Stathern Primary School

'Nurture, Inspire, Discover, Create'

Calculation Policy

2020-2021

Reviewed by teaching staff and ratified at the School Development Committee on:

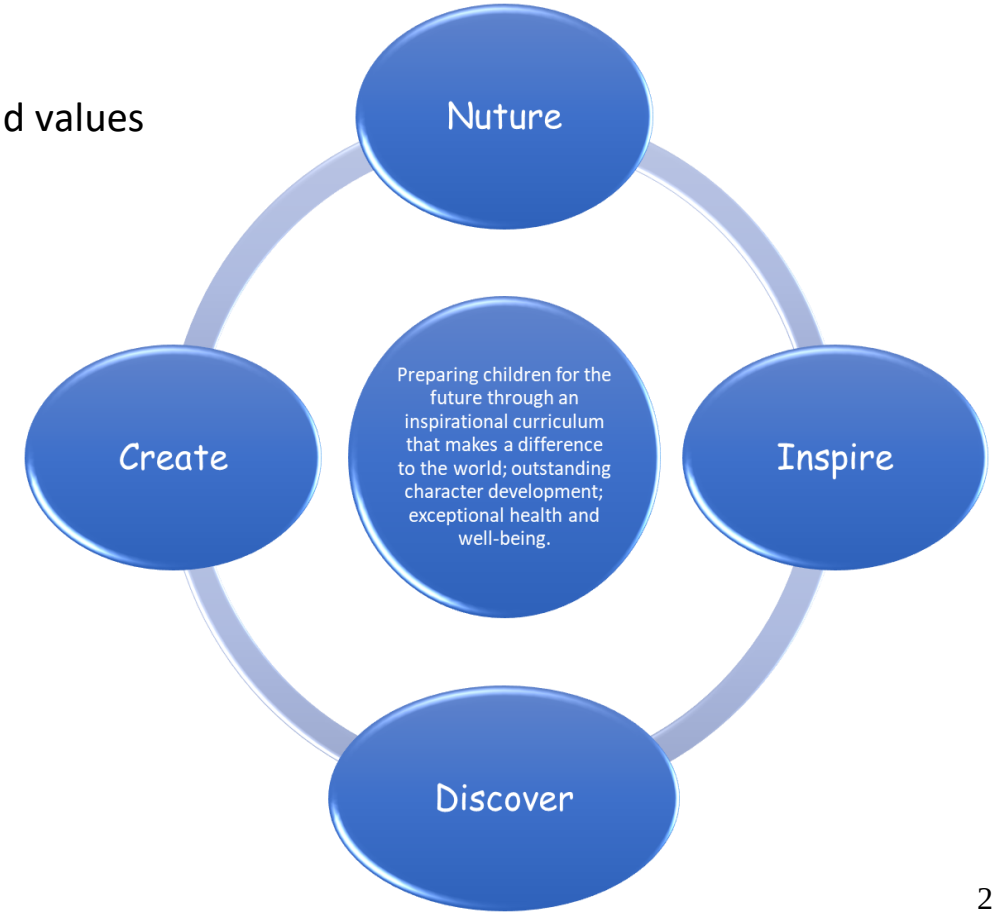
Signed:

Introduction

The following policy represents the agreed written calculation policy for Stathern Primary School. It reflects the progression of calculating skills for Key Stage 1 and Key Stage 2. It is based on the NCETM policy for Written Calculation.

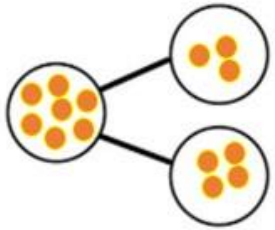
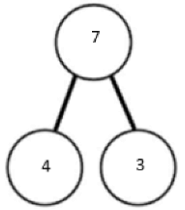
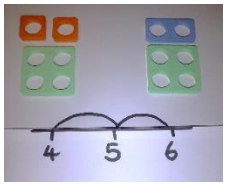
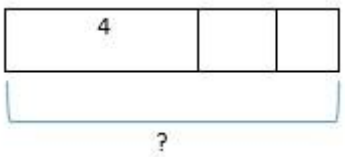
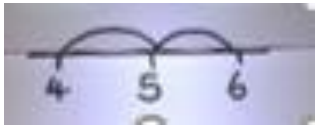
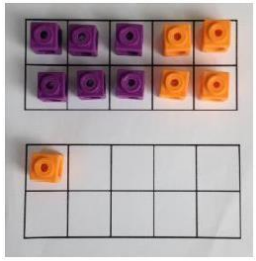
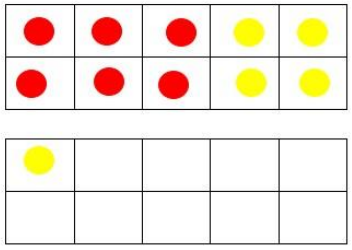
The Calculation Policy should be read in conjunction with the Mathematics Teaching and Learning Policy, Marking Policy and Feedback Policy for Stathern Primary School.

