Heronsgate School Mathematics Policy
September 2023

Review date: July 2024

Vision and Aims for Pupils:

At Heronsgate School, we aim to support the idea that everyone can do mathematics. We do this by using a teaching for mastery approach. We believe that the ability to calculate number, work logically to solve problems and apply newly learnt skills and knowledge is a vital life skill. All pupils are encouraged by the belief that by working hard at mathematics they can succeed.

Curriculum Structure

The curriculum is broken down into small, connected steps that gradually unfold the concept, providing access for all children and leading to a generalisation of the concept and the ability to apply that concept to a range of contexts. One planned lesson may take several lessons of teaching before the children are secure with a new concept. Representations used in lessons reveal the mathematical structure being taught, the aim being that children can do the maths without the need for resources. If taught ideas are to be understood deeply, they must

not solely be passively received but must be worked on by the children: thought about, reasoned with and discussed with others, both peers and adults.

Planning and Teaching:

It is expected that a typical lesson will use the CPA approach: concrete, pictorial, abstract. This approach allows the children to experience the physical aspects of Maths, using resources, before discovering a way to present their findings and understandings in a pictorial form and then moving onto a more formal written calculation. To ensure children are fluent in their mental maths and multiplications, each lesson begins with a mental starter, such as 'Fluent in Five', plus a times table grid (this increases with each year group). This is strengthened at home through the use of TT Rockstars and Sumdog as well as MyMaths and written homework.

Long Term Planning

The National Curriculum for Mathematics 2014 provides the long-term planning for mathematics taught in the school.

Medium Term Planning

Teachers use the MathsNo Problem! schemes of learning, as well as White Rose resources (these are used to reinforce concepts) to create medium-term plan for each block. They support a mastery approach to teaching and learning and have number at their core. They ensure teachers stay within the required year group and support the ideal of depth before breadth. They support pupils working together as a whole group and provide plenty of time to build reasoning and problem-solving elements into the curriculum.

Short Term Planning

Lessons are planned using a Learning Objective (LO) which sets out the key learning in the lesson. The Success Criteria (SC) is shared with the class during the lesson so that the children can access whether they have been successful.

Concrete/Pictorial/Abstract Approach – (See Appendix 1)

The children are introduced to a new concept or skill by acting it out with concrete apparatus such as multi-link cubes or counters. This hands on approach is the basis for conceptual understanding and is used though out the school. Pictorial representation is used when a child has sufficiently understood the hands-on experiences and can now relate them to representations, such as a diagram or picture of the problem.

Abstract representation is the symbolic stage where a pupil is now capable of representing problems by using mathematical notion. This is clearly the trickiest of the three approaches and children need to be secure in the first two approaches before they are able to move onto the third.

Assessment and Feedback:

Children mark their own work, so that they are able to see immediately whether they have understood the concept and have been successful. This takes place at different points within the lesson. During the end of the lesson the teacher marks pupils' books, this gives them the opportunity to 'pick-up' those children who may need extra practice before the next lesson. Verbal feedback is given during the lesson, with teachers modelling examples in books. Assessment is an integral part of teaching and learning and is a continuous process. Teachers make assessments of pupils daily by regular marking of work; analysing and picking up on misconceptions; asking questions and listening to answers and making observations. These ongoing assessment inform planning and teaching, with lessons being adapted and evaluated. Summative assessments are carried out across the school every term – Years 3-5 using MathsNo Problem! assessment materials and Year 6 using past Sats papers. These scores, alongside judgements made from class work support the teacher to assess whether a child is meeting age related expectations.

Homework and Parental Engagement:

Homework is set on a weekly basis and children are encouraged to complete it. Homework is linked to the lessons taught in class – online and paper homework are set on alternate weeks. For those children who are unable to access the online homework, they are given the opportunity to complete it at school.

Inclusion and SEND:

Pupils identified on the SEND register are assess against the National Curriculum Age related expectations in the year group in which they are in or from an earlier year group. Some children are assessed using the PIVATS document (pre- National Curriculum Levels).

Resources and Displays:

All classes have access to concrete resources, which supports the teaching of maths within the school. It is the expectation that each class room has a Maths Learning Wall, where examples of the concept being taught is on display – this should be used as an aid for learning and support for the children. Misconceptions are on display; these are talked though, giving the children the opportunity to work through any errors.

