Calculation Policy

Year 5 and Year 6

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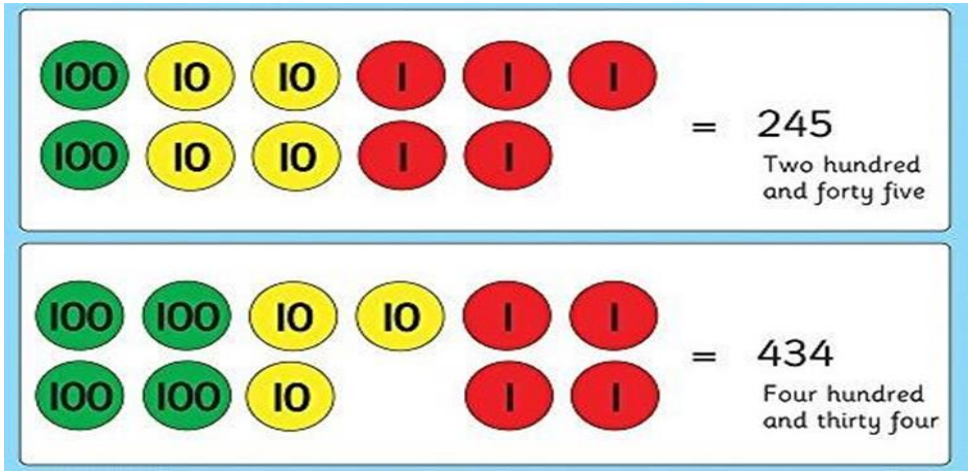
Maths Calculation Policy
Year 5 and Year 6

The following pages show our school's progression in calculation (addition, subtraction, multiplication and division) and how this works in line with the National Curriculum. The consistent use of the concrete, pictorial and abstract approach throughout our school 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.



Mathematics Intent

At Teagues Bridge, our intention is **ambitious.** We aim to create strong mathematicians who have the necessary skills and understanding to tackle mathematical challenges in varying contexts, including the ability to reason and apply their knowledge to solving problems. This should mean that children are able to apply their knowledge to everyday life and can **aspire** to achieve anything that they want. We want our pupils to have strong mental manipulation and to use written strategies when appropriate.

Our philosophy for mathematics is replacing an idea that maths is lots of rules and numbers with a study of patterns and connected ideas. In early years they will build a foundation of number understanding and representation through mainly concrete and pictorial representations. The approach will be supported by in depth questioning, throughout the school to develop mastery.

Use of CPA is encouraged to ensure the curriculum is accessible for all children and that they all have the **opportunity** and are able to demonstrate their understanding in a variety of ways. This will enable them to have a good understanding of maths and not just the ability to follow a procedure. We want to **empower** them to want to ask questions and want to find the answers.

Aims: The national curriculum for mathematics aims to ensure that all pupils:

- become fluent in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately.
- reason mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language
- can solve problems by applying their mathematics to a variety of routine and nonroutine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions.

Mathematics is an interconnected subject in which pupils need to be able to move fluently between representations of mathematical ideas. The programmes of study are, by necessity, organised into apparently distinct domains, but pupils should make rich connections across mathematical ideas to develop fluency, mathematical reasoning and competence in solving increasingly sophisticated problems. They should also apply their mathematical knowledge to science and other subjects.

The expectation is that the majority of pupils will move through the programmes of study at broadly the same pace. However, decisions about when to progress should always be based on the security of pupils' understanding and their readiness to progress to the next stage. Pupils who grasp concepts rapidly should be challenged through

being offered rich and sophisticated problems before any acceleration through new content. Those who are not sufficiently fluent with earlier material should consolidate their understanding, including through additional practice, before moving on.

Our lessons are structured to enable all children to achieve and have an **opportunity** to make progress with their learning. Each lesson begins with a **CLIC maths** activity, where they have chance to develop their mental strategies, secure number facts and number manipulation. They then **develop** their mathematical fluency with the teacher modelling and explaining before they have a go themselves. Children then have a **reasoning/ problem solving** activity which is a variation of the previous work to demonstrate they have mastered the objective. Children who are ready can then **challenge** themselves with a task that requires applying the learning to a greater depth. We have our own programme of study which is supported with schemes like White Rose to support.

National Curriculum	Year 5	Year 6
Addition	Add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction). Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.	Solve problems involving addition, subtraction, multiplication and division.
Subtraction	Add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction). Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.	Solve problems involving addition, subtraction, multiplication and division.
Multiplication	Multiply numbers up to 4 digits by a 1 or 2 digit number using a formal written method, including long multiplication for 2 digit numbers Solve problems involving multiplication and division including using knowledge of factors and multiples, squares and cubes Solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign Solve problems involving multiplication and division including scaling by simple fractions and problems involving simple rates	Multiply multi-digit numbers up to 4 digits by a 2 digit whole number using the formal written method of long multiplication. Solve problems involving addition, subtraction, multiplication and division.
Division	Divide numbers up to 4 digits by a 1 digit number using the formal written method of short division and interpret remainders appropriately for the context (as remainders, as fractions, as decimals or by rounding, e.g. 98 ÷ 4 = = 24 r2 = 24 □= 24.5 ≈ 25).	Divide numbers up to 4 digits by a 2 digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate to the context. Divide numbers up to 4 digits by a 2 digit number using the formal written method of short division where appropriate, interpreting remainders according to the context.

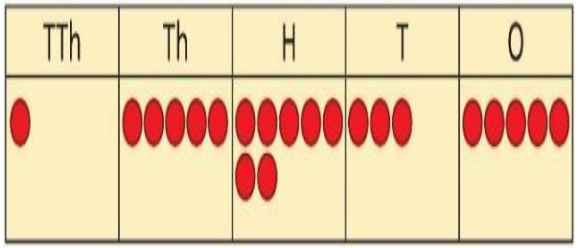
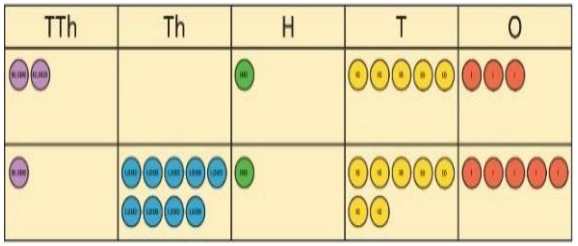
	Solve problems involving multiplication and division including using knowledge of factors and multiples, squares and cubes. Solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign. Solve problems involving multiplication and division including scaling by simple fractions and problems involving simple rates.	Solve problems involving addition, subtraction, multiplication and division.

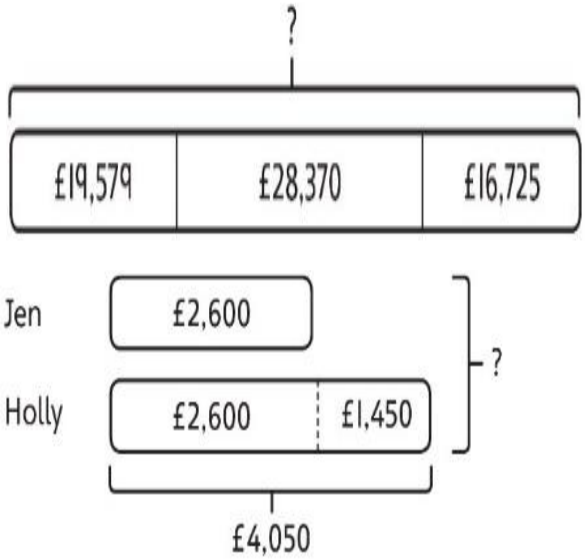
Key Language	Year 5	Known facts	Essential Knowledge	Year 6	Known facts	Essential Knowledge
Addition	**Subject specific:** put together, add, altogether, double, total, more than, equals, plus, make, commutative, inverse, sum, partition, near double, score, increase **Instructional vocabulary:** put, place arrange, rearrange change, change over split, separate	Derive and use addition and subtraction facts to 10 and 1, e.g. 3.3+ 6.7 =10 and so 0.33 + 0.67 = 1.	Fluency of 2 digit + 2 digit including with decimals. Partion second number to add. Adjust numbers to add Add multiples of 10, 100, 1000 and tenths. Use number facts, bridging and place value. Partion and Recombine	**Subject specific:** put together, add, altogether, double, total, more than, equals, plus, make, commutative, inverse, sum, partition, near double, score, increase **Instructional vocabulary:** put, place arrange, rearrange change, change over adjusting, adjust split, separate carry on, continue, repeat what comes next? predict describe the pattern, describe the rule, find, find all, find different investigate	**All KS2 required facts.**	Fluency of 2-digit + 2-digit including decimals. Partion second number to add. Adjust numbers to add. Add multiples of 10, 100, 1000, tenths and hundredths. Use number facts, bridging and place value. Partion and recombine.