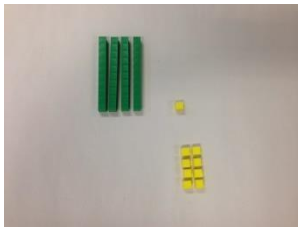
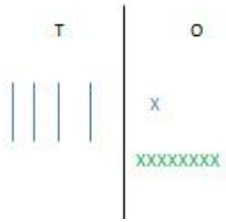
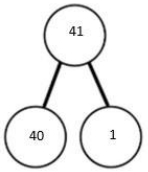
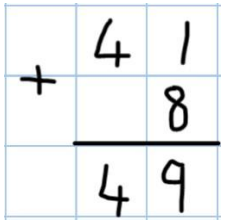
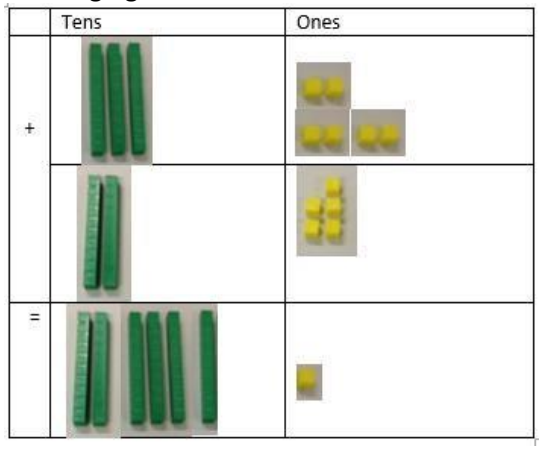
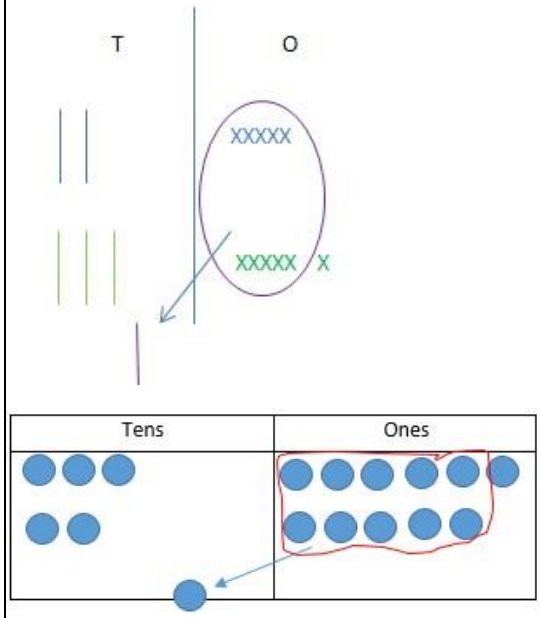
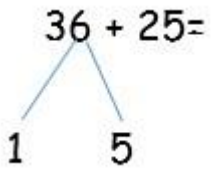
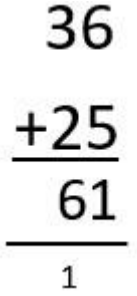
Our Calculation Policy supports our whole school ethos and values and embraces our 4 motto words.



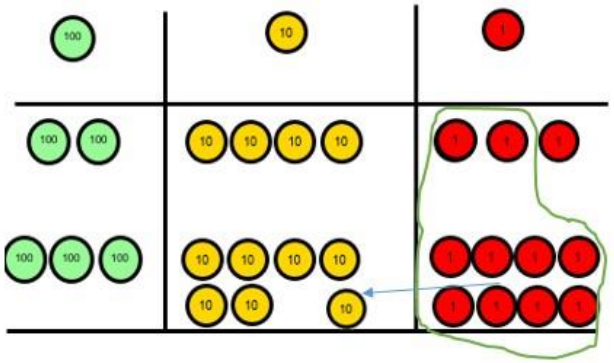
Addition

Key language which should be used: sum, total, parts and wholes, plus, add, altogether, more than, ‘is equal to’ ‘is the same as’

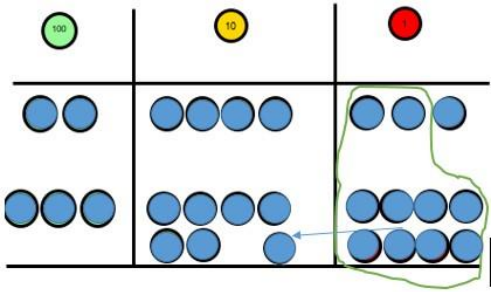
Concrete	Pictorial	Abstract
Combining two parts to make a whole (use other resources too e.g. eggs, shells, teddy bears etc.)  		4 + 3 = 7 (four is a part, 3 is a part and the whole is seven) 
Counting on using number lines by using cubes or numicon  	A bar model which encourages the children to count on 	The abstract number line: What is 2 more than 4? What is the sum of 4 and 4? What's the total of 4 and 2? 4 + 2 
Regrouping to make 10 by using ten frames and counters/cubes or using numicon: 6 + 5  	Children to draw the ten frame and counters/cubes 	Children to develop an understanding of equality e.g. 6 + ☐ = 11 and 6 + 5 = 5 + ☐ 6 + 5 = ☐ + 4

