:11

	10 – 6 = If 10 is the whole and 6 is one of the parts. What is the other part? 		Move to using numbers within the part whole model.
Make 10	14 – 9 =  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.	 Start at 13. Take away 3 to reach 10. Then take away the remaining 4 so you have taken away 7 altogether. You have reached your answer.	16 – 8= How many do we take off to reach the next 10? How many do we have left to take off?
Column method without regrouping	75 – 42 =  Use Base 10 to make the bigger number then take the smaller number away. Show how you partition numbers to subtract. Again make the larger 	  Draw the Base 10 or place value counters alongside the written calculation to help to show working.	Expanded column subtraction 

‘For I know the plans I have for you,’ declares the LORD, ‘plans to prosper you and not to harm you, plans to give you hope and a future.’ Jeremiah 29:11

	number first.		This will lead to a clear written column subtraction. 
Column method with regrouping	Use Base 10 to start with before moving on to place value counters. Start with one exchange before moving onto subtractions with 2 exchanges. Make the larger number with the place value counters  Calculations 234 - 88 Start with the ones, can I take away 8 from 4 easily? I need to **exchange** one of my tens for ten ones.  Calculations 234 - 88	 Draw the counters onto a place value grid and show what you have taken away by crossing the counters out as well as clearly showing the exchanges you make.  When confident, children can find their own way to record the exchange/regrouping. Just writing the numbers as shown here shows that the child understands the method and knows when to exchange/regroup.	 Children can start their formal written method by partitioning the number into clear place value columns.  Moving forward the children use a more compact method. This will lead to an understanding of

‘For I know the plans I have for you,’ declares the LORD, ‘plans to prosper you and not to harm you, plans to give you hope and a future.’ Jeremiah 29:11

	Now I can subtract my ones.  Now look at the tens, can I take away 8 tens easily? I need to exchange one hundred for ten tens.  Now I can take away eight tens and complete my subtraction  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.		subtracting any number including decimals. 

‘For I know the plans I have for you,’ declares the LORD, ‘plans to prosper you and not to harm you, plans to give you hope and a future.’ Jeremiah 29:11

Conceptual variation: different ways to ask children to solve 391-186	

□ = 391 – 186

391

-186

What is 186 less than 391?

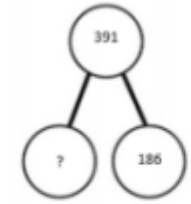
Missing digit calculations

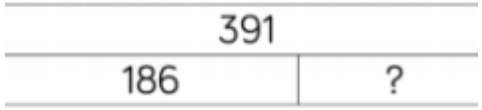
3 9 □

- □ □ 6

□ 0 5

Raj spent £391, Timmy spent £186.
How much more did Raj spend?
Calculate the difference between 391 and
186.

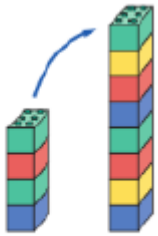
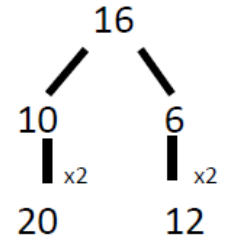




Multiplication

Key words:

double times, multiplied by, the product of, groups of, lots of, equal groups.

Objective and Strategies	Concrete	Pictorial	Abstract
Doubling	 double 4 is 8 4 × 2 = 8 Use practical activities to show how to double a number.	Draw pictures to show how to double a number. Double 4 is 8 	 Partition a number and then double each part before recombining it back together.