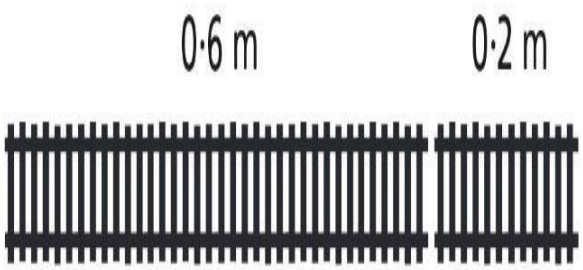
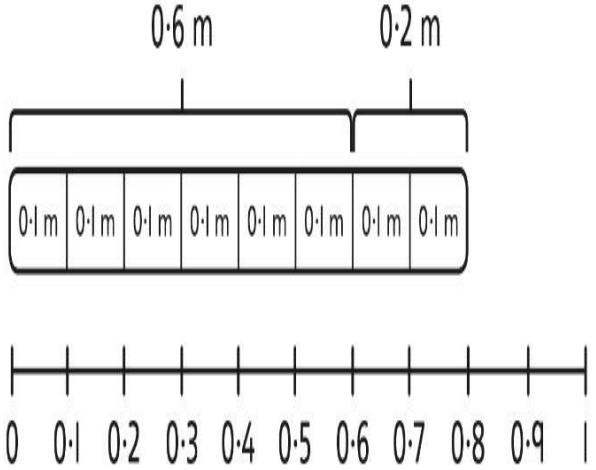
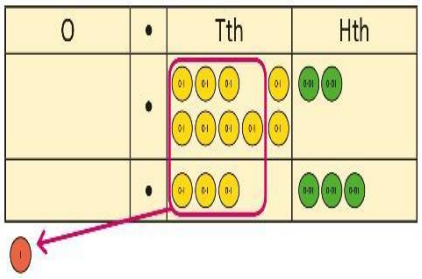
Subtraction	**Subject specific:** subtract, takeaway, distance between, difference between, less than, minus, leave, fewer, left over, equals, tens boundary, partition, rearrange, inverse, hundreds boundary, exchange, carried digits, decrease, **units boundary, tenths boundary** **Instructional vocabulary:** put, place arrange, rearrange change, change over adjusting, adjust split, separate	Derive and use addition and subtraction facts to 10 and 1, e.g. 3.3+6.7=10 leads to 10-3.3=6.7=1-0.67=0.33	Fluency of 2-digit-2-digit in	**Subject specific:** subtract, takeaway, distance between, difference between, less than, minus, leave, fewer, left over, equals, tens boundary, partition, rearrange, inverse, hundreds boundary, exchange, carried digits, decrease, units boundary, tenths boundary **Instructional vocabulary:** put, place arrange, rearrange change, change over adjusting, adjust split, separate carry on, continue, repeat what comes next? predict describe the pattern, describe the rule, find, find all, find different investigate		
Multiplication	**Subject specific:** double, equal groups, array, lots of, odd, even, repeated addition, inverse, commutative, groups of, multiply, multiplied by, multiple of, twice, row, column, tables, factor, related fact, scale, product, factor pair, known fact, derived fact, **common factor, prime number, prime factor,**	Know and use the vocabulary of prime numbers, prime factors and composite (Non-prime) numbers. Recall prime numbers to 19. Recognise and use square and cube numbers and the	4x and 8x tables 3x, 6x and 12x tables. 9x tables 11x and 7x tables 100, 1000 times bigger. 10, 100, 1000 times smaller	**Subject specific:** double, equal groups, array, lots of, odd, even, repeated addition, inverse, commutative, groups of, multiply, multiplied by, multiple of, twice, row, column, tables, factor, related fact, scale, product, factor pair, known fact, derived fact, common factor, prime number, prime factor,	Identify common factors, common multiples, and prime numbers.	Multiplication facts up to 12x12. Apply place value to derive multiplication facts, e.g. 3x4=12 so 3x0.4=1.2 Partion to multiply mentally. Double larger numbers and decimals. 10x smaller

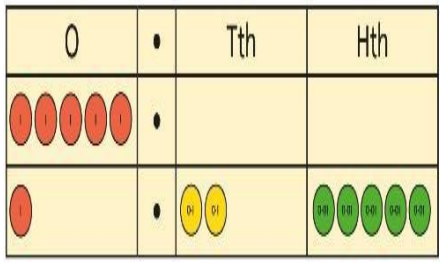
	composite number, square number, cube number, scale, rate **Instructional vocabulary:** carry on, continue, repeat what comes next? predict describe the pattern, describe the rule, find, find all, find different investigate	notation for squared (2) and Cubed (3).	Double larger numbers and decimals.	composite number, square number, cube number, scale, rate, **common multiple** **Instructional vocabulary:** carry on, continue, repeat what comes next? predict describe the pattern, describe the rule, find, find all, find different investigate		100x smaller
Division	**Subject specific:** share, equal groups, array, pairs, divide, divided by, divided into, left over, odd, even, repeated addition, remainder, dividend, divisor, **divided into remainder factor, quotient, divisible by inverse** **Instructional vocabulary:** calculate, work out, solve, investigate question, answer, check same, different missing number/s number facts, number pairs, number bonds greatest value, least value	Know and use the vocabulary of prime numbers, prime factors, and composite numbers. Recall prime numbers up to 19.	Division facts (4x and 8x tables) Division facts (3x, 6x and 12x tables, 3x and 9x tables). Division facts (11x and 7x tables).	**Subject specific:** share, equal groups, array, pairs, divide, divided by, divided into, left over, odd, even, repeated addition, remainder, dividend, divisor, divided into remainder factor, quotient, divisible by inverse, **remainders as fractions or decimals** **Instructional vocabulary:** calculate, work out, solve, investigate question, answer, check same, different missing number/s number facts, number pairs, number bonds greatest value, least value	Identify common factors, common multiples and prime numbers.	Division facts up to 12X12. Apply place value to derive division facts, e.g. 12÷3=4 so 1.2÷3=0.4 Halve larder numbers and decimals. Partion to divide mentally including decimals.

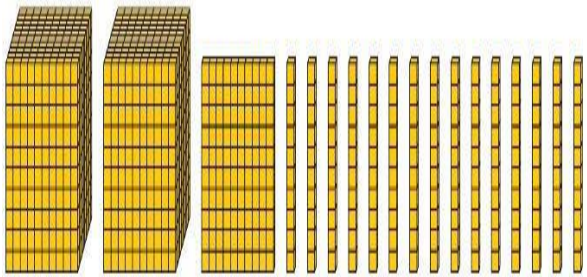
KEYSTAGE 2		
In upper Key Stage 2, children build on secure foundations in calculation, and develop fluency, accuracy and flexibility in their approach to the four operations. They work with whole numbers and adapt their skills to work with decimals, and they continue to develop their ability to select appropriate, accurate and efficient operations.		
Addition and Subtraction	**Multiplication and Division**	**Fractions**
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.	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.	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

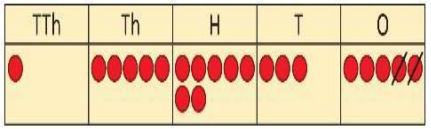
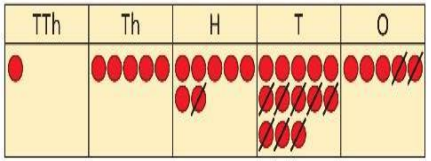
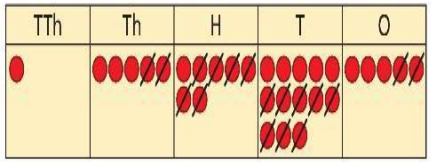
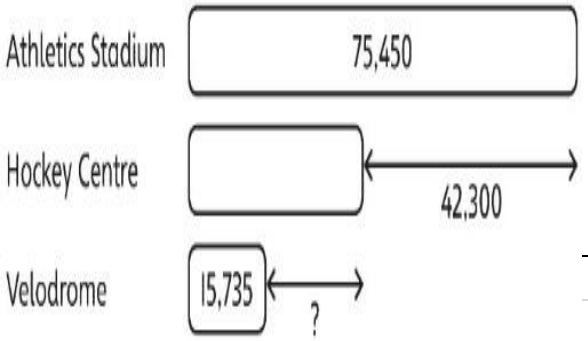
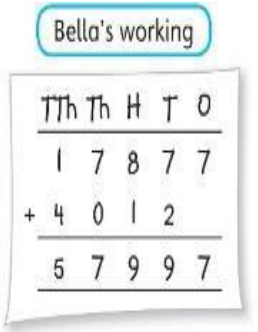
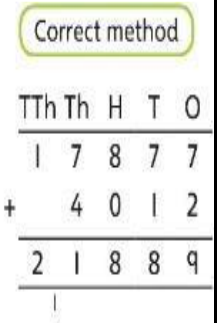
YEAR 3			
	Concrete	Pictorial	Abstract
Year 5 Addition			
Column addition with whole numbers	Use place value equipment to represent additions. *Add a row of counters onto the place value grid to show 15,735 + 4,012.* 	Represent additions, using place value equipment on a place value grid alongside written methods.  *I need to exchange 10 tens for a 100.* TTh Th H T O 2 0 1 5 3 + 1 9 1 7 5 3 9 3 2 8 1	Use column addition, including exchanges. TTh Th H T O 1 9 1 7 5 + 1 8 4 1 7 3 7 5 9 2 1 1

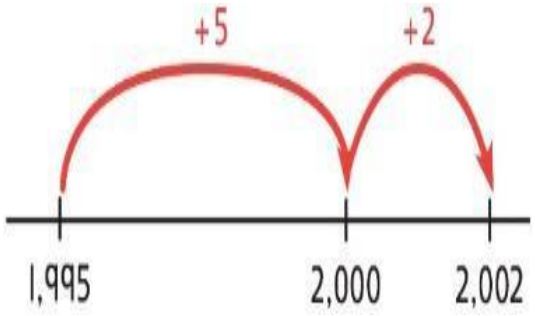
Representing additions		Bar models represent addition of two or more numbers in the context of problem solving.  Th H T O 2 6 0 0 + 1 4 5 0 4 0 5 0 1 Th H T O 2 6 0 0 + 4 0 5 0 6 6 5 0	Use approximation to check whether answers are reasonable. TTh Th H T O 2 3 4 0 5 + 7 8 9 2 2 0 2 9 7 TTh Th H T O 2 3 4 0 5 + 7 8 9 2 3 1 2 9 7 1 1 *I will use 23,000 + 8,000 to check.*
Adding tenths	Link measure with addition of decimals. *Two lengths of fencing are 0·6 m and 0·2 m.*	Use a bar model with a number line to add tenths.	Understand the link with adding fractions.

