WALTHAM LEAS
PRIMARY ACADEMY

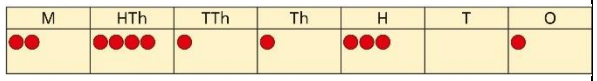
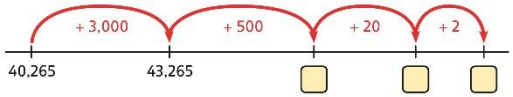
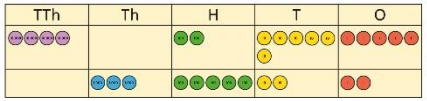
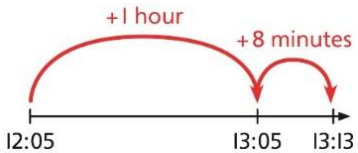
Waltham Leas Primary Academy Calculation policy

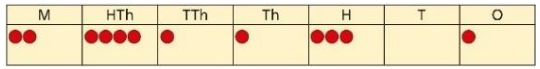
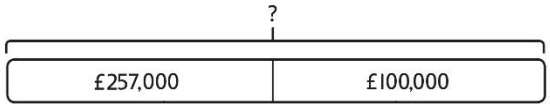
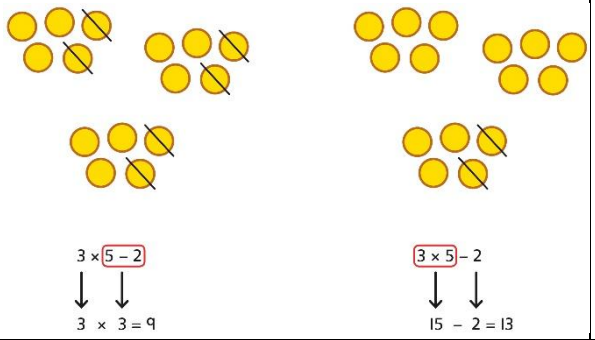
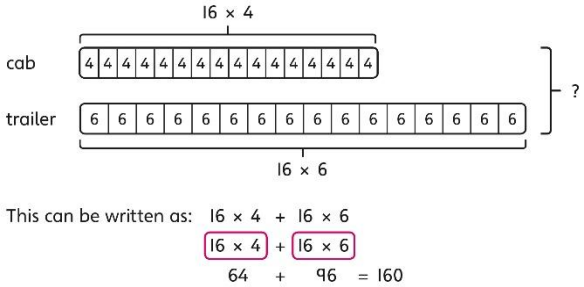
Year 6

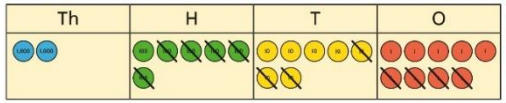
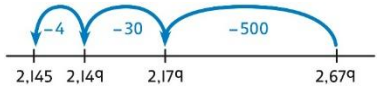
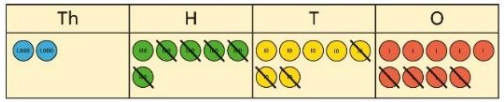
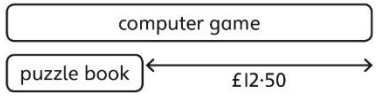
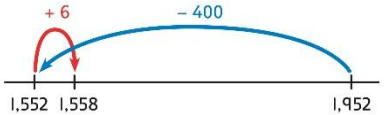
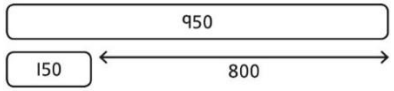
At Waltham Leas Primary Academy, we use a variety of resources for the teaching of Mathematics across Year groups 1-6. We use our own ideas, resources from Number Fun and White Rose challenges to teach the vital small steps of learning in mathematics to our children. We know that by breaking down each NC objective into its small components and concepts, this will enable our children to have deep mathematical understanding.

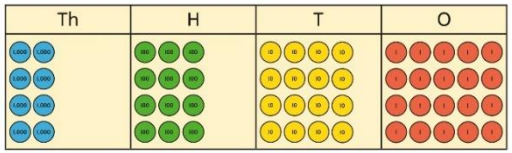
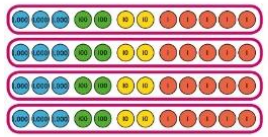
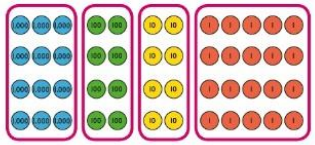
The following pages show our progression in calculation (addition, subtraction, multiplication and division) and how this works in line with the National Curriculum. The consistent use of the CPA (concrete, pictorial, abstract) approach across our curriculum helps children develop mastery across all the operations in an efficient and reliable way. This policy shows how these methods develop children's confidence in their understanding of both written and mental methods.