Cross curricular links:

In addition to taught Maths lessons, maths is linked to other areas of the curriculum. Such as science, geography, design technology and art, where children are able to use their problem solving skills.

Appendix 1

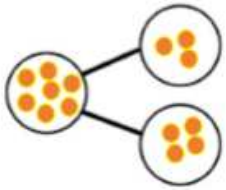
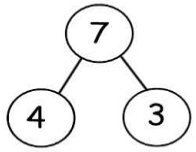
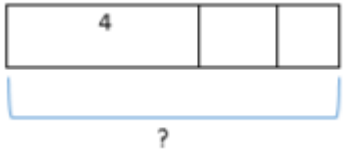
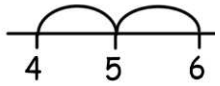
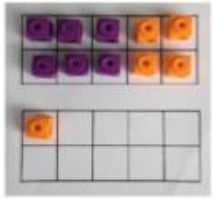
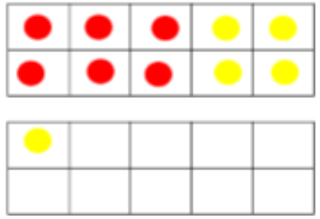
Heronsgate School Calculation Policy September 2023

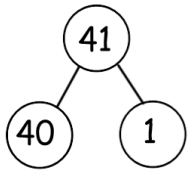
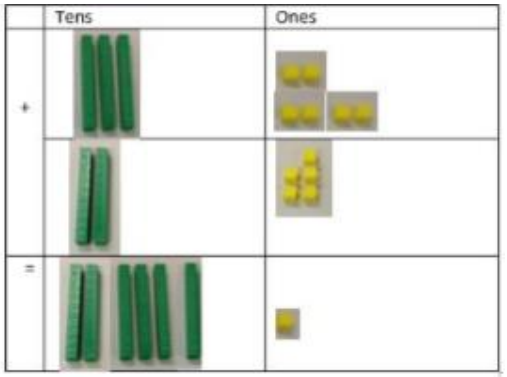
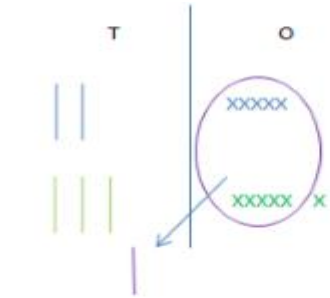
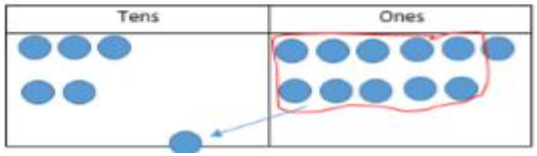
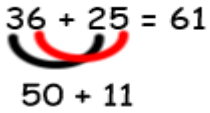
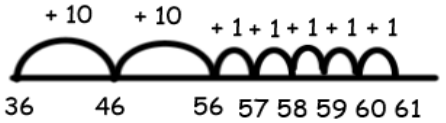
Heronsgate is operated by Milton Keynes Education Trust which is a charitable company Limited by guarantee and registered in England and Wales with company number 7663689 The Registered Office is at Walton High, Fyfield Barrow, Milton Keynes, MK7 7WH

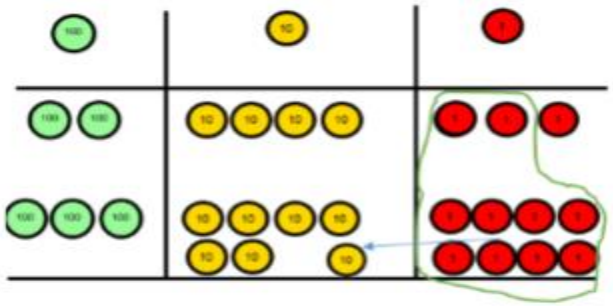
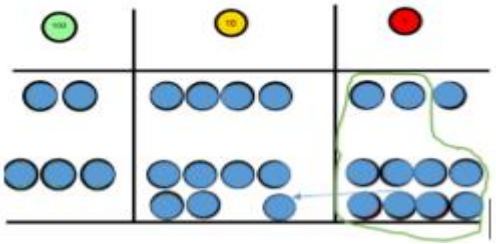
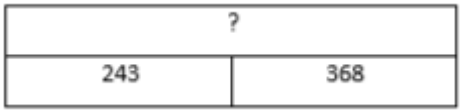
Enabling - Enhancing - Enriching

