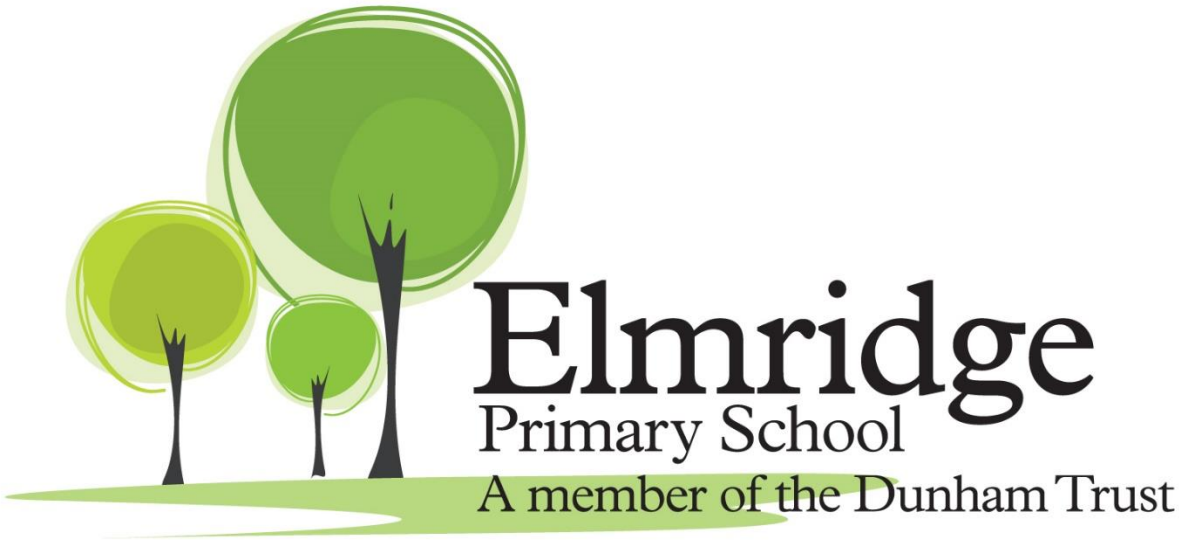


Mathematics Calculation policy

Policy Version			
Date	**Document Version**	**Document Revision History**	**Document Author/Reviser**
01/09/2020	1.0		R.Law and L.Mills

This policy will be reviewed every 12 months in light of local and Government legislation.

School Mission and Aims

"Empowering children to shape the world of tomorrow"

Elmridge strives to ensure that all its pupils meet their full academic, social, emotional and physical potential through building solid foundations during this first chapter of their lifelong learning journey.

Our goal is to develop confident, understanding, global citizens with a love of learning and respect for each other and the world around them.

Elmridge Curriculum Aims

- Enable pupils to build essential knowledge and skills within each subject and provide opportunities for them to use and apply what they have learnt across other subjects
- Develop pupils' confidence, leadership, resilience and enjoyment of learning through inspiring learning experiences
- Support and encourage pupils to establish good routines to help them maintain good physical and mental health now and into the future.
- Develop pupils' awareness of current national and global issues and understand their locality in the context of the wider world
- Develop pupils' moral values and spiritual awareness
- Develop pupils' understand of the relevance of their learning, how their learning could be built upon in the next stages of their education and awareness of careers where their knowledge and skills could be applied

Curriculum intent

Mathematics Vision Statement
The language of mathematics is international. The basic skills of mathematics are vital for the life opportunities of our children. Our aim is for all children to think mathematically, enabling them to reason, solve problems and assess risk in a range of contexts.

At Elmridge Primary School, our Mathematics Mastery curriculum has been developed to ensure every child can:

- understand the importance of developing mathematical skills in readiness for their next stage of education and to prepare them for future opportunities and responsibilities of life.
- develop confidence whilst building resilience to be successful, independent and motivated learners
- achieve excellence in mathematics,
- experience a sense of awe and wonder as they solve a problem for the first time,
- display a deeper understanding through a concrete, pictorial and abstract approach,
- develop essential life skills and understand the impact mathematics has on the wider world.