TO + O using base 10. Continue to develop understanding of partitioning and place value 41 + 8 	Children to represent the concrete using a particular symbol e.g. lines for tens and dot/crosses for ones. 	41 + 8  1 + 8 = 9 40 + 9 = 49 
TO + TO using base 10. Continue to develop understanding of partitioning and place value and use this to support addition. Begin with no exchanging. 36 + 25 	This could be done one of two ways: 	Looking for ways to m  30 + 20 = 50 5 + 5 = 10 50 + 10 + 1 = 61 Formal method: 

Use of place value counters to add HTO + TO, HTO + HTO etc. once the children have had practice with this, they should be able to apply it to larger numbers and the abstract



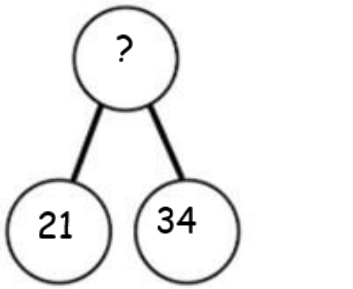
Chidren to represent the counters e.g. like the image below



If the children are completing a word problem, draw a bar model to represent what it's asking them to do

$$\begin{array}{r} 243 \\ +368 \\ \hline 611 \\ \hline 1\ 1 \end{array}$$

Fluency variation, different ways to ask children to solve 21+34:



Sam saved £21 one week and £34 another. How much did he save in total?

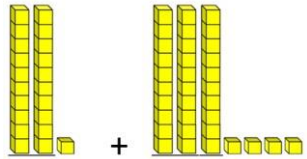
21+34=55. Prove it! (reasoning but the children need to be fluent in representing this)

$$\begin{array}{r} 21 \\ +34 \\ \hline \quad\quad \end{array}$$

21 + 34 =

$\square$ = 21 + 34

What's the sum of twenty one and thirty four?

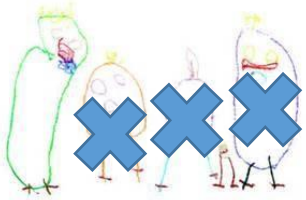
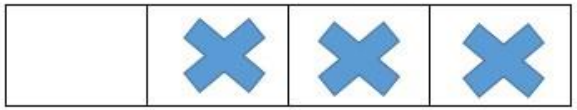
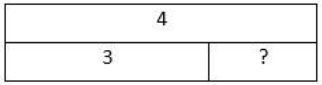
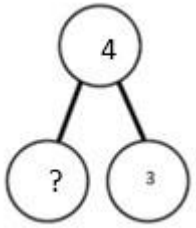


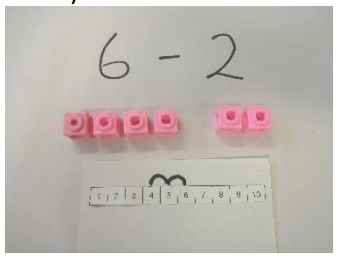
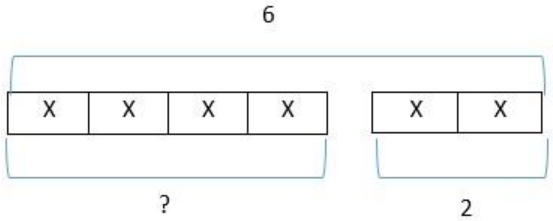
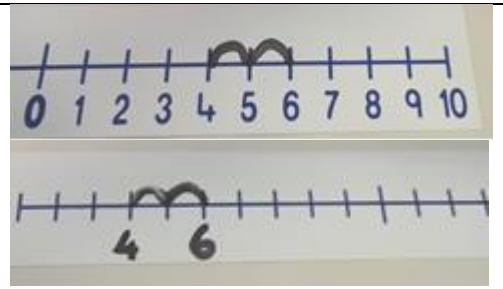
Always use missing digit problems too:

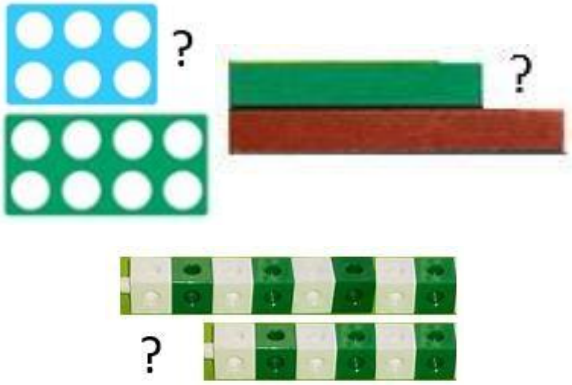
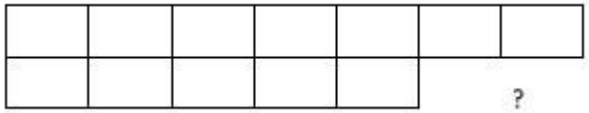
Tens	Ones
10 10	1
10 10 10	?
?	4