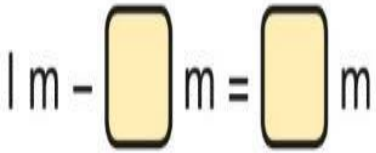
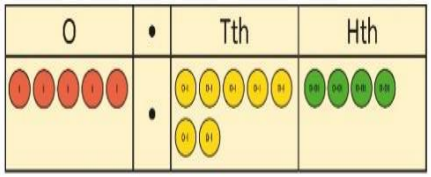
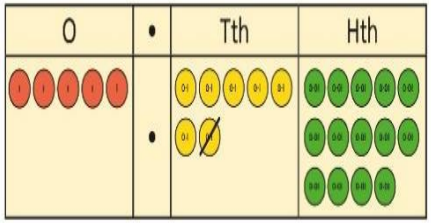
	How long are they when added together? 	 *0·6 + 0·2 = 0·8* *6 tenths + 2 tenths = 8 tenths*	$\frac{6}{10} + \frac{2}{10} = \frac{8}{10}$ *6 tenths + 2 tenths = 8 tenths* *06 + 02 = 08*
Adding decimals using column addition	Use place value equipment to represent additions. *Show 0·23 + 0·45 using place value counters.*	Use place value equipment on a place value grid to represent additions. Represent exchange where necessary.  O · Tth Hth 0 · 9 2 + 0 · 3 3 1 · 2 5 1	Add using a column method, ensuring that children understand the link with place value. O · Tth Hth 0 · 2 3 + 0 · 4 5 0 · 6 8

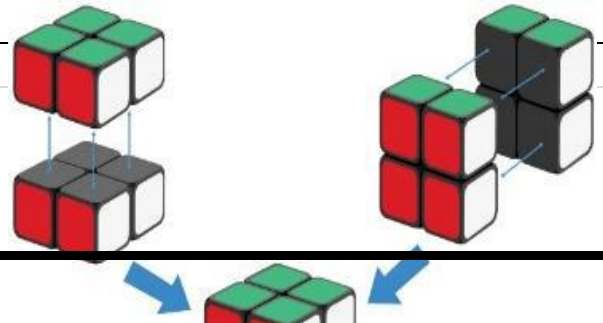
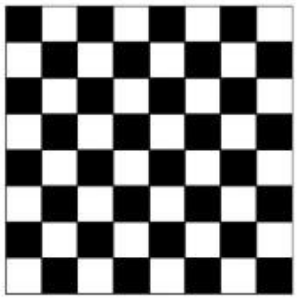
		Include examples where the numbers of decimal places are different.  O · Tth Hth 5 · 0 0 + 1 · 2 5 6 · 2 5	Include exchange where required, alongside an understanding of place value. O · Tth Hth 0 · 9 2 + 0 · 3 3 1 · 2 5 1 Include additions where the numbers of decimal places are different. *3.4 + 0.65 = ?* O · Tth Hth 3 · 4 0 + 0 · 6 5 ·

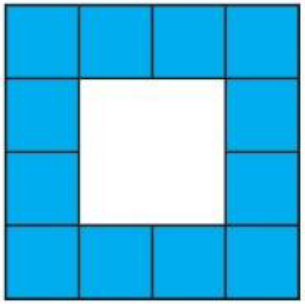
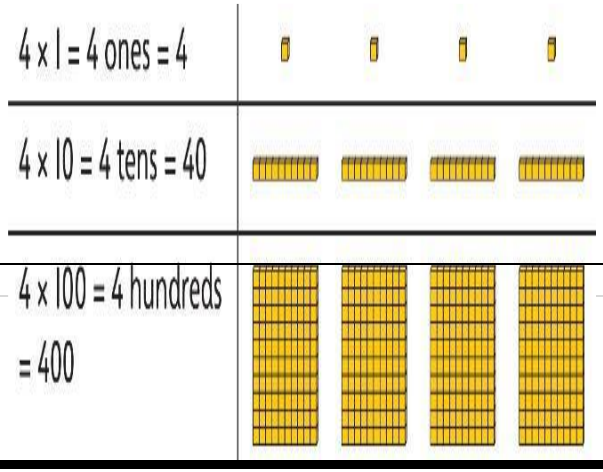
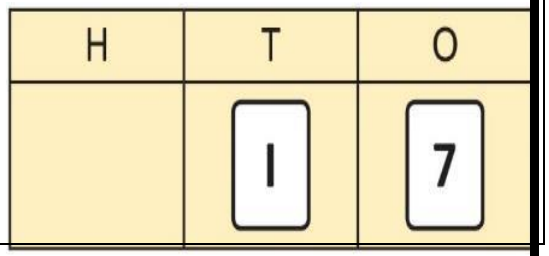
Year 5 Subtraction			
Column subtraction with whole numbers	Use place value equipment to understand where exchanges are required. *2,250 – 1,070* 	Represent the stages of the calculation using place value equipment on a grid alongside the calculation, including exchanges where required. *15,735 – 2,582 = 13,153*	Use column subtraction methods with exchange where required. TTh Th H T O $^{5}\not{6}$ $^{11}\not{2}$ $^{1}0$ 9 7 – 1 8 5 3 4 4 3 5 6 3 *62,097 – 18,534 = 43,563*

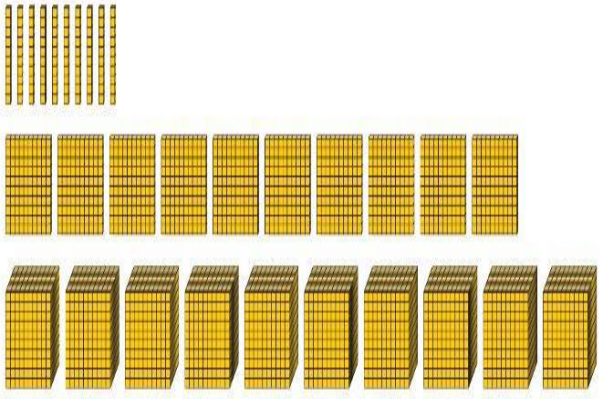
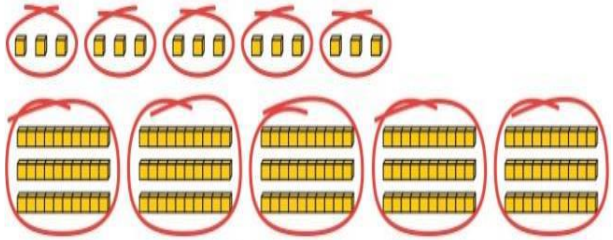
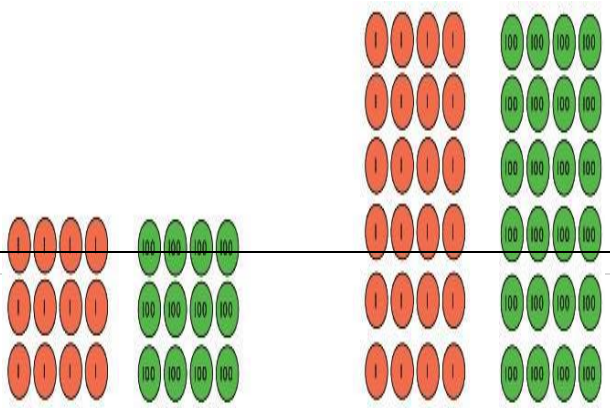
		 TTh Th H T O 1 5 7 3 5 - 2 5 8 2 3 Now subtract the 10s. Exchange 1 hundred for 10 tens.  TTh Th H T O 1 5 6 17 13 5 - 2 5 8 2 5 3 Subtract the 100s, 1,000s and 10,000s.  TTh Th H T O 1 5 6 17 13 5 - 2 5 8 2 1 3 1 5 3	
Checking strategies and representing subtractions		Bar models represent subtractions in problem contexts, including 'find the difference'. 	Children can explain the mistake made when the columns have not been ordered correctly.  

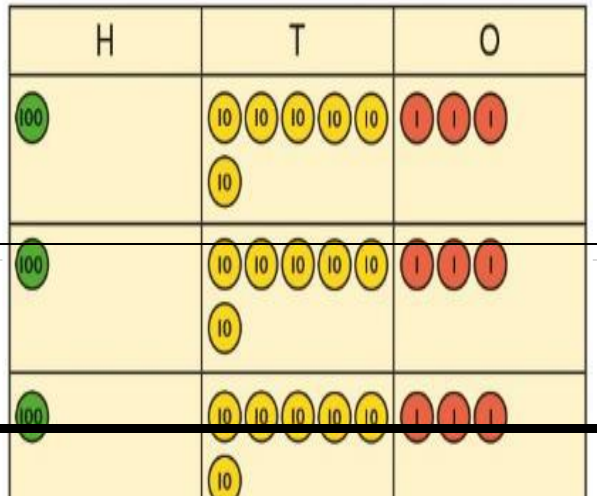
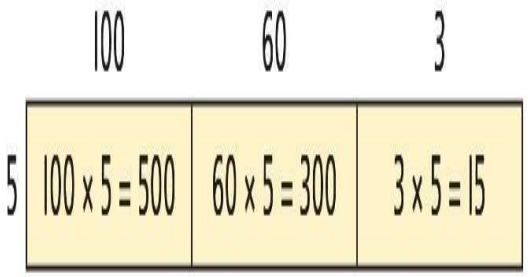
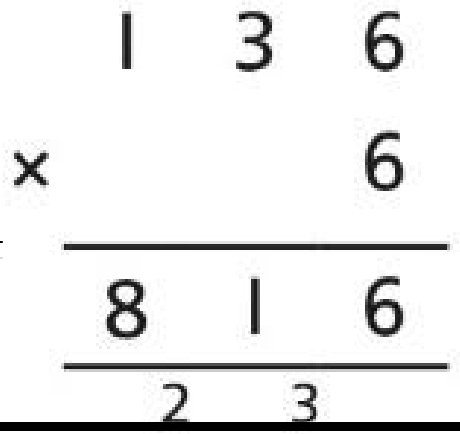
			Use approximation to check calculations. *I calculated 18,000 + 4,000 mentally to check my subtraction.*
Choosing efficient methods			To subtract two large numbers that are close, children find the difference by counting on. *2,002 – 1,995 = ?* 