Mathematics Mastery places emphasis on the cumulative mastery of essential knowledge and skills in mathematics. It embeds a deeper understanding of maths by utilising a concrete, pictorial, abstract approach.

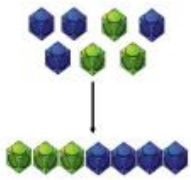
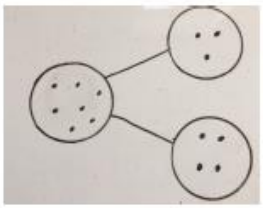
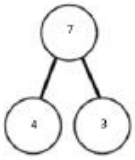
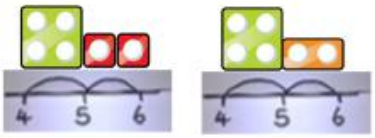
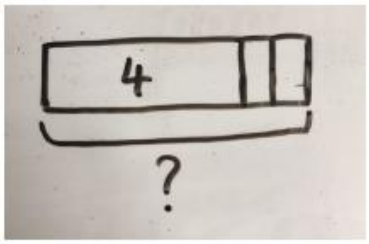
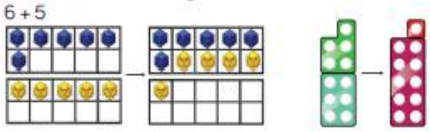
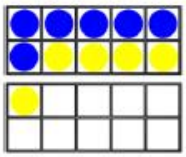
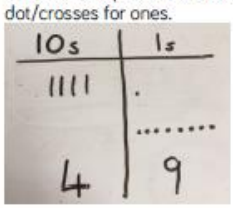
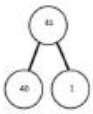
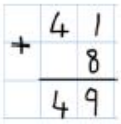
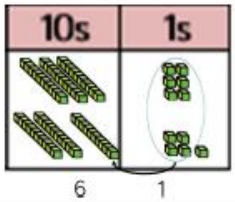
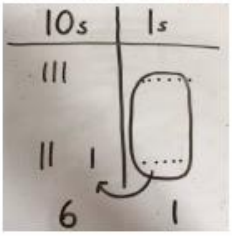
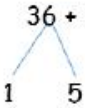
Aims
We aim to provide the children with a mathematics curriculum that will produce individuals who are numerate, literate, creative, independent, inquisitive, enquiring and confident. We also aim to provide a stimulating environment and adequate resources so that children can develop their mathematical skills to their full potential.

At Elmridge Primary school, we aim to:

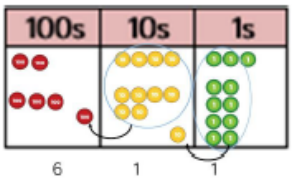
- To implement the current legal requirements of the Foundation Stage (FS) and the National Curriculum (NC).
- To foster positive attitudes, fascination and excitement of discovery through the teaching and learning of mathematical concepts.
- To ensure pupils become fluent in the fundamentals of mathematics, developing conceptual knowledge and an ability to recall and apply knowledge rapidly and accurately
- To ensure that pupils can reason mathematically and solve problems
- For our children to develop a ‘can do’ attitude and perceive themselves as mathematicians.
- To broaden children’s knowledge and understanding of how mathematics is used in the wider world.
- For our children to use and understand mathematical language and recognise its importance as a language for communication and thinking.

This guidance has been developed from the White Rose Calculation Policy.

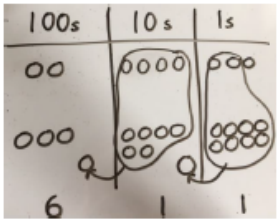
Addition

Concrete	Pictorial	Abstract
Combining two parts to make a whole (use other resources too e.g. eggs, shells, teddy bears, cars). 	Children to represent the cubes using dots or crosses. They could put each part on a part whole model too. 	4 + 3 = 7 Four is a part, 3 is a part and the whole is seven. 
Counting on using number lines using cubes or Numicon.  	A bar model which encourages the children to count on, rather than count all. 	The abstract number line: What is 2 more than 4? What is the sum of 2 and 4? What is the total of 4 and 2? 4 + 2 
Regrouping to make 10; 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
TO + O using base 10. Continue to develop understanding of partitioning and place value. 41 + 8 	Children to represent the base 10 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. 36 + 25 	Chidlren to represent the base 10 in a place value chart. 	Looking for ways to make 10.  30 + 20 = 50 5 + 5 = 10 50 + 10 + 1 = 61 Formal method: 36 +25 61 1

Use of place value counters to add HTO + TO, HTO + HTO etc. When there are 10 ones in the 1s column- we exchange for 1 ten, when there are 10 tens in the 10s column- we exchange for 1 hundred.