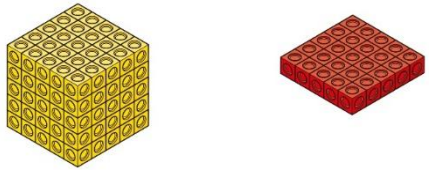
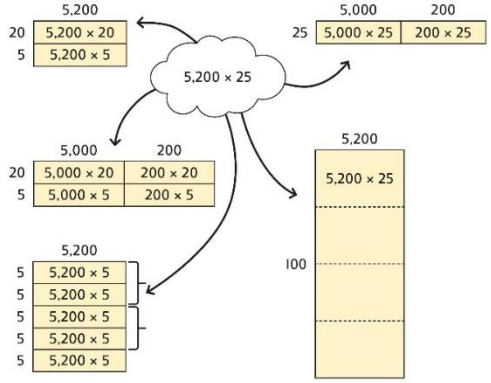
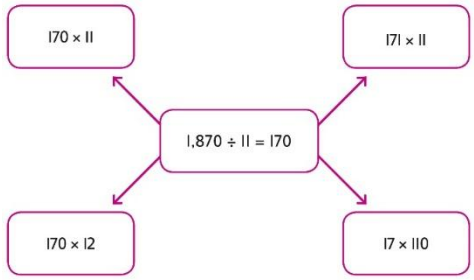
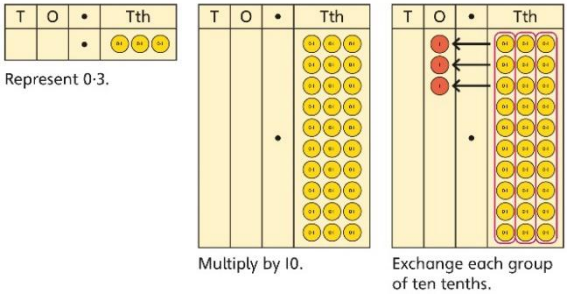
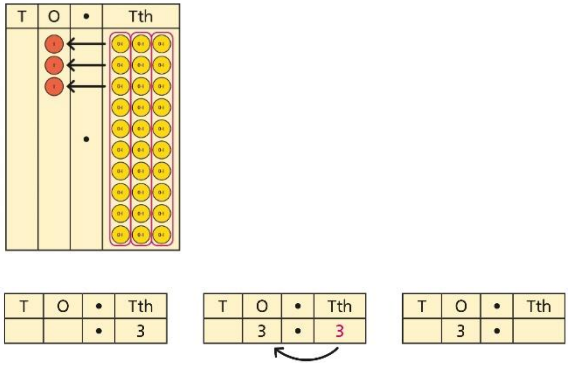
KEY STAGE 2		
In upper Key Stage 2, children build on secure foundations in calculation, and develop fluency, accuracy and flexibility in their approach to the four operations. They work with whole numbers and adapt their skills to work with decimals, and they continue to develop their ability to select appropriate, accurate and efficient operations.		
Key language: decimal, column methods, exchange, partition, mental method, ten thousand, hundred thousand, million, factor, multiple, prime number, square number, cube number		
Addition and subtraction: Children build on their column methods to add and subtract numbers with up to seven digits, and they adapt the methods to calculate efficiently and effectively with decimals, ensuring understanding of place value at every stage. Children compare and contrast methods, and they select mental methods or jottings where appropriate and where these are more likely to be efficient or accurate when compared with formal column methods. Bar models are used to represent the calculations required to solve problems and may indicate where efficient methods can be chosen.	**Multiplication and division:** Building on their understanding, children develop methods to multiply up to 4-digit numbers by single-digit and 2-digit numbers. Children develop column methods with an understanding of place value, and they continue to use the key skill of unitising to multiply and divide by 10, 100 and 1,000. Written division methods are introduced and adapted for division by single-digit and 2-digit numbers and are understood alongside the area model and place value. In Year 6, children develop a secure understanding of how division is related to fractions. Multiplication and division of decimals are also introduced and refined in Year 6.	**Fractions:** Children find fractions of amounts, multiply a fraction by a whole number and by another fraction, divide a fraction by a whole number, and add and subtract fractions with different denominators. Children become more confident working with improper fractions and mixed numbers and can calculate with them. Understanding of decimals with up to 3 decimal places is built through place value and as fractions, and children calculate with decimals in the context of measure as well as in pure arithmetic. Children develop an understanding of percentages in relation to hundredths, and they understand how to work with common percentages: 50%, 25%, 10% and 1%.