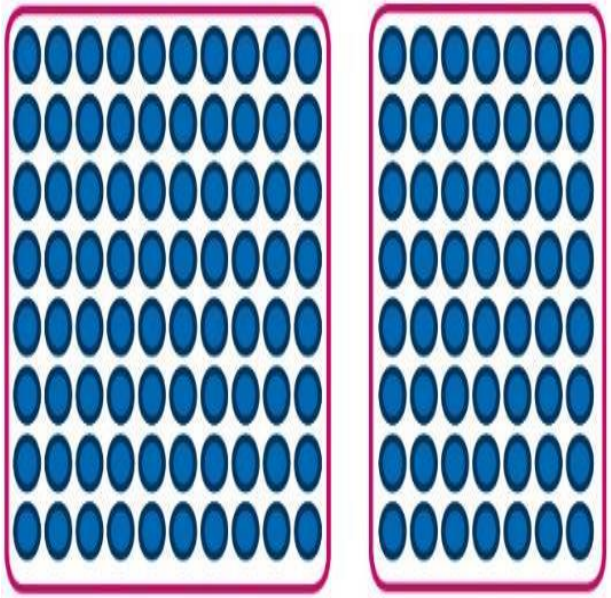
			Use addition to check subtractions. *I calculated 7,546 – 2,355 = 5,191.* *I will check using the inverse.*
Subtracting decimals	Explore complements to a whole number by working in the context of length.   *1 – 0·49 = ?*	Use a place value grid to represent the stages of column subtraction, including exchanges where required. *5·74 – 2·25 = ?*  O · Tth Hth 5 · 7 4 - 2 · 2 5 · Exchange 1 tenth for 10 hundredths.  O · Tth Hth 5 · 6 17 14 - 2 · 2 5 · Now subtract the 5 hundredths.  O · Tth Hth 5 · 6 17 14	Use column subtraction, with an understanding of place value, including subtracting numbers with different numbers of decimal places. *3·921 – 3·75 = ?* O · Tth Hth Thth 3 · 9 2 1 - 3 · 7 5 0 · _____

Year 5 Multiplication			
Understanding factors	Use cubes or counters to explore the meaning of 'square numbers'. *25 is a square number because it is made from 5 rows of 5.* Use cubes to explore cube numbers. 	Use images to explore examples and non-examples of square numbers. 	Understand the pattern of square numbers in the multiplication tables. Use a multiplication grid to circle each square number. Can children spot a pattern?

	8 is a cube number.	*8 × 8 = 64* *82 = 64*  *12 is not a square number, because you cannot multiply a whole number by itself to make 12.*	
Multiplying by 10, 100 and 1,000	Use place value equipment to multiply by 10, 100 and 1,000 by unitising. 	Understand the effect of repeated multiplication by 10.	Understand how exchange relates to the digits when multiplying by 10, 100 and 1,000. 

			*17 × 10 = 170* *17 × 100 = 17 × 10 × 10 = 1,700* *17 × 1,000 = 17 × 10 × 10 × 10 = 17,000*
Multiplying by multiples of 10, 100 and 1,000	Use place value equipment to explore multiplying by unitising.  *5 groups of 3 ones is 15 ones.* *5 groups of 3 tens is 15 tens.* *So, I know that 5 groups of 3 thousand would be 15 thousand.*	Use place value equipment to represent how to multiply by multiples of 10, 100 and 1,000. 	Use known facts and unitising to multiply. *5 × 4 = 20* *5 × 40 = 200* *5 × 400 = 2,000* *5 × 4,000 – 20,000* *5,000 × 4 = 20,000*

		4 × 3 = 12 *6 × 4 = 24* *4 × 300 = 1,200* *6 × 400 = 2,400*	
Multiplying up to 4-digit numbers by a single digit	Explore how to use partitioning to multiply efficiently. *8 × 17 = ?*	Represent multiplications using place value equipment and add the 1s, then 10s, then 100s, then 1,000s. 	Use an area model and then add the parts.  Use a column multiplication, including any required exchanges. 

	 *So, 8 × 17 = 136*		
Multiplying 2-digit numbers by 2-digit numbers	Partition one number into 10s and 1s, then add the parts. *23 × 15 = ?*	Use an area model and add the parts. *28 × 15 = ?*	Use column multiplication, ensuring understanding of place value at each stage.

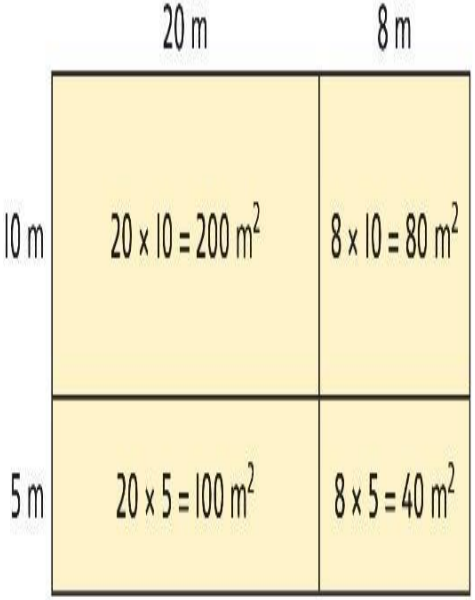
10 x 15 = 150 10 x 15 = 150

3 x 15 = 45

H	T	O
1	5	0
1	5	0
+	4	5
3	4	5
1		

There are 345 bottles of milk in total.

23 × 15 = 345

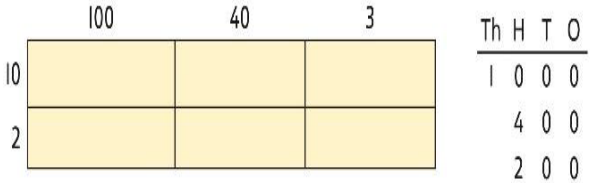
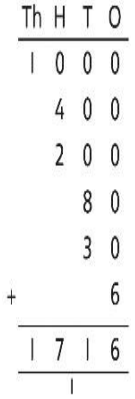


H	T	O
2	0	0
1	0	0
	8	0
+	4	0
4	2	0
1		

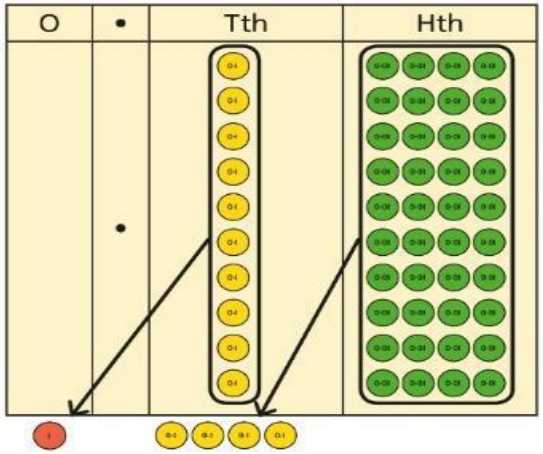
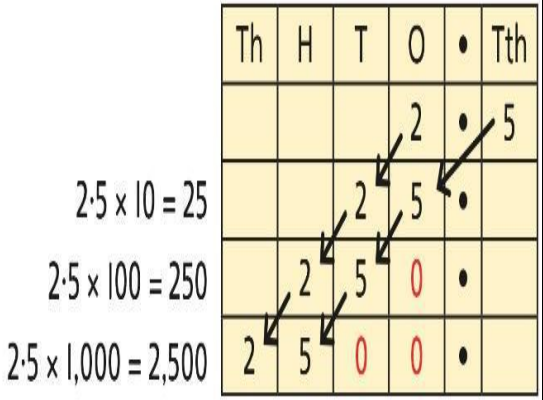
28 × 15 = 420

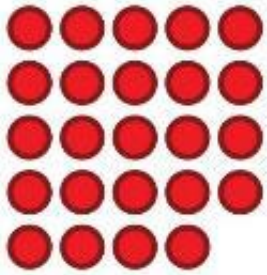
$$\begin{array}{r} 34 \\ \times\ 27 \\ \hline 238 \\ \hline \\ \hline \end{array} \quad 34 \times 7$$

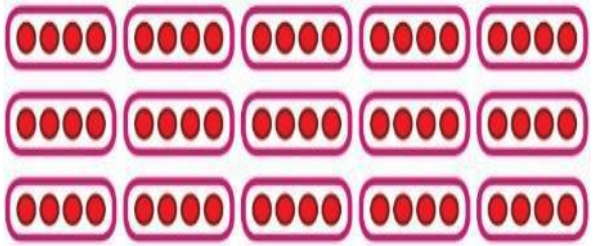
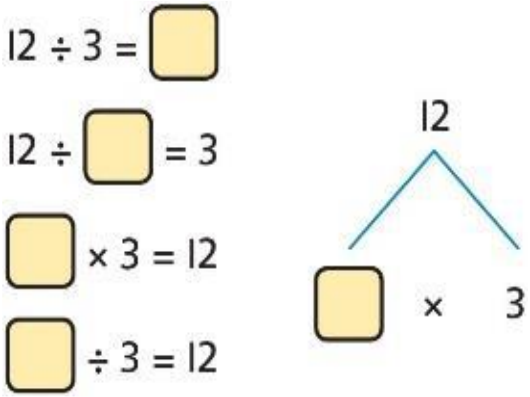
$$\begin{array}{r} 34 \\ \times\ 27 \\ \hline 238 \\ 680 \\ \hline \\ \hline \end{array} \quad \begin{array}{l} 34 \times 7 \\ 34 \times 20 \end{array}$$