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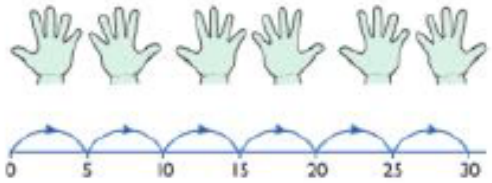
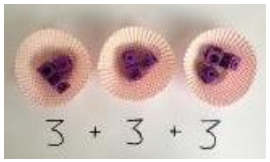
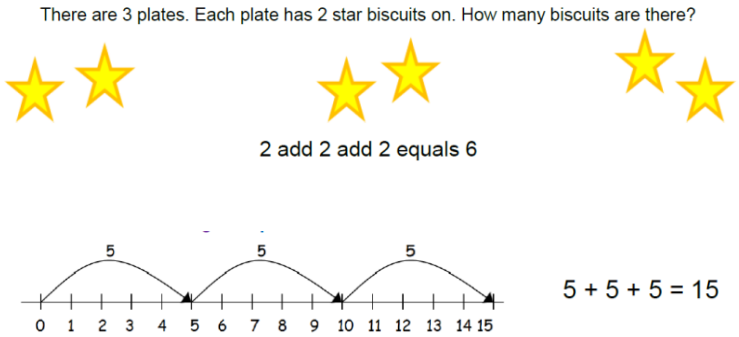
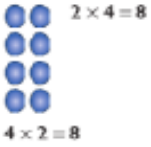
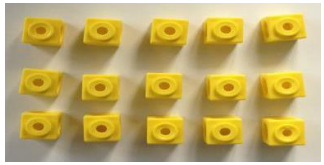
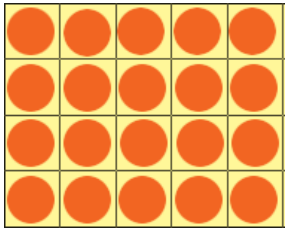
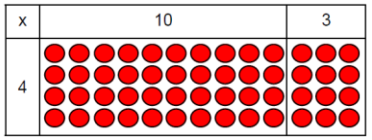
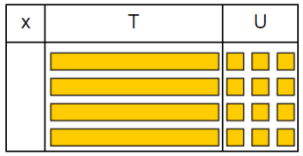
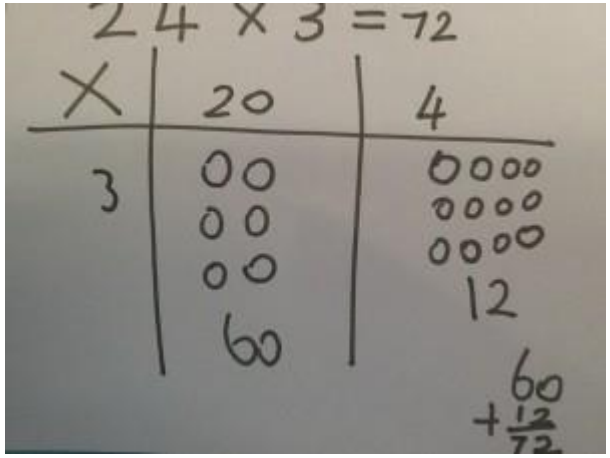
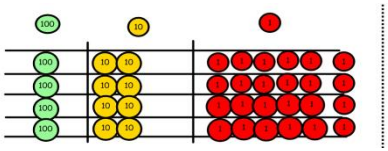
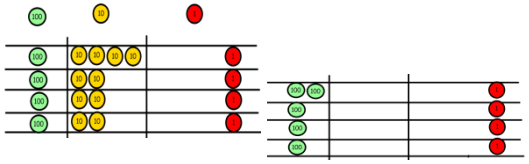
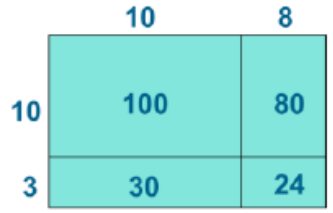
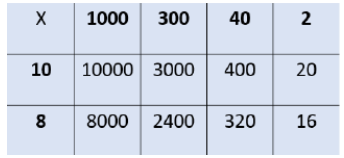
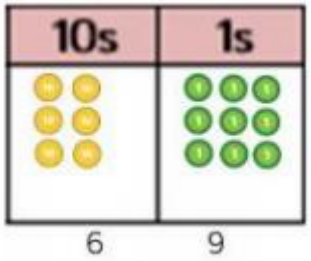
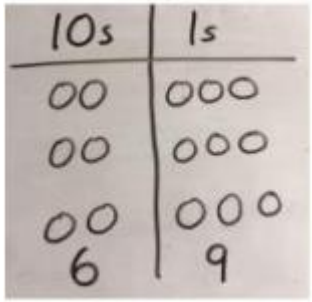
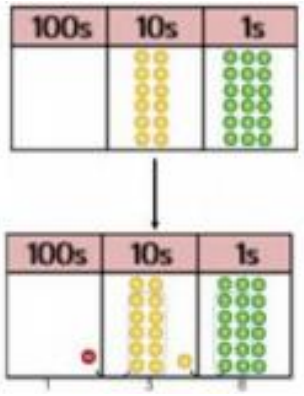
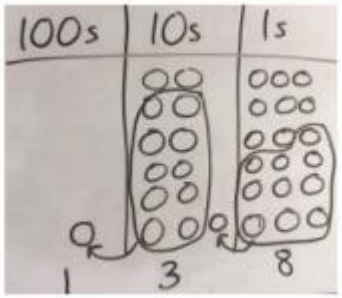
Counting in multiples	  Count in multiples supported by concrete objects in equal groups.	 Use a number line or pictures to continue support in counting in multiples.	Count in multiples of a number aloud. Write sequences with multiples of numbers. 2, 4, 6, 8, 10 5, 10, 15, 20, 25 , 30
Repeated addition	   Use different objects to add equal groups.	 	Write addition sentences to describe objects and pictures. 
Arrays- showing commutative multiplication	Create arrays using counters/ cubes to show multiplication sentences. 	Draw arrays in different rotations to find **commutative** multiplication sentences.   	Use an array to write multiplication sentences and reinforce repeated addition.