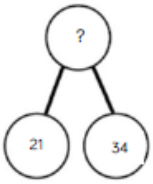


Children to represent the counters in a place value chart, circling when they make an exchange.



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

Conceptual variation; different ways to ask children to solve 21 + 34



?	
21	34

Word problems:
In year 3, there are 21 children and in year 4, there are 34 children.
How many children in total?

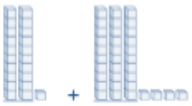
21 + 34 = 55. Prove it

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

21 + 34 =

$\square$ = 21 + 34

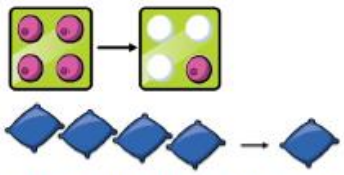
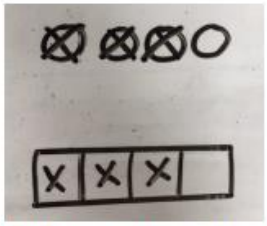
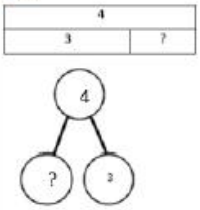
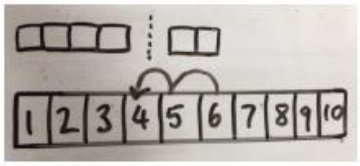
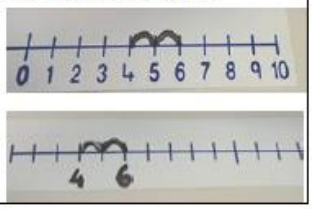
Calculate the sum of twenty-one and thirty-four.



Missing digit problems:

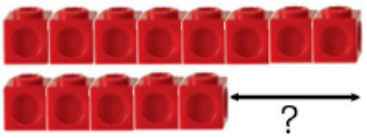
10s	1s
	1
	?
?	5

Subtraction

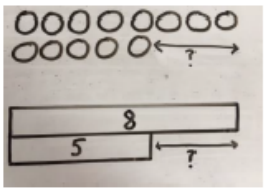
Concrete	Pictorial	Abstract
Physically taking away and removing objects from a whole (ten frames, Numicon, cubes and other items such as beanbags could be used). 4 − 3 = 1 	Children to draw the concrete resources they are using and cross out the correct amount. The bar model can also be used. 	4- 3 = $\square$ = 4 − 3 
Counting back (using number lines or number tracks) children start with 6 and count back 2. 6 − 2 = 4 	Children to represent what they see pictorially e.g. 	Children to represent the calculation on a number line or number track and show their jumps. Encourage children to use an empty number line 

Finding the difference (using cubes, Numicon or Cuisenaire rods, other objects can also be used).

Calculate the difference between 8 and 5.



Children to draw the cubes/other concrete objects which they have used or use the bar model to illustrate what they need to calculate.

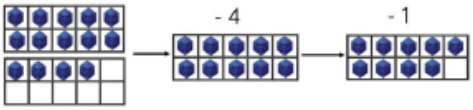


Find the difference between 8 and 5.

8 – 5, the difference is ☐

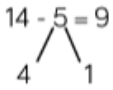
Children to explore why
9 - 6 = 8 – 5 = 7 – 4 have the same difference.

Making 10 using ten frames.
14 – 5



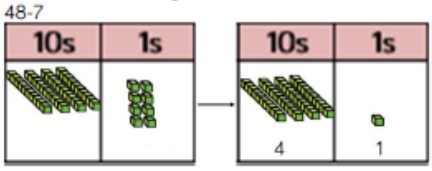
Children to present the ten frame pictorially and discuss what they did to make 10.