Addition

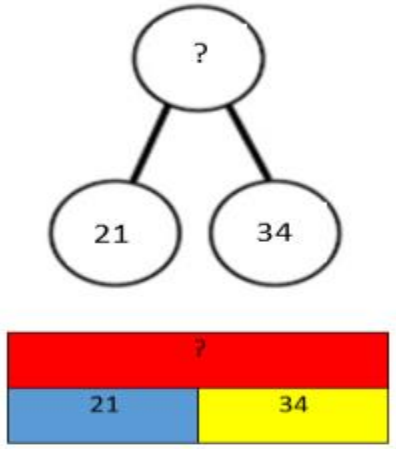
Key language which should be used: sum, total, parts and wholes, plus, add, altogether, combine, more than, 'is equal to' 'is the same as'

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 2? What is the total of 4 and 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 6 + 5 = 5 + ? 6 + 5 = ? + 4 ? = 6 + 5

Concrete	Pictorial	Abstract
TO + O using dienes. 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 = 49 1 + 8 = 9 40 + 9 = 49 
TO + TO using dienes. Continue to develop understanding of partitioning and place value and use this to support addition. Begin with no exchanging. 36 + 25 = 61 	This could be done one of two ways:  	Partitioning  Expanded column method: 30 2 + 20 5 50 + 7 = 57 Numberline: 

Concrete	Pictorial	Abstract
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 	Children 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.  	Expanded column method: 200 40 3 + 300 60 8 500 + 100 + 11 = 611 Leading to formal column addition: 243 +368 611 1 1

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



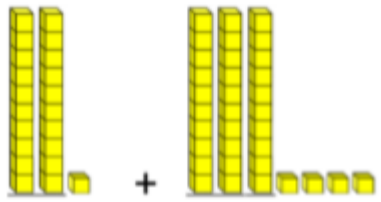
Sam saved £21 one week and £34 another. How much did he save in total?

21 + 34 = 55. Prove it! (Children need to be fluent in representing this in different ways whilst explaining)

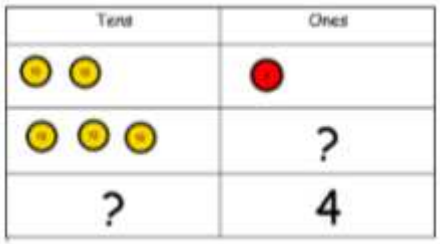
21 + 34 =

? = 21 + 34

What is the sum of twenty one and thirty four?

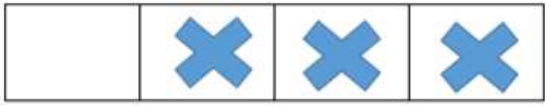
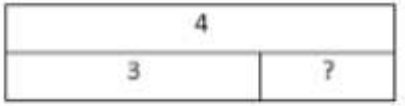
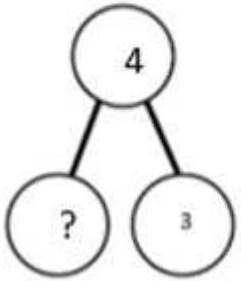
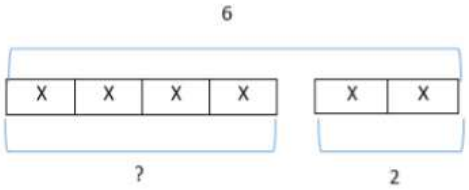
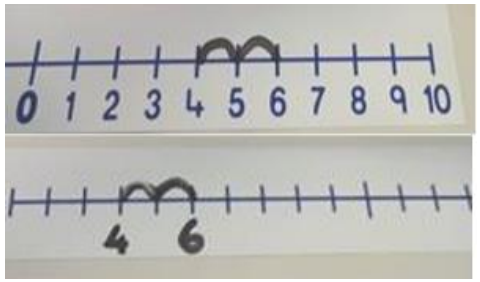