‘For I know the plans I have for you,’ declares the LORD, ‘plans to prosper you and not to harm you, plans to give you hope and a future.’ Jeremiah 29:11

		 Link arrays to area of rectangles.	 5 + 5 + 5 = 15 3 + 3 + 3 + 3 + 3 = 15 5 x 3 = 15 3 x 5 = 15
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. Fill each row with 126.	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. 	Start with multiplying by one digit numbers and showing the clear addition alongside the grid. | × | 30 | 5 | | 7 | 210 | 35 | 210 + 35 = 245 Moving forward, multiply by a 2 digit number showing the different rows within the grid method.

	 Calculations 4 x 126 Add up each column, starting with the ones making any exchanges needed.  Then you have your answer.		 10 8 10 100 80 3 30 24  X 1000 300 40 2 10 10000 3000 400 20 8 8000 2400 320 16
Column multiplication	Children can continue to be supported by place value counters at the stage of multiplication. 3 x 23  10s 1s 6 9 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 pictorially 3 x 23  10s 1s 6 9 Children to represent base 10/place value counters pictorially 6 x 23	Children to expand the column multiplication to show their understanding. 3 × 23 20 3 3 × 20 = 60 3 × 3 = 9 60 + 9 = 69 This moves to the more compact method. 23 × 3 69 Formal written method

‘For I know the plans I have for you,’ declares the LORD, ‘plans to prosper you and not to harm you, plans to give you hope and a future.’ Jeremiah 29:11

<table>
<tr>
<td></td>
<td>Formal written method with placce value counters
6 x 23
 
</td>
<td> 
</td>
<td>6 x 23 =
23
× 6
138
1 1</td>
</tr>
<tr>
<td>Conceptual variation; different ways to ask children to solve 6x23</td>
<td>What is the calculation?
What is the product?
 