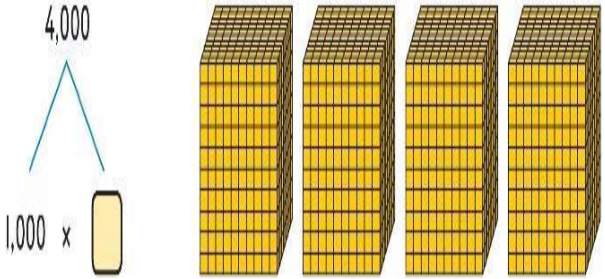
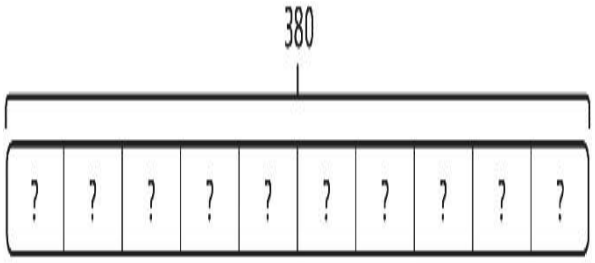
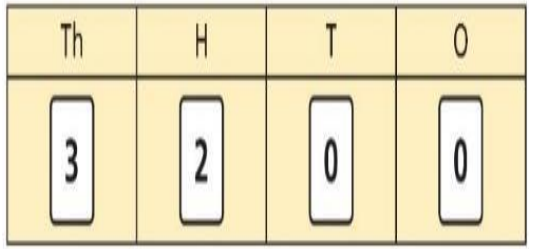
			34 × 27 238 (2) 34 × 7 680 34 × 20 918 (1) 34 × 27
Multiplying up to 4-digits by 2-digits		Use the area model then add the parts   143 x 12 = 1,716 There are 1,716 boxes of cereal in total. *143 × 12 = 1,716*	Use column multiplication, ensuring understanding of place value at each stage. 143 × 12 286 143 × 2 1430 143 × 10 1716 143 × 12 (1)

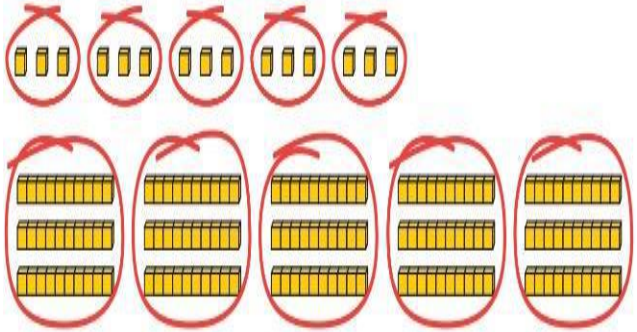
			Progress to include examples that require multiple exchanges as understanding, confidence and fluency build. *1,274 × 32 = ?* *First multiply 1,274 by 2.* 1 2 7 4 × 3 2 2 5 1 4 8 — 1,274 × 2 *Then multiply 1,274 by 30.* 1 2 7 4 × 3 2 2 5 1 4 8 — 1,274 × 2 3 8 2 2 1 2 0 — 1,274 × 30 *Finally, find the total.*

			1 2 7 4 × 3 2 2 5 4 8 (1) 1,274 × 2 3 8 2 (2) 2 0 (1) 1,274 × 30 4 0 7 6 8 1,274 × 32 (1) *1,274 × 32 = 40,768*
Multiplying decimals by 10, 100 and 1,000	Use place value equipment to explore and understand the exchange of 10 tenths, 10 hundredths or 10 thousandths.	Represent multiplication by 10 as exchange on a place value grid.  *0·14 × 10 = 1·4*	Understand how this exchange is represented on a place value chart. 

Year 5 Division			
Understanding factors and prime numbers	Use equipment to explore the factors of a given number.  *24 ÷ 3 = 8* *24 ÷ 8 = 3* *8 and 3 are factors of 24 because they divide 24 exactly.* 24 ÷ 5 = 4 remainder 4.  *5 is not a factor of 24 because there is a remainder.*	Understand that prime numbers are numbers with exactly two factors. *13 ÷ 1 = 13* *13 ÷ 2 = 6 r 1* *13 ÷ 4 = 4 r 1* *1 and 13 are the only factors of 13.* *13 is a prime number.*	Understand how to recognise prime and composite numbers. *I know that 31 is a prime number because it can be divided by only 1 and itself without leaving a remainder.* *I know that 33 is not a prime number as it can be divided by 1, 3, 11 and 33.* *I know that 1 is not a prime number, as it has only 1 factor.*

Understanding inverse operations and the link with multiplication, grouping and sharing	Use equipment to group and share and to explore the calculations that are present. *I have 28 counters.* *I made 7 groups of 4. There are 28 in total.* *I have 28 in total. I shared them equally into 7 groups. There are 4 in each group.* *I have 28 in total. I made groups of 4. There are 7 equal groups.*	Represent multiplicative relationships and explore the families of division facts.  *60 ÷ 4 = 15* *60 ÷ 15 = 4*	Represent the different multiplicative relationships to solve problems requiring inverse operations.  Understand missing number problems for division calculations and know how to solve them using inverse operations. *22 ÷ ? = 2* *22 ÷ 2 = ?* *? ÷ 2 = 22* *? ÷ 22 = 2*
Dividing whole numbers by 10, 100 and 1,000	Use place value equipment to support unitising for division. *4,000 ÷ 1,000*	Use a bar model to support dividing by unitising. *380 ÷ 10 = 38*	Understand how and why the digits change on a place value grid when dividing by 10, 100 or 1,000.

	 *4,000 is 4 thousands.* *4 × 1,000= 4,000* *So, 4,000 ÷ 1,000 = 4*	 *380* *10 ×* *380 is 38 tens.* *38 × 10 = 380* *10 × 38 = 380* *So, 380 ÷ 10 = 38*	 *3,200 ÷ 100 = ?* *3,200 is 3 thousands and 2 hundreds.* *200 ÷ 100 = 2* *3,000 ÷ 100 = 30* *3,200 ÷ 100 = 32* *So, the digits will move two places to the right.*
Dividing by multiples of 10, 100 and 1,000	Use place value equipment to represent known facts and unitising.	Represent related facts with place value equipment when dividing by unitising.	Reason from known facts, based on understanding of unitising. Use knowledge of the inverse relationship to check.

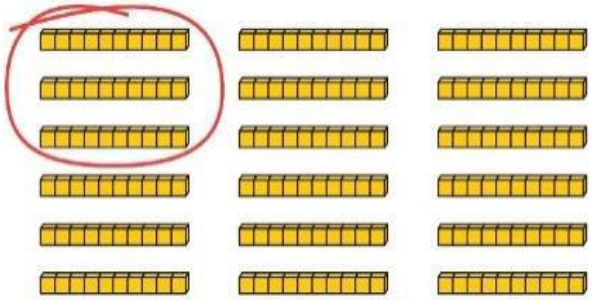


15 ones put into groups of 3 ones. There are 5 groups.

15 ÷ 3 = 5

15 tens put into groups of 3 tens. There are 5 groups.

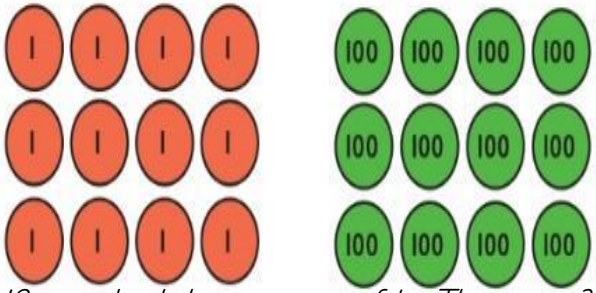
150 ÷ 30 = 5



180 is 18 tens.

18 tens divided into groups of 3 tens. There are 6 groups.

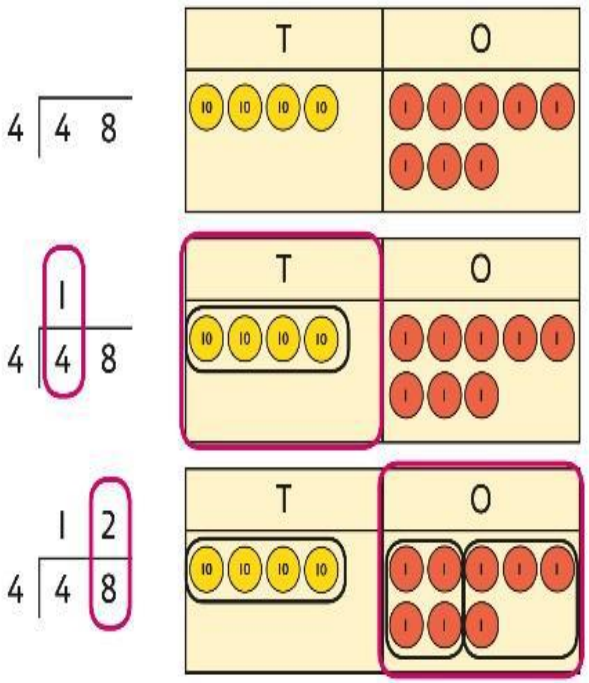
180 ÷ 30 = 6



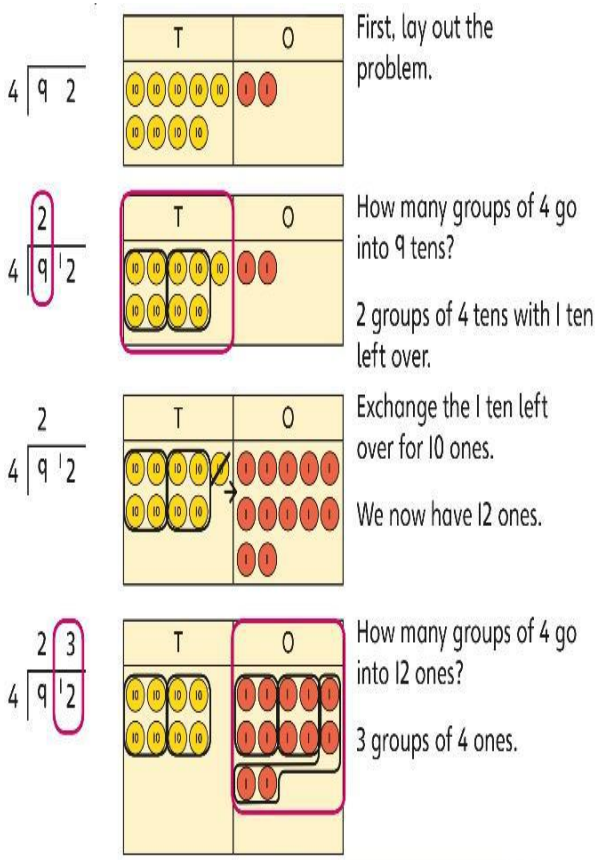
12 ones divided into groups of 4. There are 3 groups.

