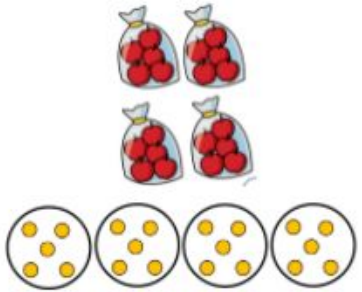
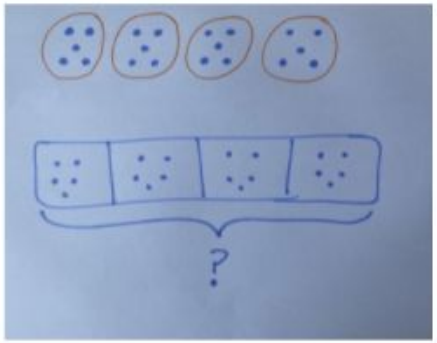
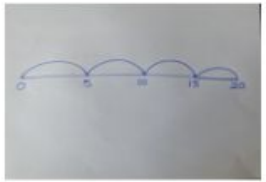
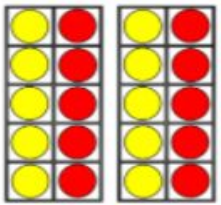
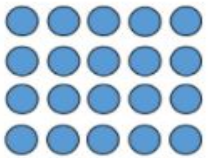
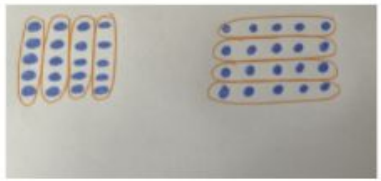
Ysgol Maes y Mynydd
Calculation Policy

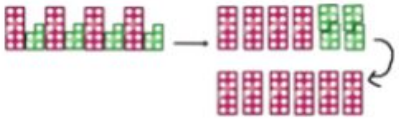
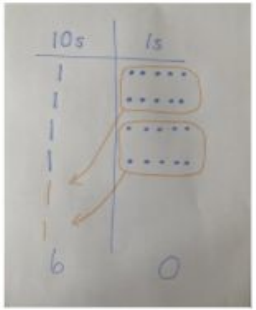
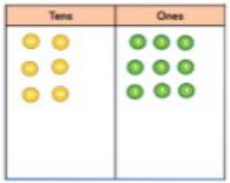
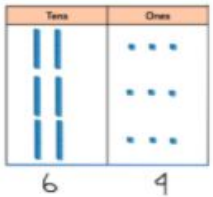
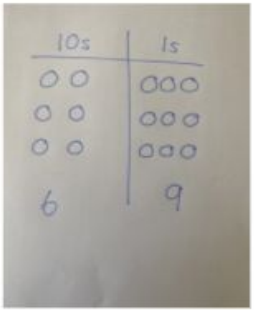
Multiplication and Division

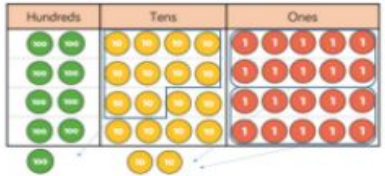
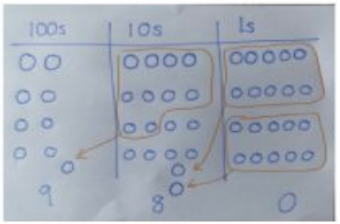
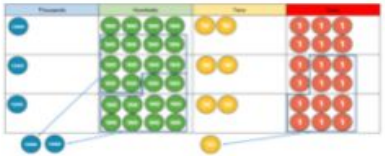
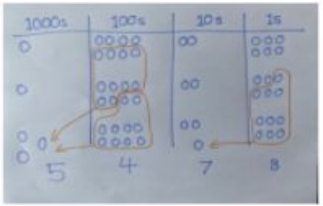
Calculation policy: Multiplication

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

Skill	Concrete	Pictorial	Abstract
Repeated grouping/repeated addition Children represent multiplication as repeated addition in many different ways. Initially children should be encouraged to use concrete and pictorial representations. They are not expected to record multiplication formally. As children progress, children can be introduced to the multiplication symbol.			One bag holds 5 apples. How many apples do 4 bags hold? 5 + 5 + 5 + 5 = 20 4 x 5 = 20