Mai had to swim 23 lengths, 6 times a week.
How many lengths did she swim in one week?
With the counters, prove that 6 x 23 = 138
 

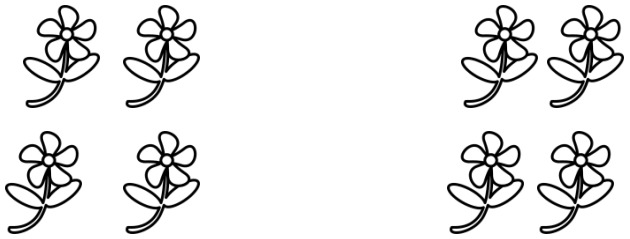
Find the product of 6 and 23
6 × 23 =
☐ = 6 × 23
6 × 23 = ___
23 × 6 = ___</td>
</tr>
</table>

‘For I know the plans I have for you,’ declares the LORD, ‘plans to prosper you and not to harm you, plans to give you hope and a future.’ Jeremiah 29:11

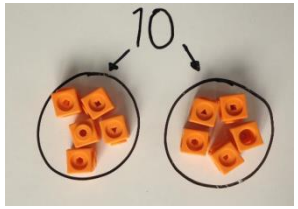
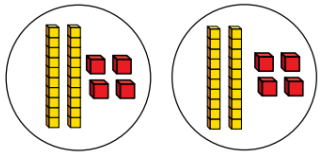
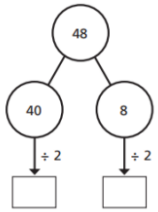
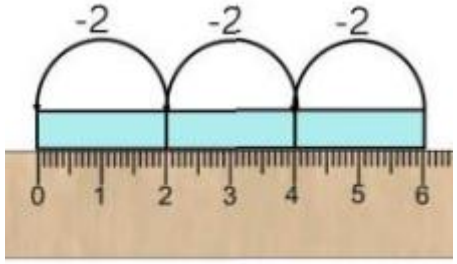
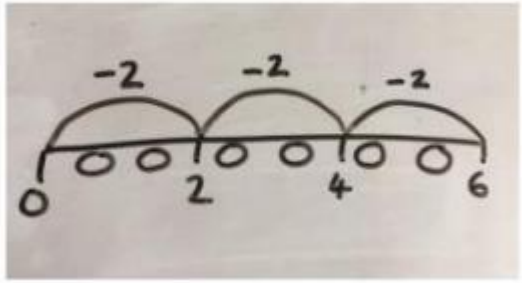
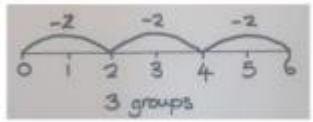
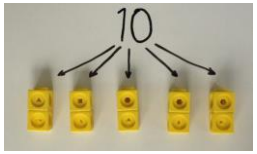
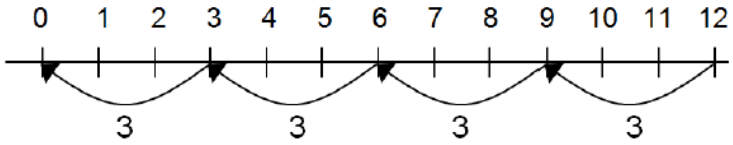
Division

Key words:

share, group, divide, divided by, half

Objective and Strategies	Concrete	Pictorial	Abstract
Sharing objects into groups	 I have 10 cubes, can you share them equally in 2 groups?	Children use pictures or shapes to share quantities.  8 ÷ 2 = 4	Share 9 buns between three people. 9 ÷ 3 = 3

‘For I know the plans I have for you,’ declares the LORD, ‘plans to prosper you and not to harm you, plans to give you hope and a future.’ Jeremiah 29:11

Halving	 10 ÷ 2 48 ÷ 2 	12 	Understanding halving is the same as dividing by 2 ½ of 6 = 3 6 ÷ 2 = 3 
Division as repeated subtraction	Repeated subtraction using cuisenaire rods  3 groups of 2	Children to represent repeated subtraction pictorially 	Abstract number line to represent the equal groups that have been subtracted 
Division as grouping	Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding. 	Use a number line to show jumps in groups. The number of jumps equals the number of groups. 	28 ÷ 7 = 4 Divide 28 into 7 groups. How many are in each group?