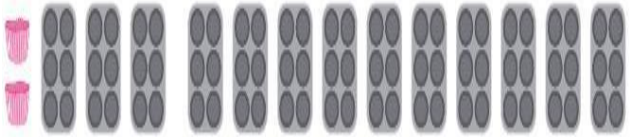
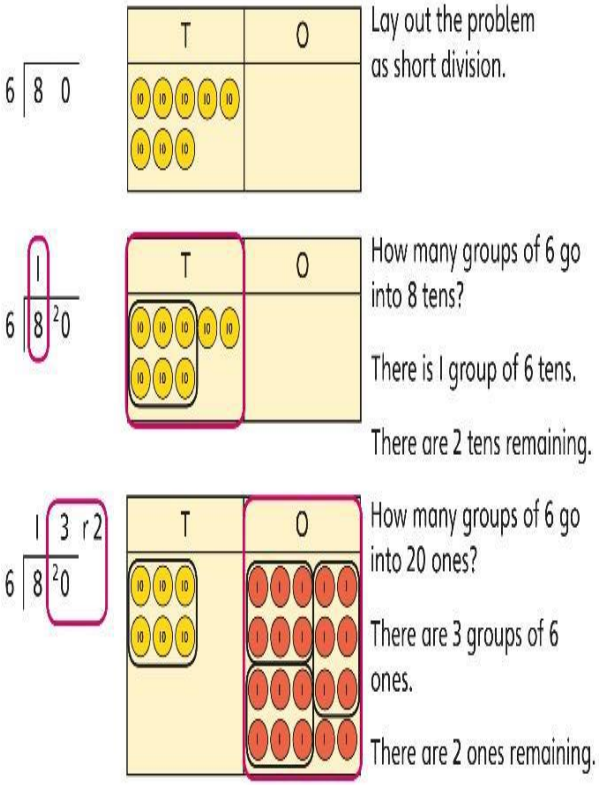
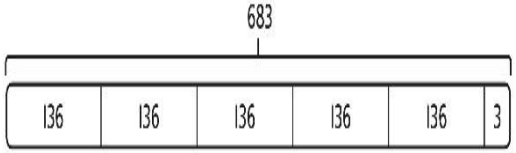
3,000 ÷ 5 = 600
3,000 ÷ 50 = 60
3,000 ÷ 500 = 6

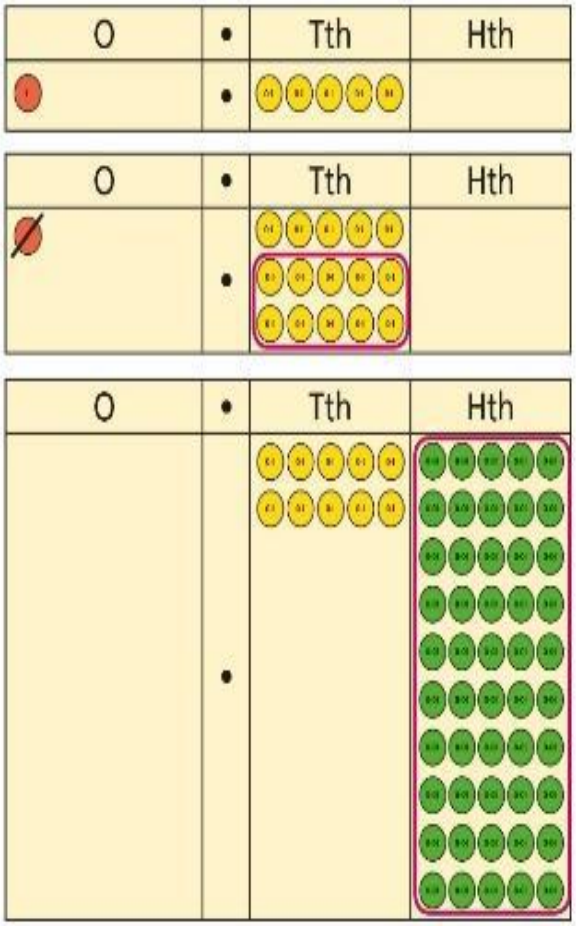
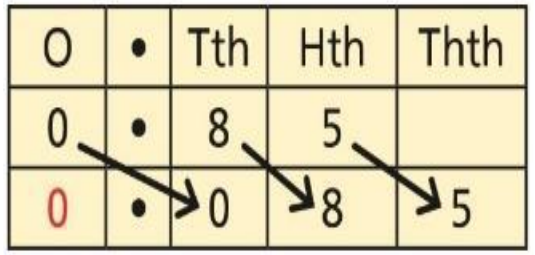
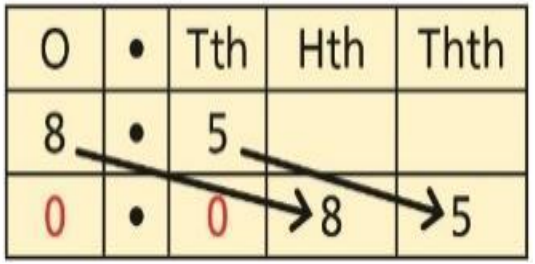
5 × 600 = 3,000
50 × 60 = 3,000
500 × 6 = 3,000

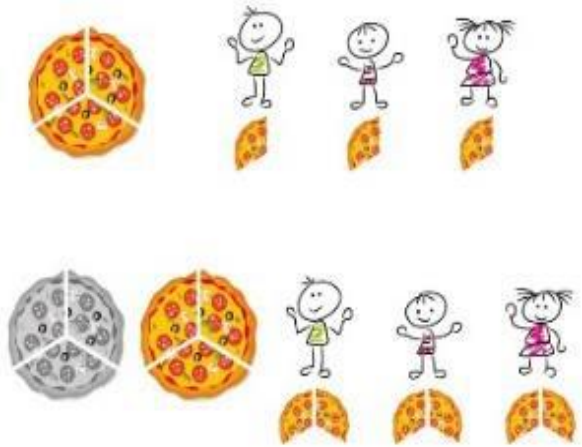
		12 hundreds divided into groups of 4 hundreds. There are 3 groups. *1200 ÷ 400 = 3*	
Dividing up to four digits by a single digit using short division	Explore grouping using place value equipment. *268 ÷ 2 = ?* *There is 1 group of 2 hundreds.* *There are 3 groups of 2 tens.* *There are 4 groups of 2 ones.* *264 ÷ 2 = 134*	Use place value equipment on a place value grid alongside short division. The model uses grouping. A sharing model can also be used, although the model would need adapting.  Lay out the problem as a short division.	Use short division for up to 4-digit numbers divided by a single digit. 0 5 5 6 7 ⟌ 3 ³8 ³9 ⁴2 *3,892 ÷ 7 = 556* Use multiplication to check. *556 × 7 = ?* *6 × 7 = 42* *50 × 7 = 350* *500 × 7 = 3500* *3,500 + 350 + 42 = 3,892*

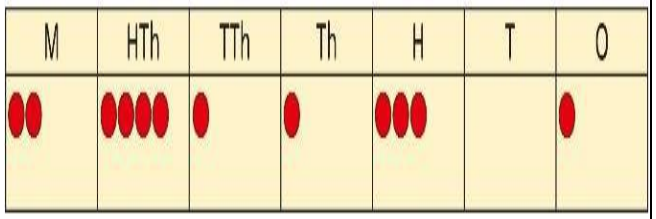
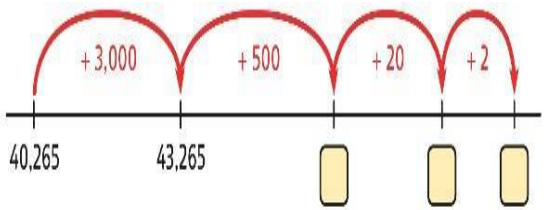
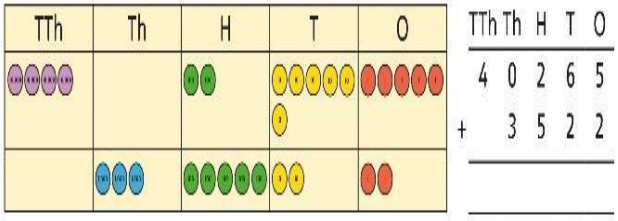
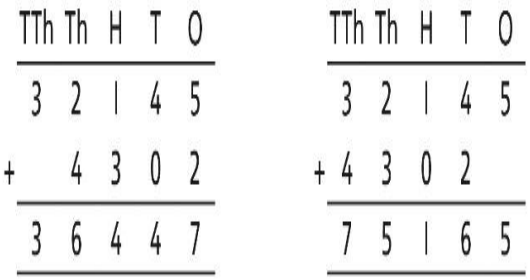
There is 1 group of 4 in 4 tens.
There are 2 groups of 4 in 8 ones.
Work with divisions that require exchange.