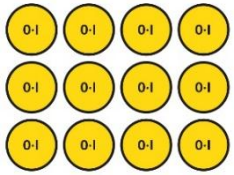
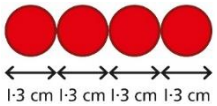
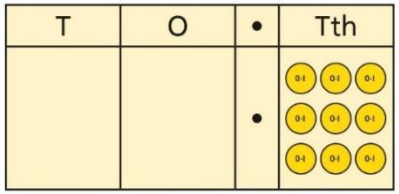
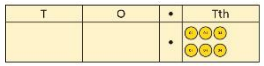
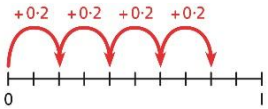
Year 6			
	Concrete	**Pictorial**	**Abstract**
Year 6 Addition			
Comparing and selecting efficient methods	Represent 7-digit numbers on a place value grid, and use this to support thinking and mental methods.  	Discuss similarities and differences between methods, and choose efficient methods based on the specific calculation. Compare written and mental methods alongside place value representations.   TTh Th H T O 4 0 2 6 5 + 3 5 2 2 Use bar model and number line representations to model addition in problem-solving and measure contexts.  	Use column addition where mental methods are not efficient. Recognise common errors with column addition. *32,145 + 4,302 = ?* TTh Th H T O 3 2 1 4 5 + 4 3 0 2 3 6 4 4 7 TTh Th H T O 3 2 1 4 5 + 4 3 0 2 7 5 1 6 5 *Which method has been completed accurately?* *What mistake has been made?* Column methods are also used for decimal additions where mental methods are not efficient. H T O · Tth Hth 1 4 0 · 0 9 + 4 9 · 8 9 1 8 9 · 9 8 1

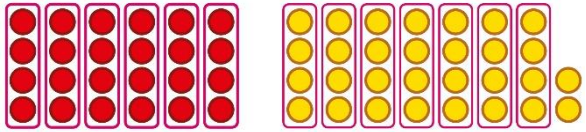
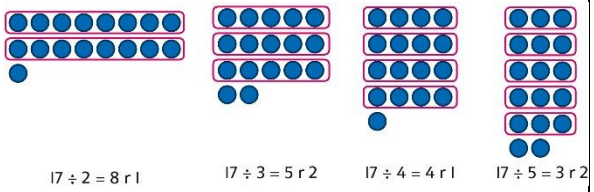
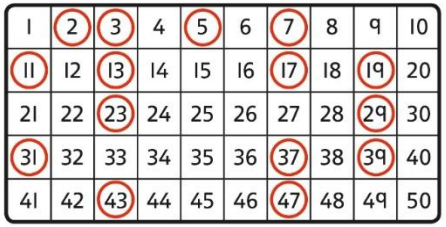
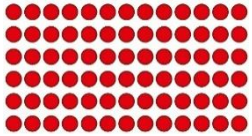
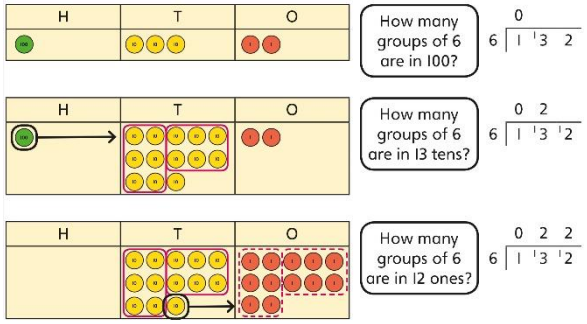
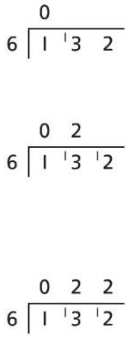
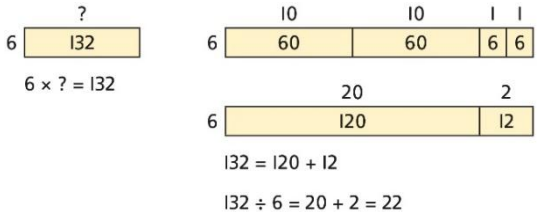
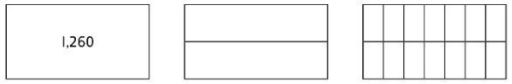
Selecting mental methods for larger numbers where appropriate	Represent 7-digit numbers on a place value grid, and use this to support thinking and mental methods.  *2,411,301 + 500,000 = ?* *This would be 5 more counters in the HTh place.* *So, the total is 2,911,301.* *2,411,301 + 500,000 = 2,911,301*	Use a bar model to support thinking in addition problems. *257,000 + 99,000 = ?*  *I added 100 thousands then subtracted 1 thousand.* *257 thousands + 100 thousands = 357 thousands* *257,000 + 100,000 = 357,000* *357,000 – 1,000 = 356,000* *So, 257,000 + 99,000 = 356,000*	Use place value and unitising to support mental calculations with larger numbers. *195,000 + 6,000 = ?* *195 + 5 + 1 = 201* *195 thousands + 6 thousands = 201 thousands* *So, 195,000 + 6,000 = 201,000*
Understanding order of operations in calculations	Use equipment to model different interpretations of a calculation with more than one operation. Explore different results. *3 × 5 − 2 = ?*  	Model calculations using a bar model to demonstrate the correct order of operations in multi-step calculations.  	Understand the correct order of operations in calculations without brackets. Understand how brackets affect the order of operations in a calculation. *4 + 6 × 16* *4 + 96 = 100* *(4 + 6) × 16* *10 × 16 = 160*
Year 6 Subtraction			