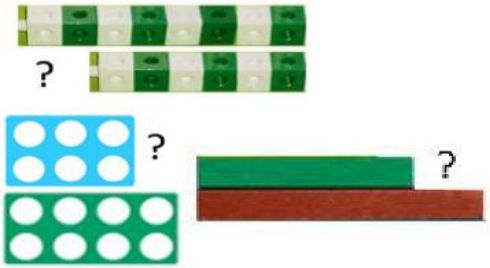
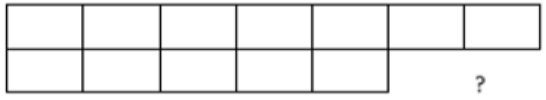
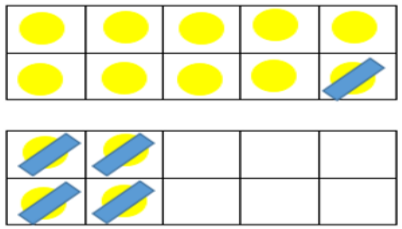
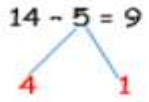
Always use missing digit problems too:

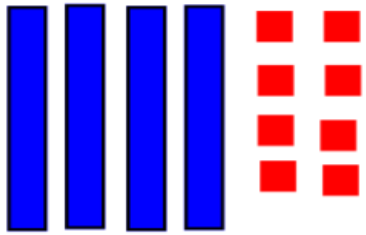
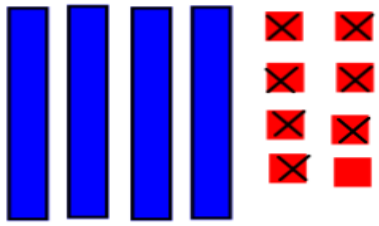
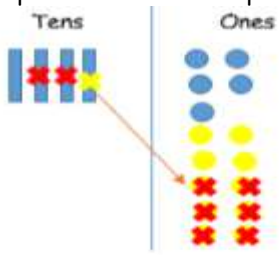
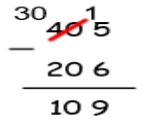
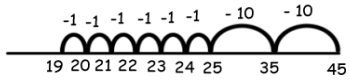


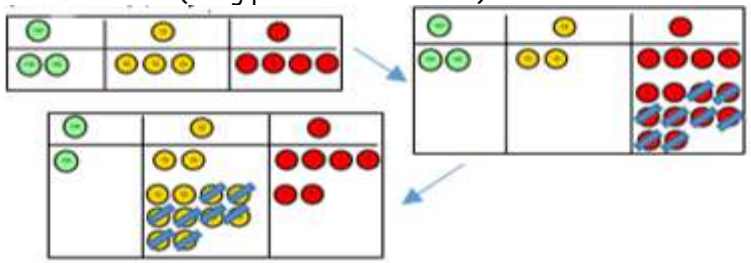
Subtraction:

Key language which should be used: take away, less than, the difference, subtract, minus, less, fewer, decrease, '7 take away 3, the difference is 4'

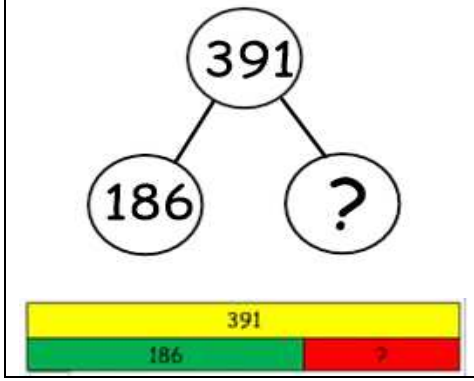
Concrete	Pictorial	Abstract
Physically taking away and removing objects from a whole Use various objects too-rather than crossing out- children will physically remove the objects. 4-3 = 1 	Children to draw the concrete resources they are using and cross out.  Use of the bar model: 	4 – 3 = ? = 4 -3  
Counting back (using number lines or number tracks) 	Children to represent what they see pictorially e.g. 	 6 - 4 = 2