Number lines to show repeated groups Bead strings and numicon are effective concrete manipulatives that can be used to represent multiplication on a number line initially. Children then represent this pictorially alongside a number line. As children progress to representing this abstract using a blank number line and representing jumps and alongside the calculation.	 	  	4 x 5 = 20
Using arrays to illustrate communitivity Counters and multilink cubes are effective concrete manipulatives that can be used to support. Once children show an understanding using concrete manipulatives, they should progress to representing the arrays pictorially. Children progress by using the array to write a range of calculations.	 		20 = 4 x 5 20 = 5 x 5 4 x 5 = 20 5 x 4 = 20 5 + 5 + 5 + 5 = 20

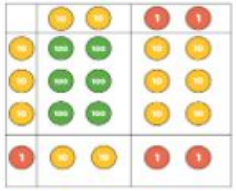
Partition to multiply Exploring the expanded column method before moving on to the short multiplication method. Numicon, base 10 and cuisenaire rods are effective concrete manipulatives to be used. Children progress on to representing the concrete manipulatives pictorially. Moving on to the abstract children to be encouraged to show the steps they have taken as a written calculation.			4 x 15 = 60 10 5 10 x 4 = 40 4 x 5 = 20 40 + 20 = 60
Formal column method (2-digit numbers by 1-digit numbers). Place value counters and base 10 should be used to support the understanding of the method rather than supporting the multiplication, as children should use times table knowledge.	 		3 x 23 20 3 3 x 20 = 60 3 x 3 = 9 60 + 9 = 69 23 × 3 69

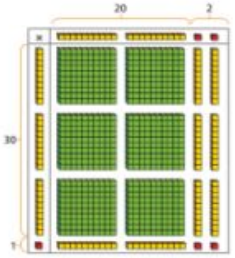
Formal column method (3-digit numbers by 1-digit numbers) When moving to 3-digit by 1 digit multiplication, encourage children to move towards the short, formal written method. Base 10 and place value counters continue to support the understanding of the written method. Limit the number of exchanges needed in the questions and move children away from resources when multiplying larger numbers.			$245 \times 4 = 980$ H T O 2 4 5 × 4 9 8 0 1 2
Formal Column Method (multiply 4-digit by 1-digit numbers) When multiplying 4-digit numbers, place value counters are the best manipulatives to use to support children in their understanding of the formal written method. If children are multiplying larger numbers and struggling with their times tables, encourage the use of multiplication grids so children can focus on the use of the written method.			$1,826 \times 3 = 5,478$ Th H T O 1 8 2 6 × 3 5 4 7 8 2 1

Multiplying 2-digit numbers by 2-digit numbers.

When multiplying a multi-digit number by 2-digits, use the area model to help children understand the size of the numbers they are using. This links to finding the area of a rectangle by finding the space covered by the base 10.

The grid method matches the area model as an initial written method before moving on to the formal written multiplication method.





×	20	2
30	600	60
1	20	2

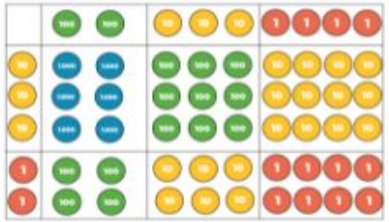
$22 \times 31 = 682$

	H	T	O
		2	2
×		3	1
		2	2
	6	6	0
	6	8	2

Multiply 3-digit numbers by 2-digit numbers

Children can continue to use the area model when multiplying 3-digits by 2-digits. Place value counters become more efficient to use but base 10 can be used to highlight the size of the numbers.

Encourage the children to move towards the formal written method, seeing the links with the grid method.