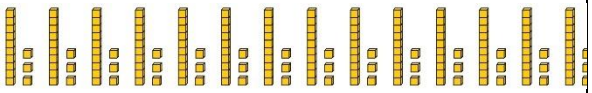
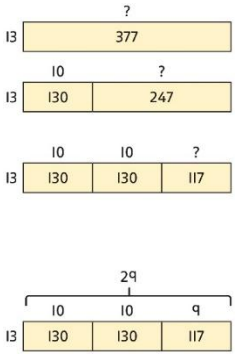
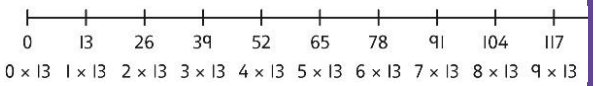
Comparing and selecting efficient methods	Use counters on a place value grid to represent subtractions of larger numbers.  	Compare subtraction methods alongside place value representations.   Th H T O 2 6 7 9 − 5 3 4 2 1 4 5 Use a bar model to represent calculations, including 'find the difference' with two bars as comparison.  	Compare and select methods. Use column subtraction when mental methods are not efficient. Use two different methods for one calculation as a checking strategy. Th H T O 1 $^{8}\cancel{9}$ $^{14}\cancel{5}$ $^{1}2$ − 1 5 5 8 3 9 4  Use column subtraction for decimal problems, including in the context of measure. H T O · Tth Hth 3 0 9 · 6 0 − 2 0 6 · 4 0 1 0 3 · 2 0
Subtracting mentally with larger numbers		Use a bar model to show how unitising can support mental calculations. *950,000 − 150,000* *That is 950 thousands − 150 thousands*  *So, the difference is 800 thousands.* *950,000 − 150,000 = 800,000*	Subtract efficiently from powers of 10. *10,000 − 500 = ?*
Year 6 Multiplication			