Concrete	Pictorial	Abstract
Finding the difference Using cubes, Numicon or Cuisenaire rods, other objects can also be used. 	Children to draw the cubes/other concrete objects that they have used. XXXXXXXX XXXXXX **8 – 6 = 2** Use of the bar model  **8 – 6 = 2**	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 so the difference is the same- this will help when solving 19-17 = 18 - ?
Making 10 (using Numicon and ten frames and physically subtracting) E.g 14 - 5  Children could also do this by subtracting a five from the 10.  = 14  = 5  14 – 5 = 9	Children to represent the ten frame pictorially 14 - 5 = 9 	14 – 5 = 9 You also want children to see related facts e.g. 14 – 9 = 5 Children to represent how they have solved it e.g.  5 is made up of 4 and 1 so I can subtract 4 to make 10 and then 1 to get to 9

Concrete	Pictorial	Abstract
Subtraction using dienes 48 – 7 = 	Children draw the dienes and subtract as below  48 – 7 = 41	Children to apply this to their understanding of equality e.g. 48 – 7 = ? = 48 – 7 48 – 7 = 47 - ?
Using dienes and exchanging 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 	**Apply this to column method.** It is crucial that the children understand that when they have exchanged the 10 they still have 45. 45 = 30 + 15 **Expanded column method**  **Formal column method**  **Numberline** 45-26= 19 

Concrete	Pictorial	Abstract
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.	$\overset{1}{\cancel{2}}\overset{12}{\cancel{3}}\overset{1}{4}$ $-\ 88$ 146

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

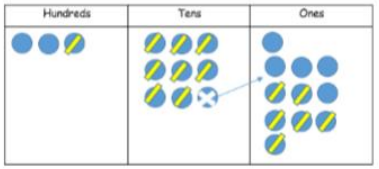
? = 391 – 186

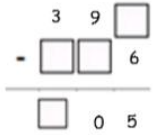
391

-186

Find the difference between 391 and 186.
Subtract 186 from 391
What is 186 less than 391?

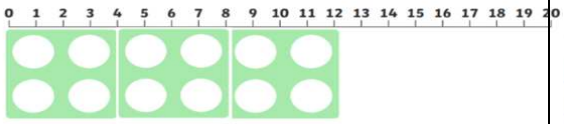
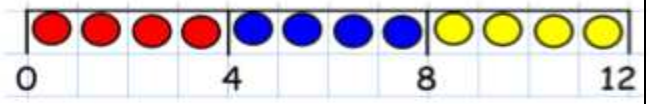
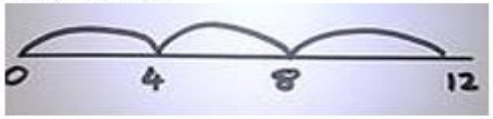
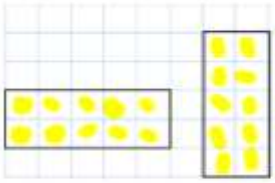
What's the calculation? What's the answer?

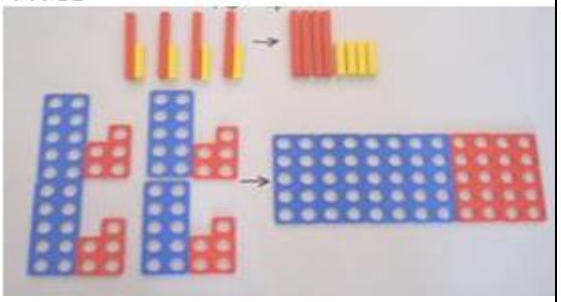
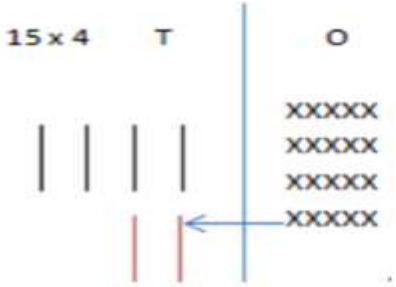
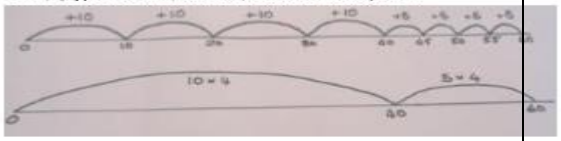
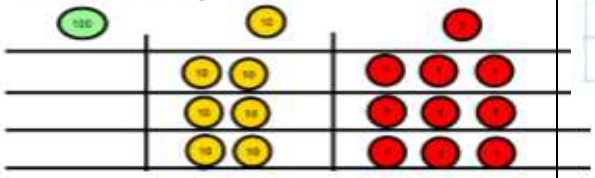