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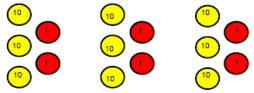
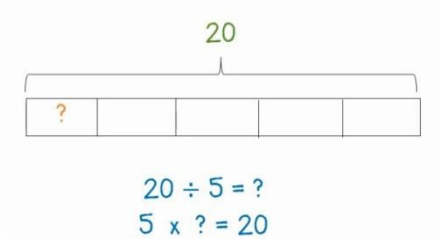
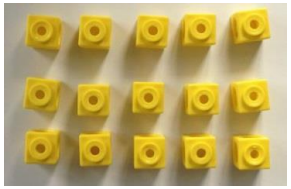
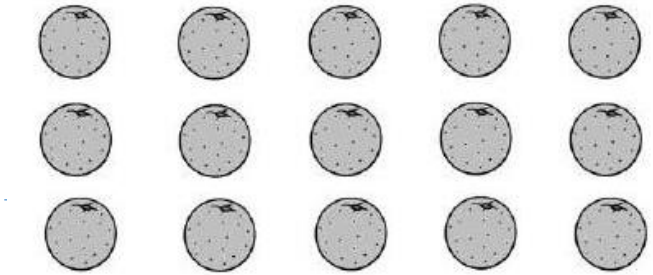
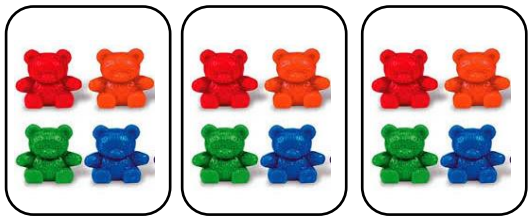
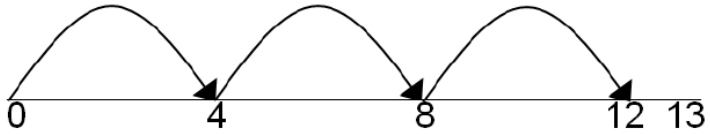
	  96 ÷ 3 = 32 	Think of the bar as a whole. Split it into the number of groups you are dividing by and work out how many would be within each group. 	
Division within arrays	Link division to multiplication by creating an array and thinking about the number sentences that can be created. 15 ÷ 3 = 5 5 x 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. 7 x 4 = 28 4 x 7 = 28 28 ÷ 7 = 4 28 ÷ 4 = 7
Division with a remainder	14 ÷ 3 = Divide objects between groups and see how much is left over 	Jump forward in equal jumps on a number line then see how many more you need to jump to find a remainder. 	Complete written divisions and show the remainder using r.  Children should be encouraged to use the time tables facts the could also represent repeated adition on a number line '3 groups of 8 with 5 left over'