Children to show how they can make 10 by partitioning the subtrahend.

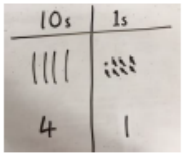


14 – 4 = 10
10 – 1 = 9

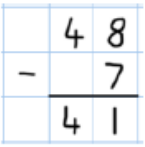
Column method using base 10.
48-7



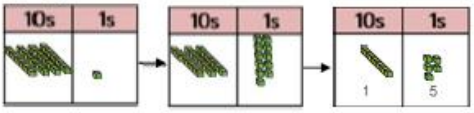
Children to represent the base 10 pictorially.



Column method or children could count back 7.



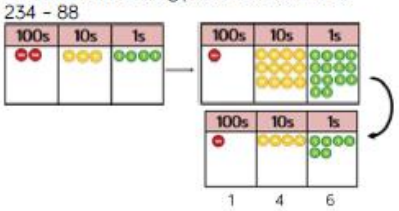
Column method using base 10 and having to exchange.
41 – 26



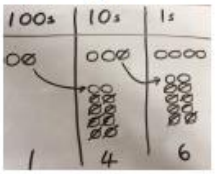
Represent the base 10 pictorially, remembering to show the exchange.

Formal column method. Children must understand that when they have exchanged the 10 they still have 41 because 41 = 30 + 11.

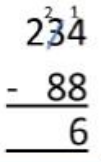
Column method using place value counters.
234 – 88



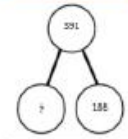
Represent the place value counters pictorially, remembering to show what has been exchanged.



Formal colum method. Children must understand what has happened when they have crossed out digits.



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



391	
186	?

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

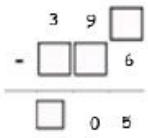
Calculate the difference between 391 and 186.

☐ = 391 – 186

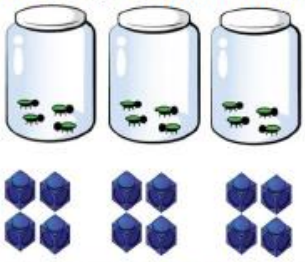
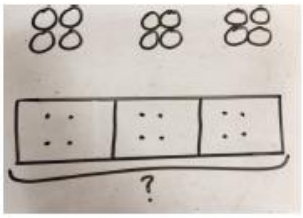
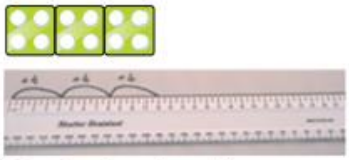
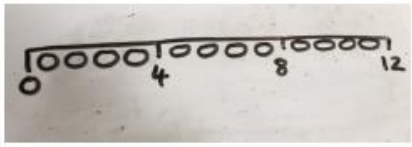
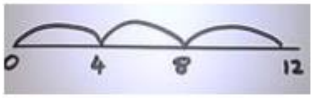
391
-186
———

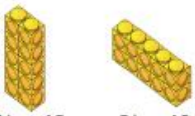
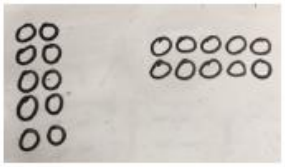
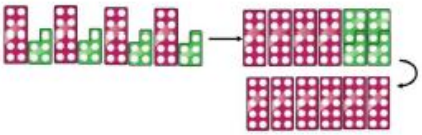
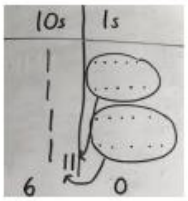
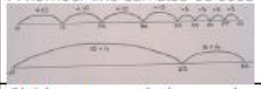
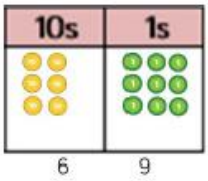
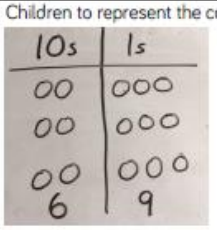
What is 186 less than 391?