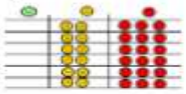
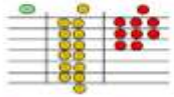
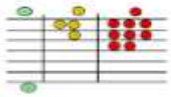
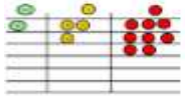
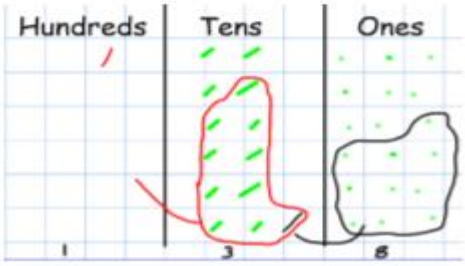


Multiplication

Key language which should be used: 'doubled, 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 = ? = 3 lots of 4 4 + 4 + 4 =
Use number lines to show repeated groups: 3 x 4 = 12 	Represent this pictorially alongside a number lin 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

Concrete	Pictorial	Abstract
Partition to multiply (use numicon, base 10, Cuisenaire rods) 4 x 15 	Children to represent the concrete manipulativ in a picture e.g. base 10 can be represented lik 	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 x 3 69

Concrete	Pictorial	Abstract
Formal column method with place value counters (children need this stage, initially, to understand how the column method works) 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?	Children to represent the counters/base 10, pictorially e.g. the image below. 	The aim is to get to the formal method but the children need to understand how it works. 6 x 23 = 23 × 6 138 1 1

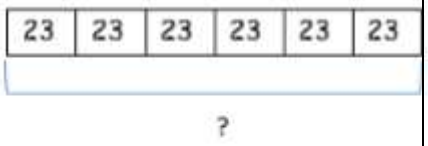
When children start to multiply 3d x 3d and 4d x 2d etc, they should be confident with the abstract:

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

$$\begin{array}{r} 1\ 2\ 4 \\ \times\quad 2\ 6 \\ \hline 7\ 4\ 4 \\ 2\ 4\ 8\ 0 \\ \hline 3\ 2\ 2\ 4 \\ \hline 1\ 1 \end{array}$$

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?

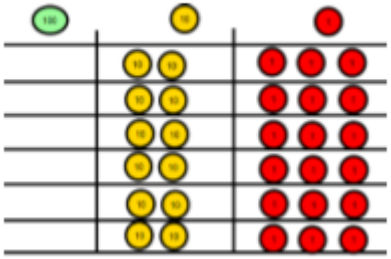
Find the product of 6 and 23

6 x 23 =

☐ = 6 x 23

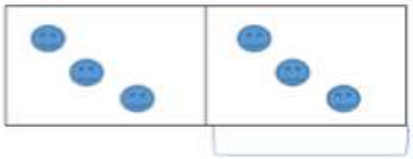
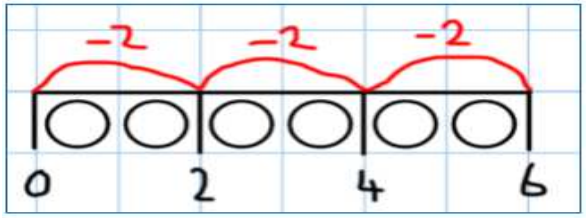
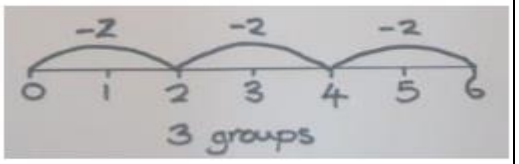
$$\begin{array}{r} 6 \\ \times\ 23 \\ \hline \end{array} \qquad \begin{array}{r} 23 \\ \times\ 6 \\ \hline \end{array}$$