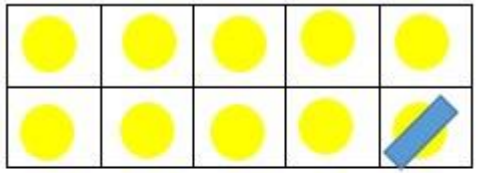
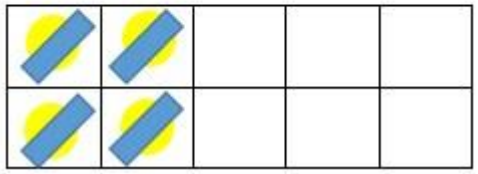
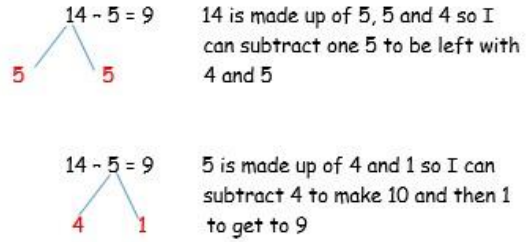
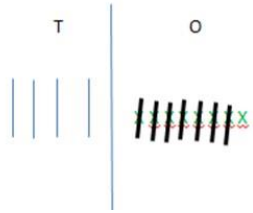
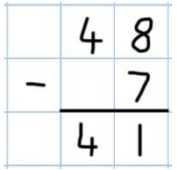
Subtraction

Key language which should be used: take away, less than, the difference, subtract, minus, fewer, decrease, '7 take away 3, the difference is four'

Concrete	Pictorial	Abstract
Physically taking away and removing objects from a whole (use various objects too) rather than crossing out- children will physically remove the objects 4 – 3 = 1 	Children to draw the concrete resources they are using and cross out.  Use of the bar model: 	**4- 3 =** □ = **4 – 3**  

Counting back (using number lines or number tracks) 	Children to represent what they see pictorially e.g. 	

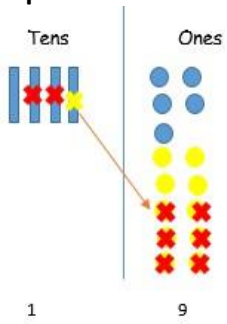
Finding the difference (using cubes, numicon or Cuisenaire rods, other objects can also be used) 	Children to draw the cubes/other concrete objects which they have used XXXXXXXX XXXXXX Use of the bar model 	Find the difference between 8 and 6. 8 – 6, the difference is? Children to also explore why 9- 7 = 8 – 6 (the difference, of each digit, has changed by 1 do the difference is the same- this will help when solving 10000-9987)

Making 10 (using numicon or ten frames) 14 – 5  **C**hildren could also do this by subtracting a 5 from the 10. 	Children to present the ten frame pictorially  	14 – 5 = 9 You also want children to see related facts e.g. 15 – 9 = 5 Children to represent how they have solved it e.g. 
Column method (using base 10) 48-7 		48 – 7 = 

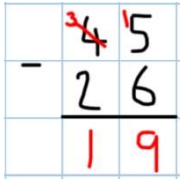
Column method (using base 10 and having to exchange) **45-26**

1) Start by partitioning 45
2) Exchange one ten for ten more ones
3) Subtract the ones, then the tens.

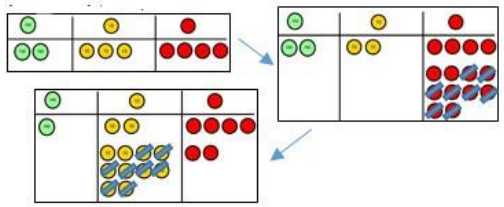
Represent the base 10 pictorially



It's crucial that the children understand that when they have exchanged the 10 they still have 45. 45 = 30 + 15

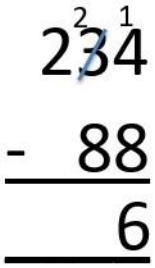


Column method (using place value counters) 234-88

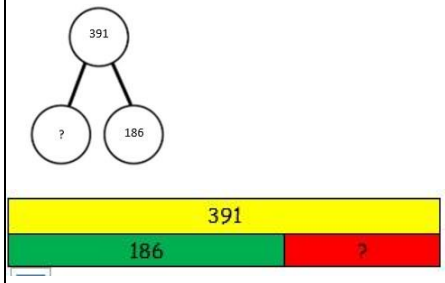


Once the children have had practice with the concrete, they should be able to apply it to any subtraction.

Like the other pictorial representations, children to represent the counters.



Fluency variation, different ways to ask children to solve 391-186:

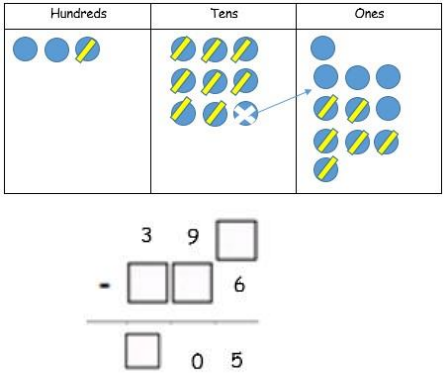


Raj spent £391, Timmy spent £186. How much more did Raj spend?

I had 391 metres to run. After 186 I stopped. How many metres do I have left to run?