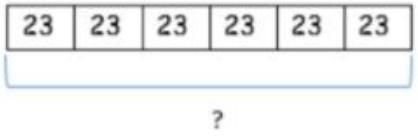


×	200	30	4
30	6,000	900	120
2	400	60	8

$234 \times 32 = 7{,}488$

Th	H	T	O
	2	3	4
×		3	2
	4	6	8
$^{1}7$	$^{1}0$	2	0
7	4	8	8

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



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

With counters, prove that 6 x 23 = 138

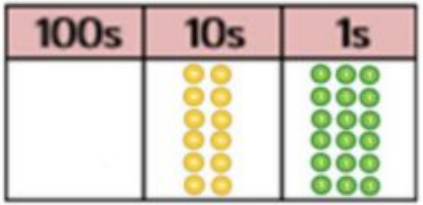
Find the product of 6 and 23

6 x 23 =

__ = 6 x 23

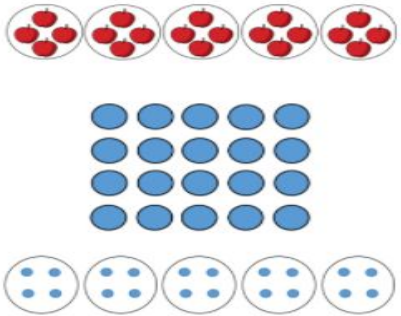
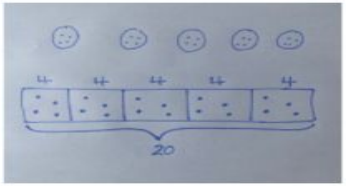
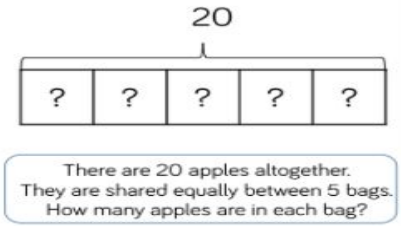
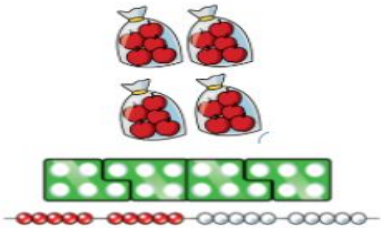
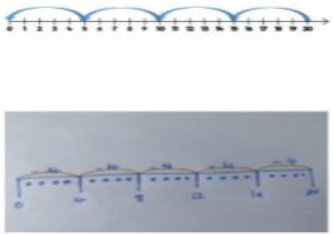
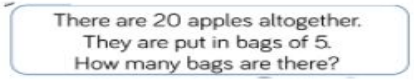
6	23
× 23	× 6
___	___

What is the calculation?
What is the product?



Calculation policy: Division

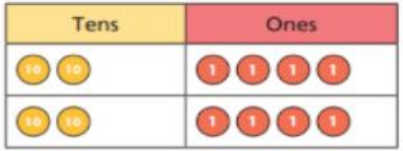
Key vocabulary: share, group, divide, divided by, half.

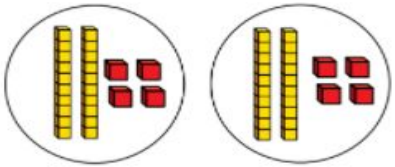
Skill	Concrete	Pictorial	Abstract
Sharing Children solve problems by sharing amounts into equal groups.Children to be encouraged to use concrete and pictorial representations to solve problems. Initially children are not expected to record division formally. As they progress onto abstract, children are to be introduced to the division symbol and formal calculations.			
Grouping (including repeated subtraction) Children solve problems by grouping and counting the number of groups. Grouping encourages children to count in multiples and links the repeated subtraction on a number line. They can use concrete representations in fixed groups such as numicon which helps to show the link between multiplication and division.			

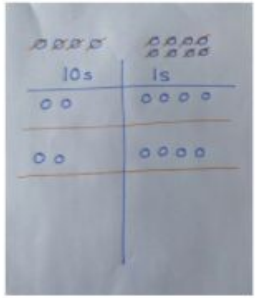
Divide 2-digits by 1-digit (sharing with no exchange)

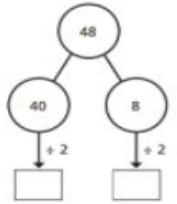
When dividing larger numbers, children can use manipulatives that allow them to partition into tens and ones.
Straws, Base 10 and place value counters can all be used to share numbers into equal groups.

Part-whole models can provide children with a clear written method that matches the concrete representation.