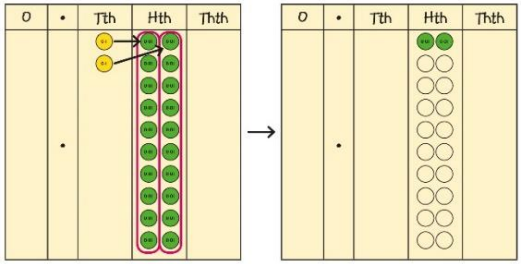
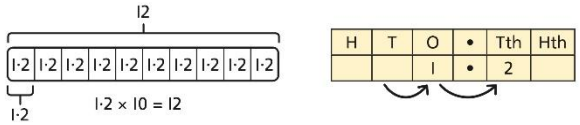
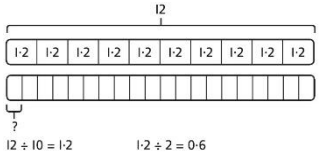
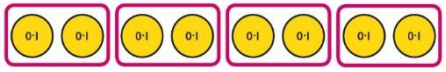
Multiplying up to a 4-digit number by a single digit number	Use equipment to explore multiplications.  *4 groups of 2,345* *This is a multiplication:* *4 × 2,345* *2,345 × 4*	Use place value equipment to compare methods. **Method 1**  3 2 2 5 3 2 2 5 3 2 2 5 + 3 2 2 5 1 2 9 0 0 1 1 2 **Method 2**  4 × 3,000 4 × 200 4 × 20 4 × 5 12,000 + 800 + 80 + 20 = 12,900	Understand area model and short multiplication. Compare and select appropriate methods for specific multiplications. **Method 3** 3,000 200 20 5 4 | 12,000 | 800 | 80 | 20 12,000 + 800 + 80 + 20 = 12,900 **Method 4** 3 2 2 5 × 4 1 2 9 0 0 1 2
Multiplying up to a 4-digit number by a 2-digit number		Use an area model alongside written multiplication. **Method 1** 1,000 200 30 5 20 | 20,000 | 4,000 | 600 | 100 1 | 1,000 | 200 | 30 | 5 1 2 3 5 × 2 1 5 1 × 5 3 0 1 × 30 2 0 0 1 × 200 1 0 0 0 1 × 1,000 1 0 0 20 × 5 6 0 0 20 × 30 4 0 0 0 20 × 200 2 0 0 0 0 20 × 1,000 2 5 9 3 5 21 × 1,235	Use compact column multiplication with understanding of place value at all stages. 1 2 3 5 × 2 1 1 2 3 5 1 × 1,235 2 4 7 0 0 20 × 1,235 2 5 9 3 5 21 × 1,235
Using knowledge of factors and partitions to compare	Use equipment to understand square numbers and cube numbers.	Compare methods visually using an area model. Understand that multiple approaches will produce the same answer if completed accurately.	Use a known fact to generate families of related facts.

methods for multiplications	 *$5 \times 5 = 5^2 = 25$* *$5 \times 5 \times 5 = 5^3 = 25 \times 5 = 125$*	 Represent and compare methods using a bar model.	 Use factors to calculate efficiently. *15 × 16* *= 3 × 5 × 2 × 8* *= 3 × 8 × 2 × 5* *= 24 × 10* *= 240*
Multiplying by 10, 100 and 1,000	Use place value equipment to explore exchange in decimal multiplication.  *0·3 × 10 = ?* *0·3 is 3 tenths.* *10 × 3 tenths are 30 tenths.* *30 tenths are equivalent to 3 ones.*	Understand how the exchange affects decimal numbers on a place value grid.  *0·3 × 10 = 3*	Use knowledge of multiplying by 10, 100 and 1,000 to multiply by multiples of 10, 100 and 1,000. *8 × 100 = 800* *8 × 300 = 800 × 3* *= 2,400* *2·5 × 10 = 25* *2·5 × 20 = 2·5 × 10 × 2* *= 50*
Multiplying decimals	Explore decimal multiplications using place value equipment and in the context of measures.	Represent calculations on a place value grid.	Use known facts to multiply decimals. *4 × 3 = 12* *4 × 0·3 = 1·2* *4 × 0·03 = 0·12*

	 *3 groups of 4 tenths is 12 tenths.* *4 groups of 3 tenths is 12 tenths.*  *4 × 1 cm = 4 cm* *4 × 0·3 cm = 1.2 cm* *4 × 1·3 = 4 + 1·2 = 5·2 cm*	3 × 3 = 9 3 × 0·3 = 0·9  Understand the link between multiplying decimals and repeated addition.   	*20 × 5 = 100* *20 × 0·5 = 10* *20 × 0·05 = 1* Find families of facts from a known multiplication. *I know that 18 × 4 = 72.* *This can help me work out:* *1·8 × 4 = ?* *18 × 0·4 = ?* *180 × 0·4 = ?* *18 × 0·04 = ?* Use a place value grid to understand the effects of multiplying decimals. H T O • Tth Hth 2 × 3: 6 • 0·2 × 3: 0 • 6 0·02 × 3: •
Year 6 Division			
Understanding factors	Use equipment to explore different factors of a number.	Recognise prime numbers as numbers having exactly two factors. Understand the link with division and remainders.	Recognise and know primes up to 100. Understand that 2 is the only even prime, and that 1 is not a prime number.