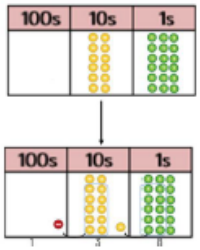
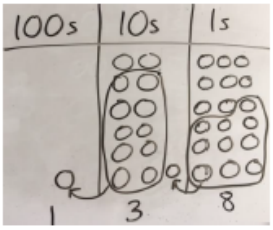
Missing digit calculations



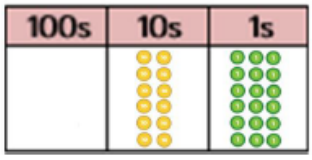
Multiplication

Concrete	Pictorial	Abstract
Repeated grouping/repeated addition 3 × 4 4 + 4 + 4 There are 3 equal groups, with 4 in each group. 	Children to represent the practical resources in a picture and use a bar model. 	3 × 4 = 12 4 + 4 + 4 = 12
Number lines to show repeated groups- 3 × 4  Cuisenaire rods can be used too.	Represent this pictorially alongside a number line e.g.: 	Abstract number line showing three jumps of four. 3 × 4 = 12 

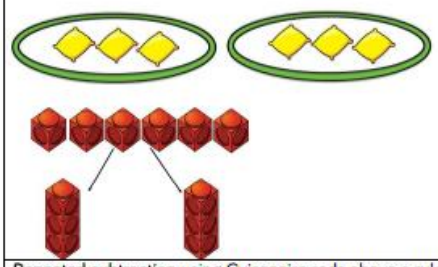
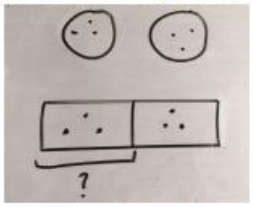
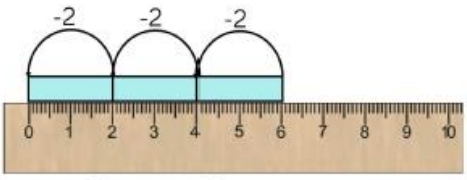
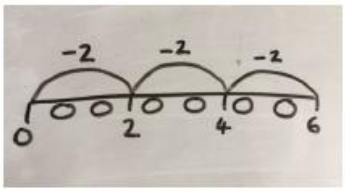
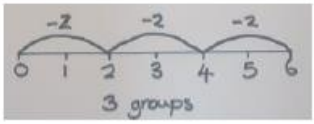
Use arrays to illustrate commutativity counters and other objects can also be used. 2 × 5 = 5 × 2  2 lots of 5 5 lots of 2	Children to represent the arrays pictorially. 	Children to be able to use an array to write a range of calculations e.g. 10 = 2 × 5 5 × 2 = 10 2 + 2 + 2 + 2 + 2 = 10 10 = 5 + 5
Partition to multiply using Numicon, base 10 or Cuisenaire rods. 4 × 15 	Children to represent the concrete manipulatives pictorially. 	Children to be encouraged to show the steps they have taken. 4 × 15 10 5 10 × 4 = 40 5 × 4 = 20 40 + 20 = 60 A number line can also be used 
Formal column method with place value counters (base 10 can also be used.) 3 × 23 	Children to represent the counters pictorially. 	Children to record what it is they are doing to show understanding. 3 × 23 3 × 20 = 60 3 × 3 = 9 20 3 60 + 9 = 69 23 × 3 69

Formal column method with place value counters. 6 x 23	Children to represent the counters/base 10, pictorially e.g. the image below.	Formal written method
		6 x 23 = 23 × 6 138 1 1
When children start to multiply 3d × 3d and 4d × 2d etc., they should be confident with the abstract: To get 744 children have solved 6 × 124. To get 2480 they have solved 20 × 124.		 Answer: 3224

Conceptual variation; different ways to ask children to solve 6 × 23

	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	What is the calculation? What is the product? 

Division

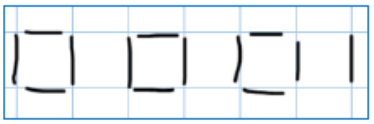
Concrete	Pictorial	Abstract
Sharing using a range of objects. 6 ÷ 2 	Represent the sharing pictorially. 	6 ÷ 2 = 3  Children should also be encouraged to use their 2 times tables facts.
Repeated subtraction using Cuisenaire rods above a ruler. 6 ÷ 2  3 groups of 2	Children to represent repeated subtraction pictorially. 	Abstract number line to represent the equal groups that have been subtracted. 