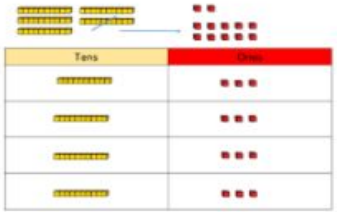
$$48 \div 2 = 24$$

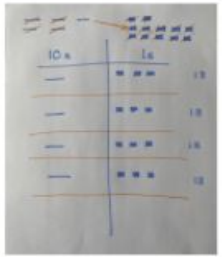
48 ÷ 2
48 = 40 + 8
40 ÷ 2 = 20
8 ÷ 2 = 4
20 + 4 = 24

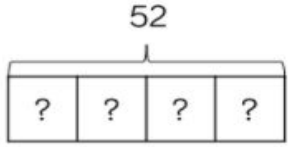
Divide 2-digits by 1 digit (sharing with exchange)

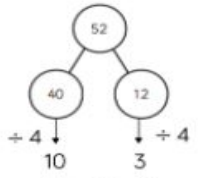
When dividing numbers involving an exchange, children can use Base 10 and place value counters to exchange one tens for ten ones.

Children should start with the equipment outside the place value grid before sharing the tens and ones equally between the rows.
Flexible partitioning in a part-whole model supports this method.

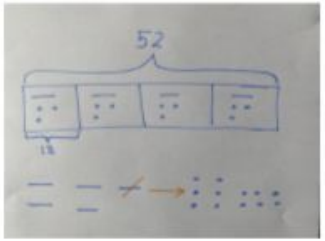
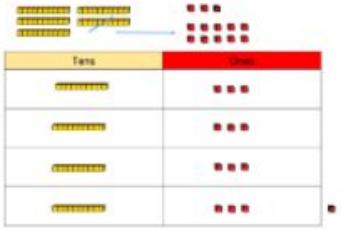
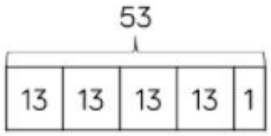
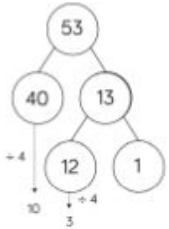








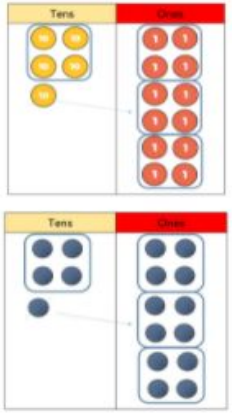
10 + 3 = 13

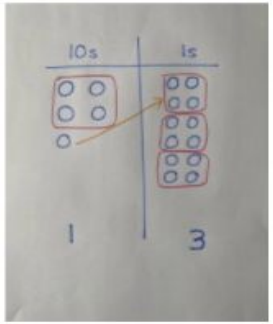
			$52 \div 4 = 13$
Divide 2-digits by 1-digit (sharing with remainder) When dividing numbers with remainders, children can use Base 10 and place value counters to exchange one ten for ten ones. Starting with the equipment outside the place value grid will highlight remainders, as they will be left outside the grid once the equal groups have been made. Flexible partitioning in a part-whole model supports this method.	 	 	$53 \div 4 = 13\ r1$ 

Divide 2-digits by 1-digit (grouping)

When using short division method, children use grouping. Starting with the largest place value counter, they group by the divisor.

Language is important here. Children should consider 'How many groups of 4 tens can we make?' and 'How many groups of 4 ones can we make?' Remainders can also be seen as they are left ungrouped.





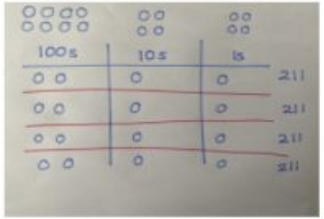
		1	3	
	4	5	12	

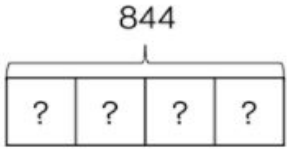
$52 \div 4 = 13$

Divide 3-digits by 1-digit (sharing)

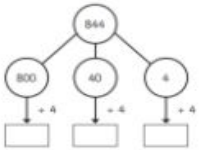
Children can continue to use place value counters to share 3-digit numbers into equal groups.

Children should start with the equipment outside the place value grid before sharing the hundreds, tens and ones equally between the rows.
This method can also help to highlight remainders. Flexible partitioning in a part-whole model supports this method.