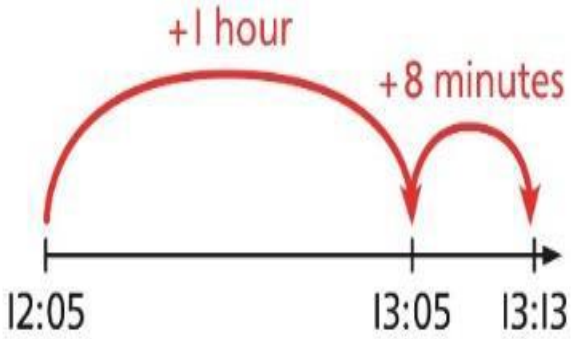
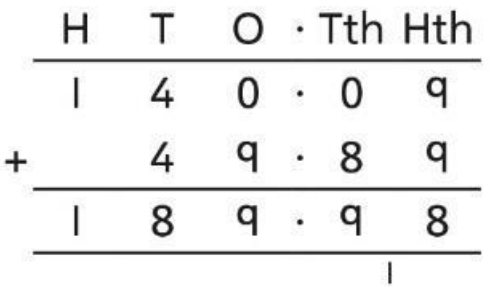
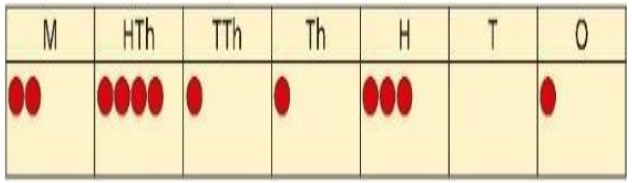
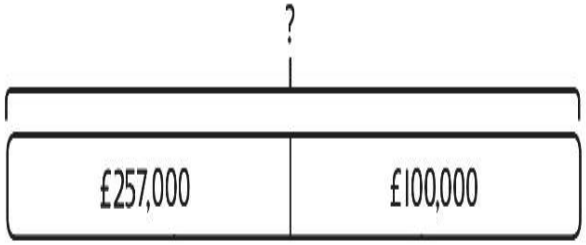


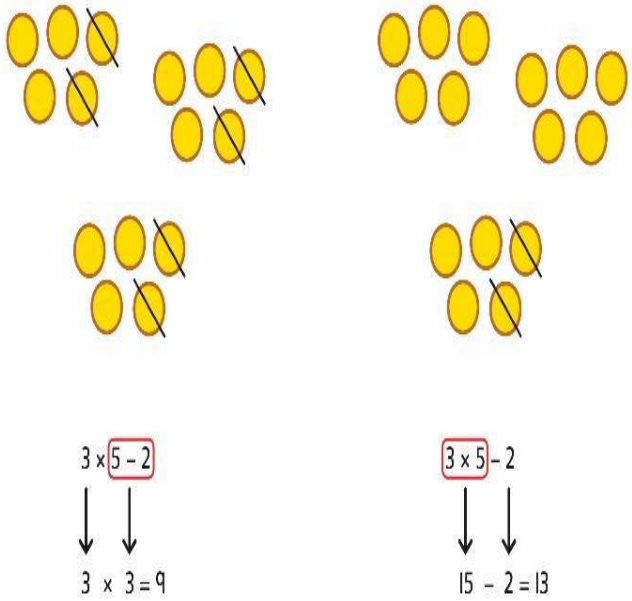
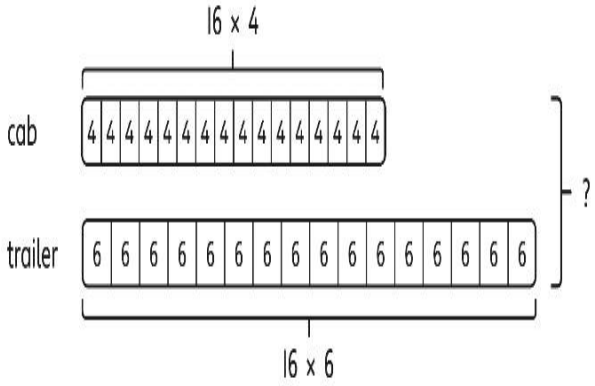
Understanding remainders	Understand remainders using concrete versions of a problem. *80 cakes divided into trays of 6.*  *80 cakes in total. They make 13 groups of 6, with 2 remaining.*	Use short division and understand remainders as the last remaining Is. 	In problem solving contexts, represent divisions including remainders with a bar model.  *683 = 136 × 5 + 3* *683 ÷ 5 = 136 r 3*

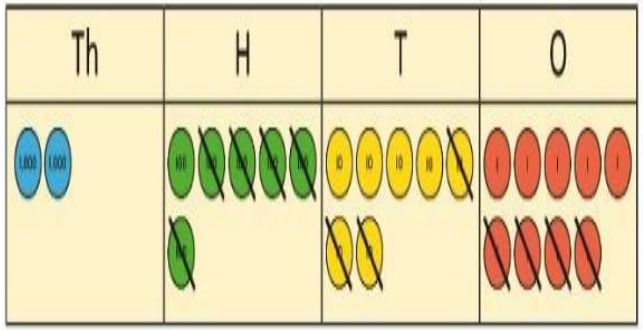
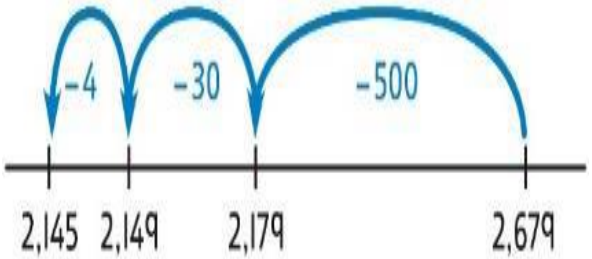
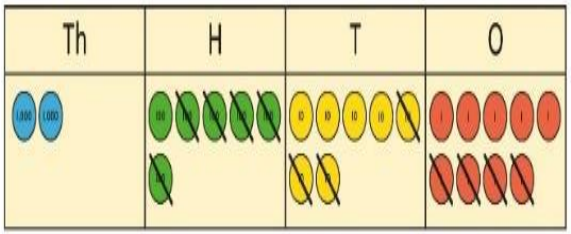
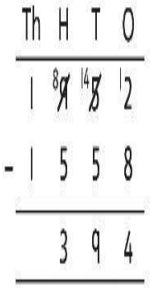
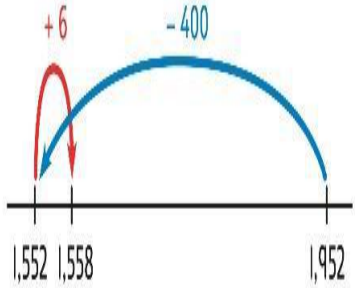
Dividing decimals by 10, 100 and 1,000	Understand division by 10 using exchange. *2 ones are 20 tenths.* *20 tenths divided by 10 is 2 tenths.*	Represent division using exchange on a place value grid. 	Understand the movement of digits on a place value grid.  0·85 ÷ 10 = 0·085  *8·5 ÷ 100 = 0·085*

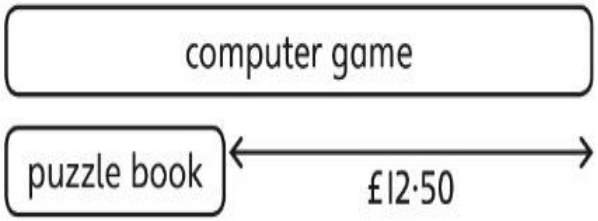
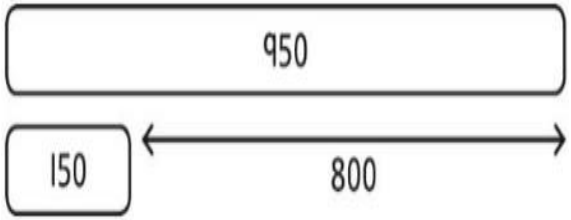
		1·5 is 1 one and 5 tenths. *This is equivalent to 10 tenths and 50 hundredths.* *10 tenths divided by 10 is 1 tenth.* *50 hundredths divided by 10 is 5 hundredths.* *1·5 divided by 10 is 1 tenth and 5 hundredths.* *1·5 ÷ 10 = 0.15*	
Understanding the relationship between fractions and division	Use sharing to explore the link between fractions and division. *1 whole shared between 3 people.* *Each person receives one-third.* 	Use a bar model and other fraction representations to show the link between fractions and division.  $1 \div 3 = \frac{1}{3}$	Use the link between division and fractions to calculate divisions. $5 \div 4 = \frac{5}{4} = 1\frac{1}{4}$ $11 \div 4 = \frac{11}{4} = 2\frac{3}{4}$

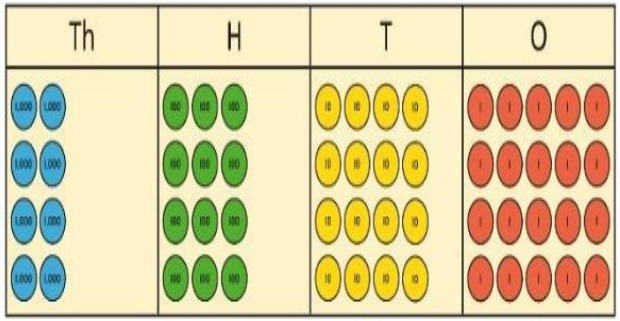
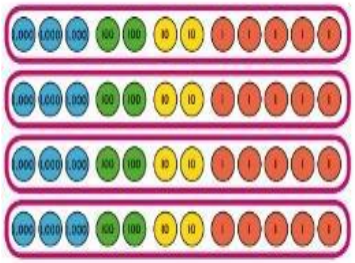
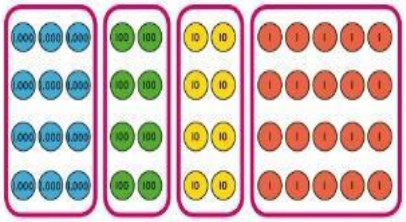
Year 6			
	Concrete	Pictorial	Abstract
Year 6 Addition			
Comparing and selecting efficient methods	Represent 7-digit numbers on a place value grid, and use this to support thinking and mental methods. 	Discuss similarities and differences between methods, and choose efficient methods based on the specific calculation. Compare written and mental methods alongside place value representations.   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 = ?*  *Which method has been completed accurately?* *What mistake has been made?*

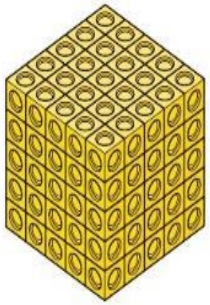
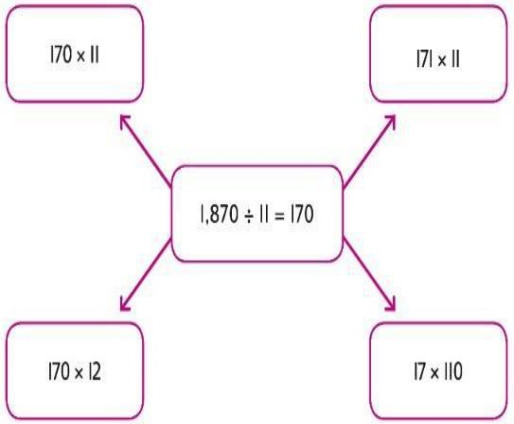
			Column methods are also used for decimal additions where mental methods are not efficient. 
Selecting mental methods for larger numbers where appropriate	Represent 7-digit numbers on a place value grid, and use this to support thinking and mental methods.  *2,411,301 + 500,000 = ?* *This would be 5 more 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.*	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*