2d ÷ 1d with remainders using lollipop sticks. Cuisenaire rods, above a ruler can also be used.
13 ÷ 4

Use of lollipop sticks to form wholes- squares are made because we are dividing by 4.

There are 3 whole squares, with 1 left over.

Children to represent the lollipop sticks pictorially.



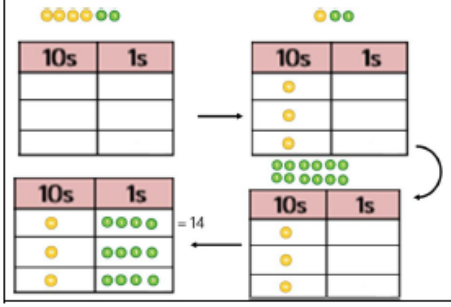
There are 3 whole squares, with 1 left over.

13 ÷ 4 = 3 remainder 1

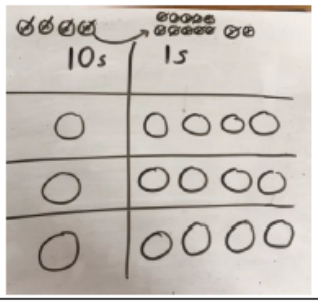
Children should be encouraged to use their times table facts; they could also represent repeated addition on a number line.

'3 groups of 4, with 1 left over'

Sharing using place value counters.
42 ÷ 3 = 14



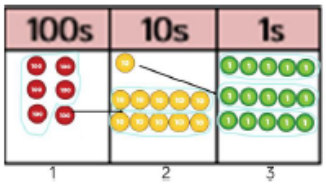
Children to represent the place value counters pictorially.



Children to be able to make sense of the place value counters and write calculations to show the process.

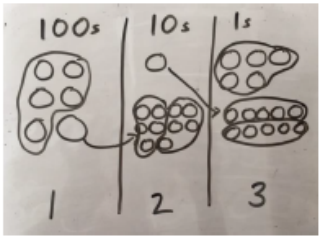
42 ÷ 3
42 = 30 + 12
30 ÷ 3 = 10
12 ÷ 3 = 4
10 + 4 = 14

Short division using place value counters to group.
615 ÷ 5



1. Make 615 with place value counters.
2. How many groups of 5 hundreds can you make with 6 hundred counters?
3. Exchange 1 hundred for 10 tens.
4. How many groups of 5 tens can you make with 11 ten counters?
5. Exchange 1 ten for 10 ones.
6. How many groups of 5 ones can you make with 15 ones?

Represent the place value counters pictorially.

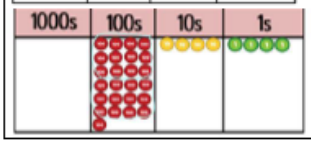


Children to the calculation using the short division scaffold.

$$5\overline{)615}\quad 123$$

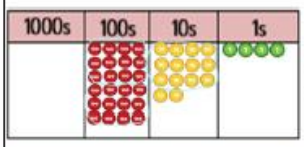
Long division using place value counters
2544 ÷ 12

We can't group 2 thousands into groups of 12 so will exchange them.



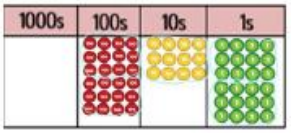
We can group 24 hundreds into groups of 12 which leaves with 1 hundred.

$$12\overline{)2544}\quad 02,\ 24,\ 1$$



After exchanging the hundred, we have 14 tens. We can group 12 tens into a group of 12, which leaves 2 tens.

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

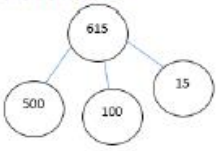


After exchanging the 2 tens, we have 24 ones. We can group 24 ones into 2 group of 12, which leaves no remainder.

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

Conceptual 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 short division?



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

What is the calculation?
What is the answer?