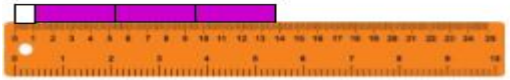
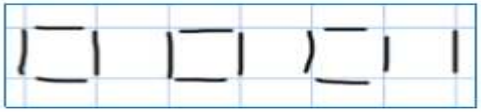
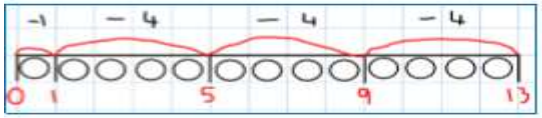
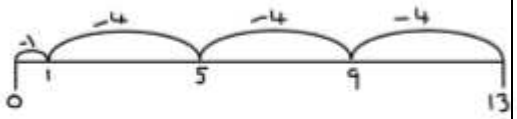
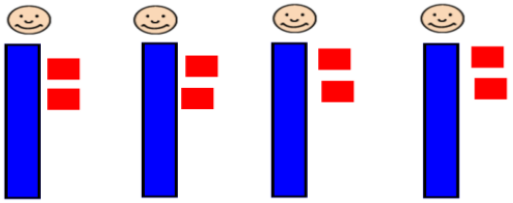
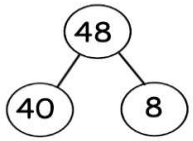
What's the calculation? What's the answer?

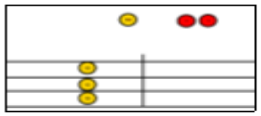
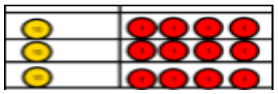
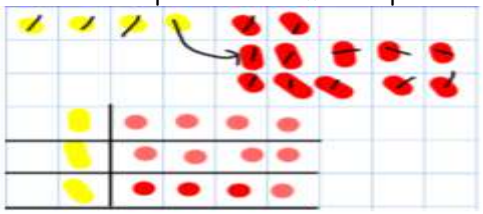
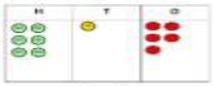
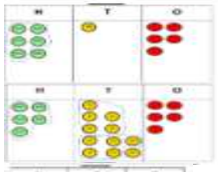
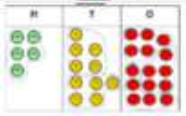


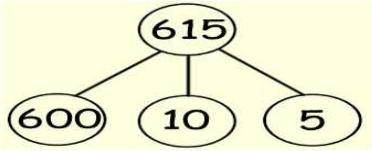
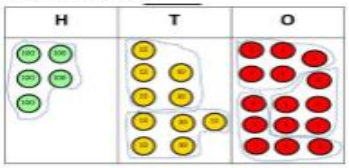
Division

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

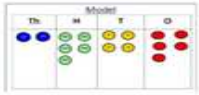
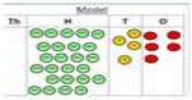
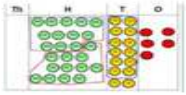
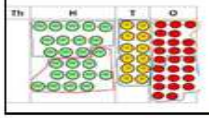
Concrete	Pictorial	Abstract
Sharing objects. E.g: **6 shared between 2** (other concrete objects can also be used e.g. children and hoops, teddy bears, cakes and plates) 	 This can also be done in a bar so all 4 operatio have a similar structure: 	6 ÷ 2 = 3 What's the calculation? 
Understand division as repeated grouping and subtracting 6 ÷ 2 	Division as grouping on a number-line with pictures. 	Abstract number line 

Concrete	Pictorial	Abstract
2d ÷ 1d with remainders 13 ÷ 4 = 3 remainder 1 Use of lollipop sticks to form wholes  Use of Cuisenaire rods and rulers (using repeated subtraction) 	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 
2d divided by 1d using base 10 (no remainders) SHARING **48 ÷ 4 = 12**  Start with the tens. Divide the ones and then recombine.	Children to represent the base 10 and sharing pictorially. 	 48 ÷ 4 = 12 4 tens ÷ 4 = 1 ten 8 ones ÷ 4 = 2 ones 10 + 2 = 12

Concrete	Pictoral	Abstract
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	Children to represent this method pictorially. 	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  Step 2: Circle your groups of 5 Step 3: Exchange 1H for 10T and circle groups of 5  Step 4: Exchange 1T for 10 ones and circle groups of 5	Children to represent pictorally (as shown in concrete pictures)	$5\overline{)615}$ = 123

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
 2544 ÷ 12 How many groups of 12 thousands do we have? None  Exchange 2 thousand for 20 hundreds.  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.  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.	Step one- exchange 2 thousand for 20 hundreds so we now have 25 hundreds. 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. 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. Exchange the 2 tens for 20 ones. The 24 is how many ones I have grouped and the 0 is what I have left.