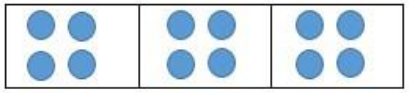
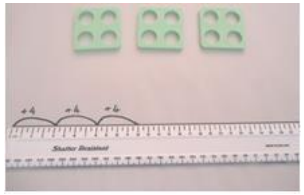
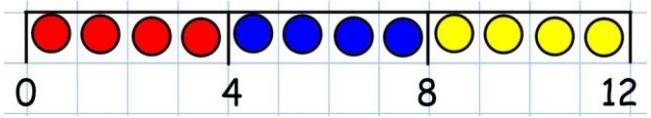
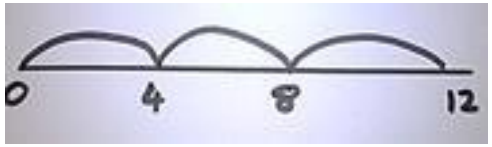
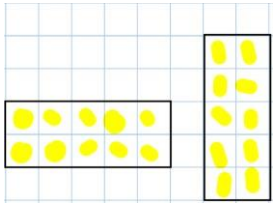
391 – 186

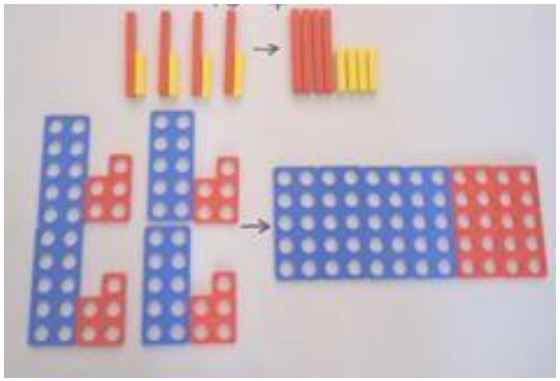
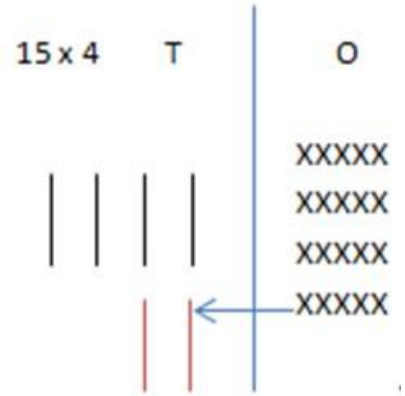
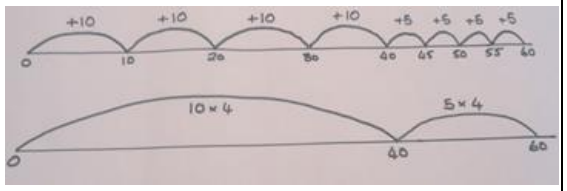
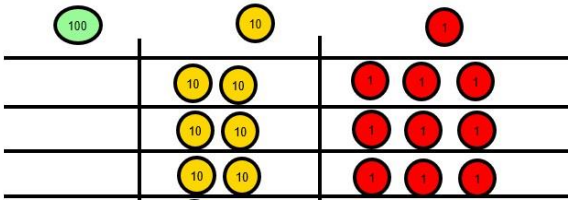
What's the calculation? What's the answer?



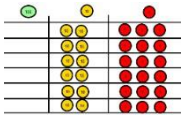
Multiplication

Key language which should be used: double times, multiplied by, the product of, groups of, lots of, 'is equal to' 'is the same as'

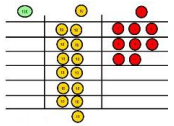
Concrete	***Pictorial***	***Abstract***
Repeated grouping/repeated addition *(does not have to be restricted to cubes)* *3 x 4 or 3 lots of 4* 	*Children to represent the practical resources in a picture e.g.* ***XX XX XX*** ***XX XX XX*** *Use of a bar model for a more structured method* 	3 *x 4* 4 *+ 4 + 4*
Use number lines to show repeated groups- *3 x 4*  	*Represent this pictorially alongside a number line e.g:* 	*Abstract number line* ***3 x 4 = 12*** 
Use arrays to illustrate commutativity *(counters and other objects can also be used)* ***2 x 5 = 5 x 2***   	*Children to draw the arrays* 	*Children to be able to use an array to write a range of calculations e.g.* *2 x 5 = 10* *5 x 2 = 10* *2 + 2 + 2 + 2 + 2 = 10* *5 + 5 =10*

Partition to multiply *(use numicon, base 10, Cuisenaire rods)* *4 x 15* 	*Children to represent the concrete manipulatives in a picture e.g. base 10 can be represented like:* 	*Children to be encouraged to show the steps they have taken* 4 x 15 10 5 10 x 4 = 40 5 x 4 = 20 40 + 20 = 60 *A number line can also be used* 
Formal column method *with place value counters or base 10 (at the first stage- no exchanging) 3 x 23* *Make 23, 3 times. See how many ones, then how many tens* 	***Children to represent the counters in a pictorial way*** 	*Children to record what it is they are doing to show understanding* *3 x 23* *20 3* *3 x 20 = 60* *3 x 3 = 9* *60 + 9= 69* 23 × 3 69
Formal column method *with place value counters (children need this stage, initially, to understand how the column method works)*	*Children to represent the counters/base 10, pictorially e.g. the image below.*	***6 x 23*** *6 x 3 = 18* *6 x 20 = 120* *120 + 18 = 138*

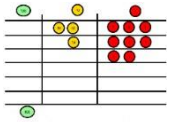
6 x 23



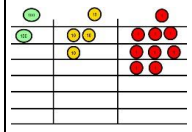
***Step 1**: get 6 lots of 23*



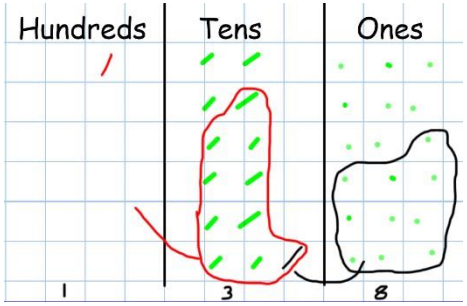
***Step 2**: 6 x 3 is 18. Can I make an exchange? Yes!*
Ten ones for one ten….