	 24 ÷ 4 = 6 30 ÷ 4 = 7 remainder 2 *4 is a factor of 24 but is not a factor of 30.*	 17 ÷ 2 = 8 r 1 17 ÷ 3 = 5 r 2 17 ÷ 4 = 4 r 1 17 ÷ 5 = 3 r 2	 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
Dividing by a single digit	Use equipment to make groups from a total.  *There are 78 in total.* *There are 6 groups of 13.* *There are 13 groups of 6.*	 	Use short division to divide by a single digit.  Use an area model to link multiplication and division. 
Dividing by a 2-digit number using factors	Understand that division by factors can be used when dividing by a number that is not prime.	Use factors and repeated division. *1,260 ÷ 14 = ?*  *1,260 ÷ 2 = 630*	Use factors and repeated division where appropriate. *2,100 ÷ 12 = ?*

		630 ÷ 7 = 90 *1,260 ÷ 14 = 90*	2,100 → ÷ 2 → ÷ 6 → 2,100 → ÷ 6 → ÷ 2 → 2,100 → ÷ 3 → ÷ 4 → 2,100 → ÷ 4 → ÷ 3 → 2,100 → ÷ 3 → ÷ 2 → ÷ 2 →
Dividing by a 2-digit number using long division	Use equipment to build numbers from groups.  *182 divided into groups of 13.* *There are 14 groups.*	Use an area model alongside written division to model the process. *377 ÷ 13 = ?*  *377 ÷ 13 = 29*	Use long division where factors are not useful (for example, when dividing by a 2-digit prime number). Write the required multiples to support the division process. *377 ÷ 13 = ?*  $\begin{array}{r\|rrr} 13 & 3 & 7 & 7 \\ - & 1 & 3 & 0 \quad 10 \\ \hline & 2 & 4 & 7 \\ - & 1 & 3 & 0 \quad 10 \\ \hline & 1 & 1 & 7 \\ - & 1 & 1 & 7 \quad 9 \\ \hline & & & 0 \quad 29 \end{array}$ *377 ÷ 13 = 29* A slightly different layout may be used, with the division completed above rather than at the side.

			$\begin{array}{r} 3 \\ 21\,\overline{)\,7\;9\;8} \\ -\;6\;3\;0 \\ \hline 1\;6\;8 \end{array}$ $\begin{array}{r} 3\;8 \\ 21\,\overline{)\,7\;9\;8} \\ -\;6\;3\;0 \\ \hline 1\;6\;8 \\ -\;1\;6\;8 \\ \hline 0 \end{array}$ Divisions with a remainder explored in problem-solving contexts.
Dividing by 10, 100 and 1,000	Use place value equipment to explore division as exchange.  *0·2 is 2 tenths.* *2 tenths is equivalent to 20 hundredths.* *20 hundredths divided by 10 is 2 hundredths.*	Represent division to show the relationship with multiplication. Understand the effect of dividing by 10, 100 and 1,000 on the digits on a place value grid.  Understand how to divide using division by 10, 100 and 1,000. *12 ÷ 20 = ?*  	Use knowledge of factors to divide by multiples of 10, 100 and 1,000. 40 ÷ 50 = ☐ 40 → ÷ 10 → ÷ 5 → ? 40 → ÷ 5 → ÷ 10 → ? *40 ÷ 5 = 8* *8 ÷ 10 = 0·8* *So, 40 ÷ 50 = 0·8*
Dividing decimals	Use place value equipment to explore division of decimals. 	Use a bar model to represent divisions.	Use short division to divide decimals with up to 2 decimal places.

	8 tenths divided into 4 groups. 2 tenths in each group.	0·8 ? ? ? ? 4 × 2 = 8 8 ÷ 4 = 2 So, 4 × 0·2 = 0·8 0·8 ÷ 4 = 0·2	$\begin{array}{r} \cdot \\ 8\,\overline{)\,4\cdot 2\ 4} \end{array}$ $\begin{array}{r} 0\cdot \\ 8\,\overline{)\,4\cdot {}^{4}2\ 4} \end{array}$ $\begin{array}{r} 0\cdot 5 \\ 8\,\overline{)\,4\cdot {}^{4}2\ {}^{2}4} \end{array}$ $\begin{array}{r} 0\cdot 5\ 3 \\ 8\,\overline{)\,4\cdot {}^{4}2\ {}^{2}4} \end{array}$