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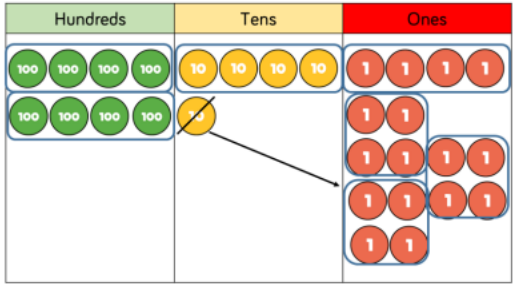
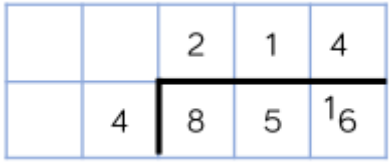
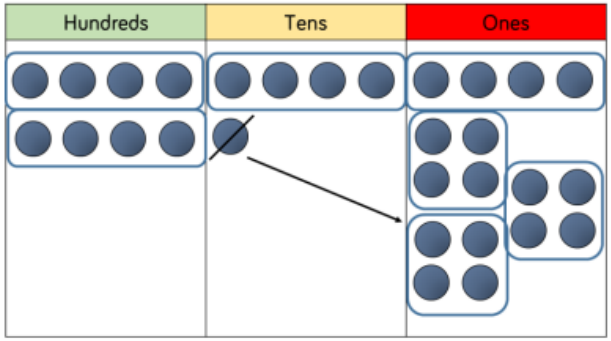
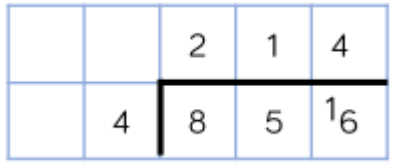
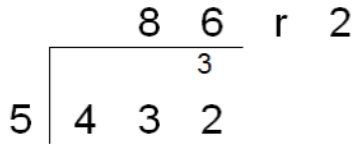
		Draw dots and group them to divide an amount and clearly show a remainder. 	
Short division	Using plave value counters to divide  	Represent the place valye counters pictorially 	Begin with divisions that divide equally with no remainder.  Move onto divisions with a remainder. 

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Short division- divide multiple digits by two digits

White rose multiplication and division calculation policy

		0	3	6
	12	4	$^{4}3$	$^{7}2$

432 ÷ 12 = 36

7,335 ÷ 15 = 489

	0	4	8	9
15	7	$^{7}3$	$^{13}3$	$^{13}5$

15	30	45	60	75	90	105	120	135	150

When children begin to divide up to 4-digits by 2-digits, written methods become the most accurate as concrete and pictorial representations become less effective. Children can write out multiples to support their calculations with larger remainders. Children will also solve problems with remainders where the quotient can be rounded as appropriate.

Long division- divide multiple digits by two digits

White rose multiplication and division calculation policy

		0	3	6
1	2	4	3	2
	–	3	6	0
			7	2
	–		7	2
				0

(×30)

(×6)

$12 \times 1 = 12$
$12 \times 2 = 24$
$12 \times 3 = 36$
$12 \times 4 = 48$
$12 \times 5 = 60$
$12 \times 6 = 72$
$12 \times 7 = 84$
$12 \times 8 = 96$
$12 \times 7 = 108$
$12 \times 10 = 120$

$432 \div 12 = 36$

$7{,}335 \div 15 = 489$

	0	4	8	9	
15	7	3	3	5	
–	6	0	0	0	(×400
	1	3	3	5	
–	1	2	0	0	(×80)
		1	3	5	
–		1	3	5	(×9)
				0	

$1 \times 15 = 15$
$2 \times 15 = 30$
$3 \times 15 = 45$
$4 \times 15 = 60$
$5 \times 15 = 75$
$10 \times 15 = 150$

Children can also divide by 2-digit numbers using long division.

Children can write out multiples to support their calculations with larger remainders.

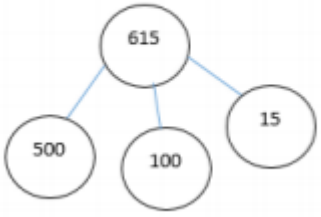
Children will also solve problems with remainders where the quotient can be rounded as appropriate.

Conceptual variation; different ways to ask children to solve 615÷5

I have £615 and share it equally between 5 bank accounts. How much will be in each account?

615 pupils need to be put into 5 groups. How many will be in each group?

Using the part whole model below, how can you divide 615 by 5 without using short division?



$5 \overline{)615}$

$615 \div 5 =$

$\square = 615 \div 5$

What is the calculation?
What is the answer?

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