***Step 3**: 6 x 2 tens and my extra ten is 13 tens. Can I make an exchange? Yes! Ten tens for one hundred…*



***Step 4**- what do I have I each column?*



The aim is to get to the formal method but the children need to understand how it works.

$$\begin{array}{r} 6 \times 23 = \\ 23 \\ \times\ \ 6 \\ \hline 138 \\ \hline \end{array}$$

1 1

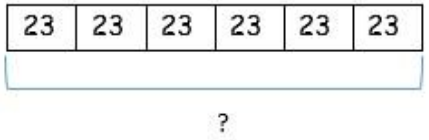
When children start to multiply 3d x 3d and 4d x 2d etc., they should be confident with the abstract:

To get 744 children have solved 6 x 124
To get 2480 they have solved 20 x 124

$$\begin{array}{rrrr} & 1 & 2 & 4 \\ \times & & 2 & 6 \\ \hline & {\scriptstyle 1}7 & {\scriptstyle 2}4 & 4 \\ 2 & {\scriptstyle 1}4 & 8 & 0 \\ \hline 3 & 2 & 2 & 4 \\ \hline & 1 & 1 & \end{array}$$

Answer: 3224

Fluency variation, different ways to ask children to solve 6 x 23:



With the counters, prove that 6 x 23 = 138

Why is 6 x 23 = 32 x 6?

Mai had to swim 23 lengths, 6 times a week. How many lengths did she swim in one week?

Tom saved 23p three days a week. How much did he save in 2 weeks?

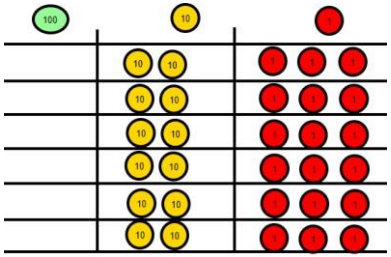
Find the product of 6 and 23

6 x 23 =

☐ *= 6 x 23*

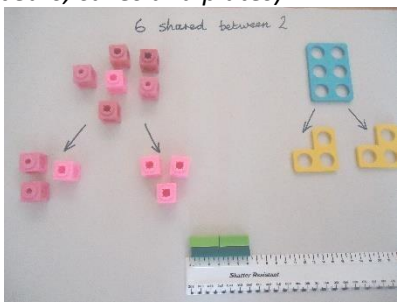
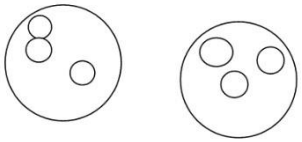
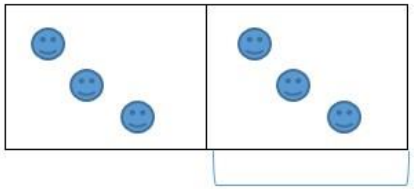
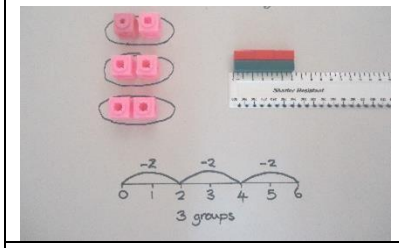
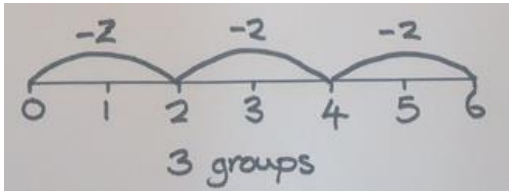
$$\begin{array}{r} 6 \\ \times\ 23 \\ \hline \end{array} \qquad \begin{array}{r} 23 \\ \times\ 6 \\ \hline \end{array}$$

What's the calculation? What's the answer?