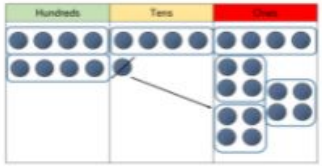
$844 \div 4 = 211$

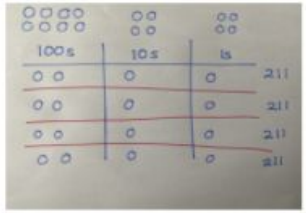


Divide 3-digits by 1-digit (grouping)

Children can continue to use grouping to support their understanding of short division when dividing a 3-digit number by a 1-digit number.

Place value counters or plain counters can be used on a place value grid to support this understanding. Children can also draw their own counters and group them through a more pictorial method.





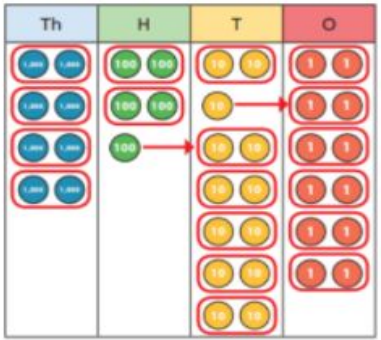
		2	1	4
	4	8	5	$^{1}6$

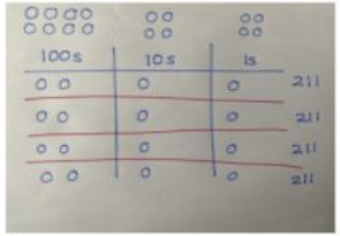
$856 \div 4 = 214$

Divide 4-digits by 1-digit (grouping)

Place value counters or plain counters can be used on a place value grid to support children to divide 4-digits by 1-digit. Children can also draw their own counters and group them through a more pictorial method.

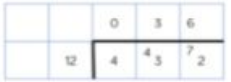
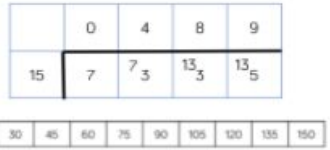
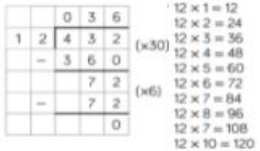
Children should be encouraged to move away from the concrete and pictorial when dividing numbers with multiple exchanges.





$8{,}532 \div 2 = 4{,}266$

	4	2	6	6
2	8	5	$^{1}3$	$^{1}2$

Divide multi digits by 2-digits (short division) When children begin to divide up to 4-digits by 2-digits, the written method becomes the most accurate as concrete and pictorial representations become less effective. Children can write out multiples to support their calculations with larger remainders. Children will also solve problems with remainders where the quotient can be rounded as appropriate.			432 ÷ 12 = 36  7,335 ÷ 15 = 489 
Divide multi-digits by 2-digits (long division) Children can also divide by 2-digit numbers using long division. Children can write out multiples to support their calculations with larger remainders. Children will also solve problems with remainders where the quotients can be rounded as appropriate.			432 ÷ 12 = 36  7,335 ÷ 15 = 489 

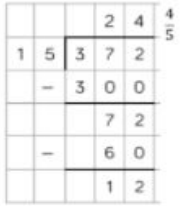
Divide multi digits by 2-digits (long division)

When a remainder is left at the end of a calculation, children can either leave it as remainder or convert it to a fraction. This will depend on the context of the question.

Children can also answer questions where the quotient needs to be rounded according to the context.

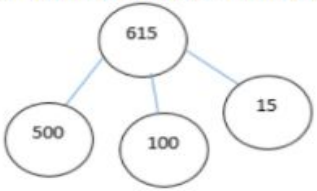
$372 \div 15 = 24\ r12$

$372 \div 15 = 24\frac{4}{5}$



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?

$5\overline{)615}$

$615 \div 5 =$

$\square = 615 \div 5$

What is the calculation?
What is the answer?

Calculation policy: Glossary

Array	An ordered collection of counters, cubes or other items in rows and columns.
Commutative	Numbers can be multiplied in any order.
Dividend	In division, the number that is divided.
Divisor	In division, the number by which another is divided.
Exchange	Change a number or expression for another of an equal value.
Factor	A number that multiplies with another to make a product.
Multiplicand	In multiplication, a number to be multiplied by another.
Partitioning	Splitting a number into its component parts.
Product	The result of multiplying one number by another.
Quotient	The result of a division.
Remainder	The amount left over after a division when the divisor is not a factor of the dividend.
Scaling	Enlarging or reducing a number by a given amount, called the scale factor