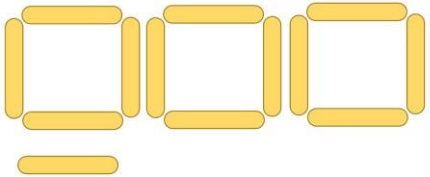


Division

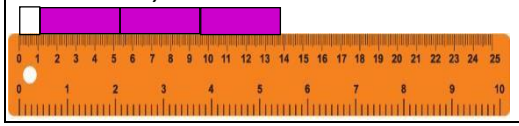
Key language which should be used: share, group, divide, divided by, half, 'is equal to' 'is the same as'

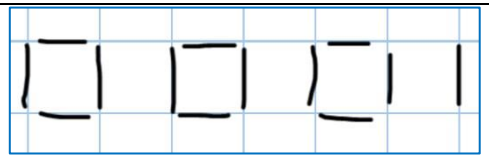
Concrete	***Pictorial***	***Abstract***
6 shared between 2 *(other concrete objects can also be used e.g. children and hoops, teddy bears, cakes and plates)* 	ıs  *This can also be done in a bar so all 4 operation have a similar structure:* 	*6 ÷ 2 = 3* *What's the calculation?* 3 | 3
Understand division as repeated grouping and subtracting *6 ÷ 2* 		*Abstract number line* 
2d ÷ 1d with remainders *13 ÷ 4 – 3 remainder 1*	*Children to have chance to represent the resources they use in a pictorial way e.g. see below:*	*13 ÷ 4 – 3 remainder 1* *Children to count their times tables facts in their heads*

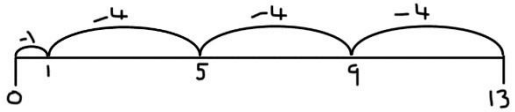
Use of lollipop sticks to form wholes



Use of Cuisenaire rods and rulers (using repeated subtraction)

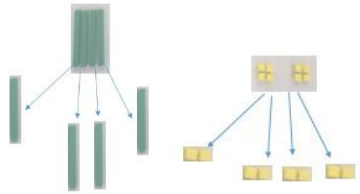






2d divided by 1d using base 10 *(no remainders) SHARING*

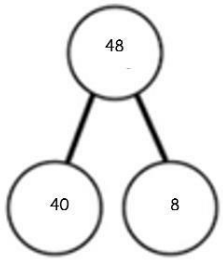
48 ÷ 4 = 12



Start with the tens.

Children to represent the base 10 and sharing pictorially.

48 ÷ 4



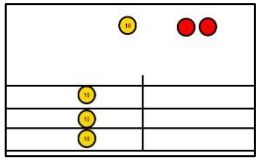
4 tens ÷ 4 = 1 ten

8 ones ÷ 4 = 2 ones

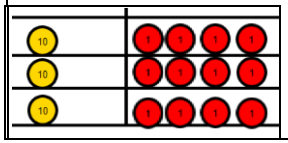
10 + 2 = 12

Sharing using place value counters.

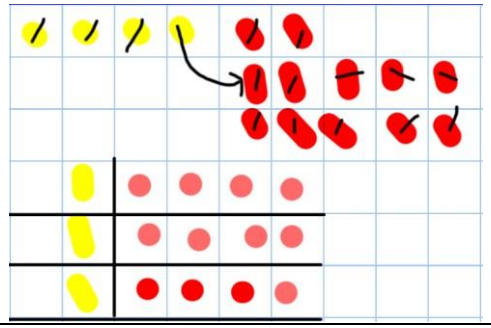
42 ÷ 3= 14



1. Make 42. Share the 4 tens between 3. Can we make an exchange with the extra 10?



Exchange the ten for 10 ones and share out 12 ones



42 ÷ 3

42 = 30 + 12

30 ÷ 3 = 10

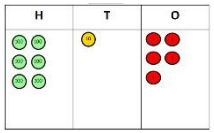
12 ÷ 3 = 4

10 + 4 = 14

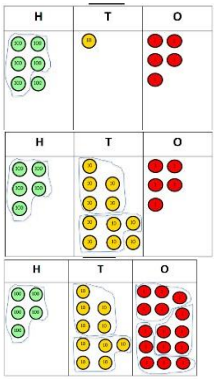
Use of the 'bus stop method' *using grouping and counters. Key language for grouping- how many groups of X can we make with X hundreds'-* **this can also be done using sharing!**

615 ÷ 5

Step 1: make 615



Circle your groups



Step 2: of 5

Step 3: Exchange 1H for 10T and circle groups of 5

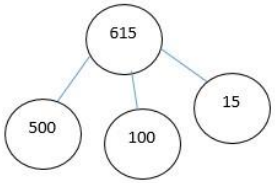
Step 4: exchange 1T for 10ones and circles groups of 5

This can easily be represented pictorially, till the children no longer to do it.
It can also be done to decimal places if you have a remainder!

$$5\overline{)615}\quad \begin{matrix}123\\ {}^{1}{}^{1}\end{matrix}$$

Fluency variation, different ways to ask children to solve 615 ÷ 5:

Using the part whole model below, how can you divide 615 by 5 without using the 'bus stop' method?



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?

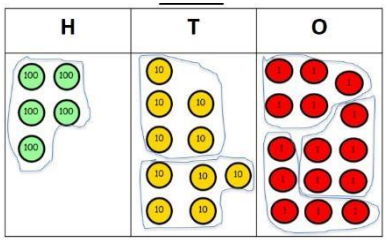
$5\overline{)615}$

615 ÷ 5 =

☐ *= 615 ÷ 5*

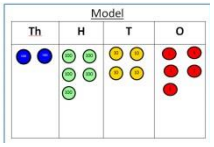
How many 5's go into 615?

What's the calculation? What's the answer?



Long Division

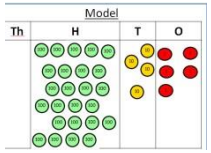
Concrete	*Pictorial*	*Abstract*



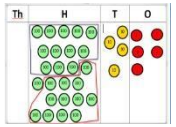
$$\begin{array}{r} 0\,2\,1\,2 \\ 12\overline{)\,2544} \\ 24 \\ \hline 14 \\ 12 \\ \hline 24 \\ 24 \\ \hline 0 \end{array}$$

2544 ÷ 12

How many groups of 12 thousands do we have? None



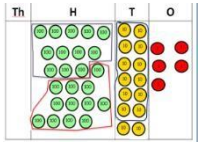
Exchange 2 thousand for 20 hundreds.



$$\begin{array}{r} 0\,2 \\ 12\overline{)\,2544} \\ 24 \\ \hline 1 \end{array}$$

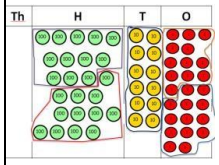
How many groups of 12 are in 25 hundreds? 2 groups.

Circle them. We have grouped 24 hundreds so can take them off and we are left with one.



$$\begin{array}{r} 0\,2\,1 \\ 12\overline{)\,2544} \\ 24 \\ \hline 14 \\ 12 \\ \hline 2 \end{array}$$

Exchange the one hundred for ten tens so now we have 14 tens. How many groups of 12 are in 14? 1 remainder 2.



Exchange the two tens for twenty ones so now we have 24 ones. How many groups of 12 are in 24? 2

Children to represent the counters, pictorially and record the subtractions beneath.

$$\begin{array}{r} 0 \\ 12\overline{)\,2544} \end{array}$$

Step one- exchange 2 thousand for 20 hundreds so we now have 25 hundreds.

$$\begin{array}{r} 0\,2 \\ 12\overline{)\,2544} \\ 24 \\ \hline 1 \end{array}$$

Step two- How many groups of 12 can I make with 25 hundreds? The 24 shows the hundreds we have grouped. The one is how many hundreds we have left.

$$\begin{array}{r} 0\,2\,1 \\ 12\overline{)\,2544} \\ 24 \\ \hline 14 \\ 12 \\ \hline 2 \end{array}$$

Exchange the one hundred for 10 tens. How many groups of 12 can I make with 14 tens? The 14 shows how many tens I have, the 12 is how many I grouped and the 2 is how many tens I have left.

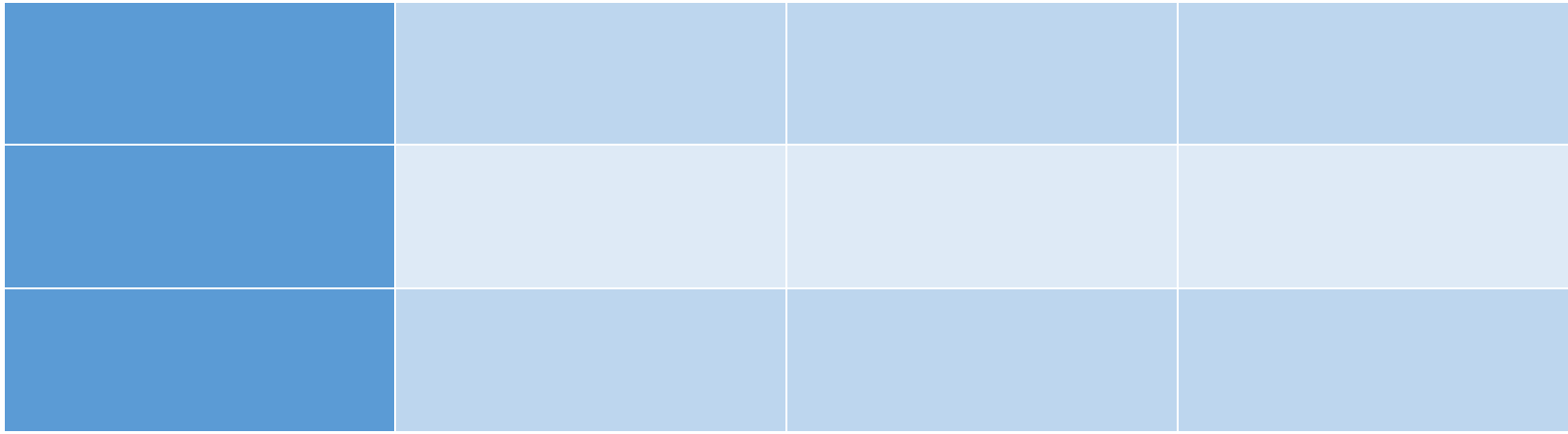
$$\begin{array}{r} 0\,2\,1\,2 \\ 12\overline{)\,2544} \\ 24 \\ \hline 14 \\ 12 \\ \hline 24 \\ 24 \\ \hline 0 \end{array}$$

Exchange the 2 tens for 20 ones. The 24 is how many ones I have grouped and the 0 is what I have left.

This policy should be reviewed annually by the SDC and presented for approval to the Full Governing Body.

Log of changes and updates to the document:

Date	Page	Change	Approver
5/11/2020	All	Policy created by Maths Leader – EM and reviewed with HT	KL
11/11/2020	All	Reviewed at staff meeting	
	All	Reviewed by governors	SDC



Appendix A