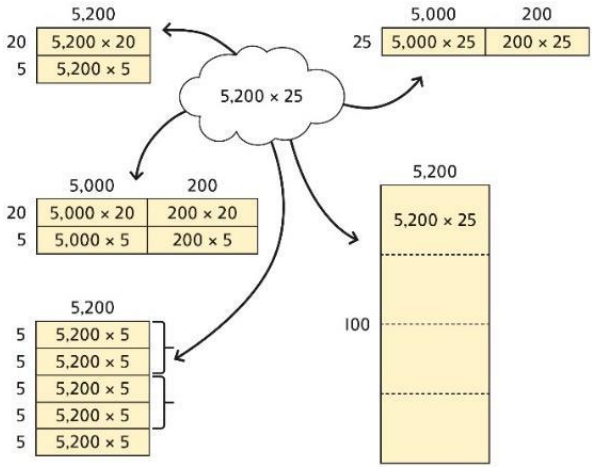
		257 thousands + 100 thousands = 357 thousands *257,000 + 100,000 = 357,000* *357,000 – 1,000 = 356,000* *So, 257,000 + 99,000 = 356,000*	
Understanding order of operations in calculations	Use equipment to model different interpretations of a calculation with more than one operation. Explore different results. *3 × 5 – 2 = ?*  	Model calculations using a bar model to demonstrate the correct order of operations in multi-step calculations.  This can be written as: 16 x 4 + 16 x 6 16 x 4 + 16 x 6 64 + 96 = 160	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

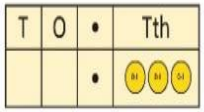
Year 6 Subtraction			
Comparing and selecting efficient methods	Use counters on a place value grid to represent subtractions of larger numbers. 	Compare subtraction methods alongside place value representations.   Th H T O 2 6 7 9 − 5 3 4 2 1 4 5	Compare and select methods. Use column subtraction when mental methods are not efficient. Use two different methods for one calculation as a checking strategy.   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

		Use a bar model to represent calculations, including 'find the difference' with two bars as comparison. 	
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			

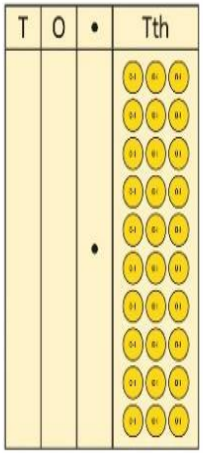
Multiplying up to a 4-digit number by a single digit number	Use equipment to explore multiplications.  *4 groups of 2,345* *This is a multiplication:* *4 × 2,345* *2,345 × 4*	Use place value equipment to compare methods. **Method 1**  3 2 2 5 3 2 2 5 3 2 2 5 + 3 2 2 5 1 2 9 0 0 1 1 2 **Method 2**  4 × 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 formal written method for multiplication.	Use compact column multiplication with understanding of place value at all stages.

		Method I |	1,000	200	30	5
---	---	---	---	---
20	20,000	4,000	600	100
1	1,000	200	30	5		1 2 3 5 x 2 1 --- 1 2 3 5 — 1 x 1,235 2 4 7 0 0 — 20 x 1,235 --- 2 5 9 3 5 — 21 x 1,235
Using knowledge of factors and partitions to compare methods for multiplications	Use equipment to understand square numbers and cube numbers.   $5 \times 5 = 5^2 = 25$	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. 

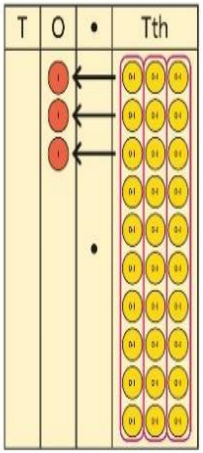
	$5 \times 5 \times 5 = 5^3 = 25 \times 5 = 125$	 Represent and compare methods using a bar model.	Use factors to calculate efficiently. 15 × 16 $= 3 \times 5 \times 2 \times 8$ $= 3 \times 8 \times 2 \times 5$ $= 24 \times 10$ $= 240$
Multiplying by 10, 100 and 1,000	Use place value equipment to explore exchange in decimal multiplication	Understand how the exchange affects decimal numbers on a place value grid.	Use knowledge of multiplying by 10, 100 and 1,000 to multiply by multiples of 10, 100 and 1,000. $8 \times 100 = 800$ $8 \times 300 = 800 \times 3$ = 2,400 $2.5 \times 10 = 25$ $2.5 \times 20 = 2.5 \times 10 \times 2$ = 50



Represent 0·3.

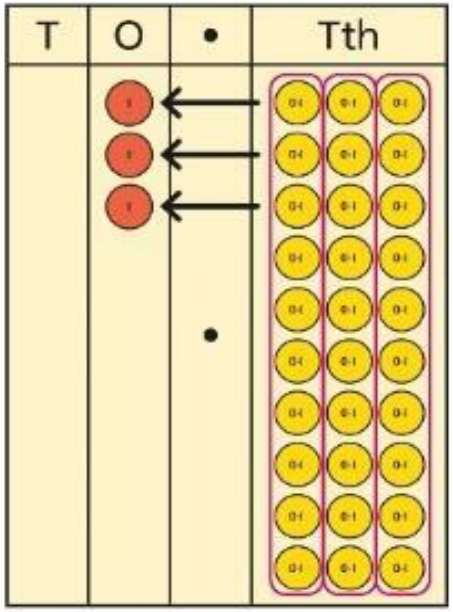


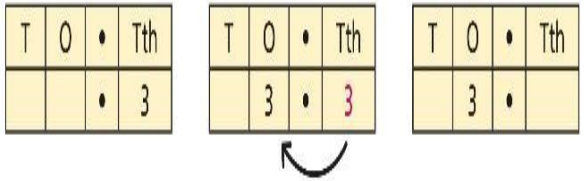
Multiply by 10.



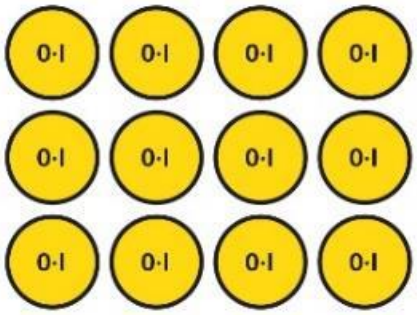
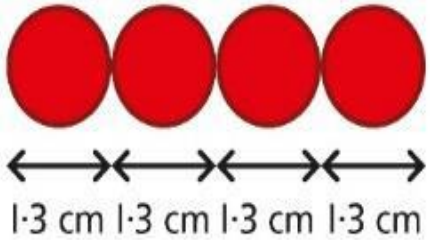
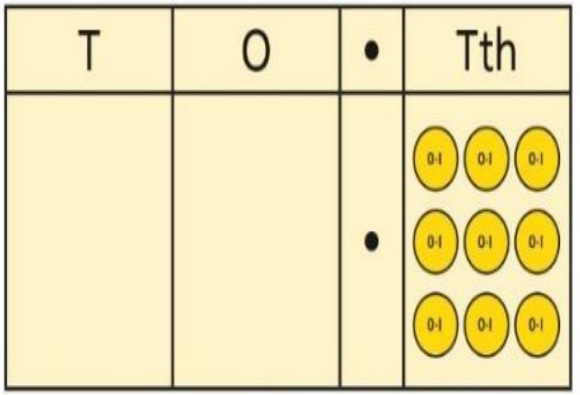
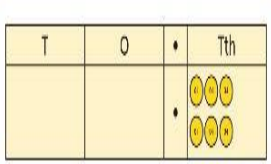
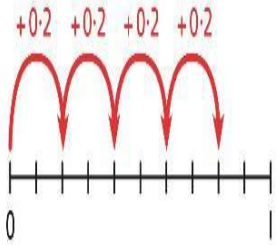
Exchange each group of ten tenths.

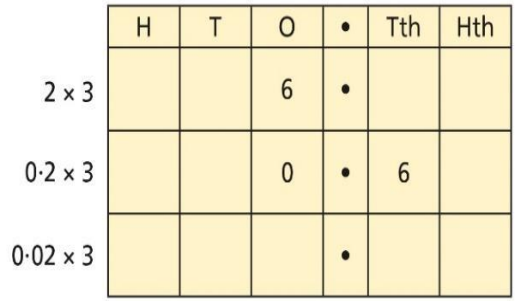
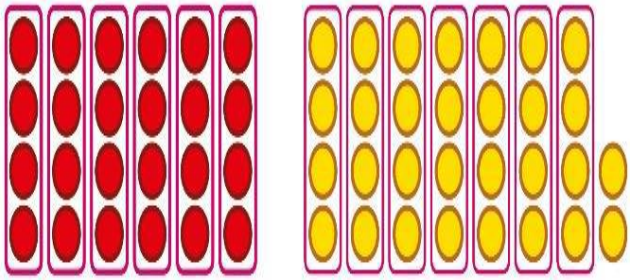
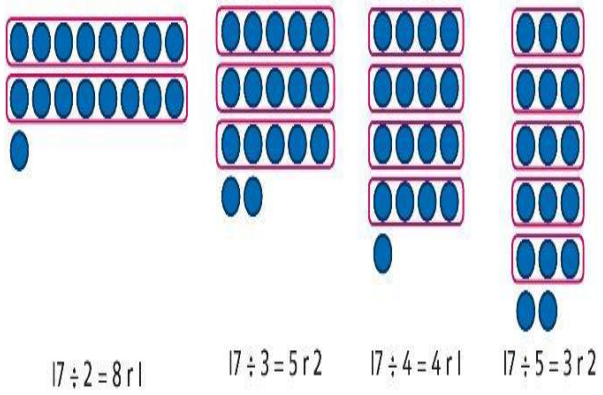
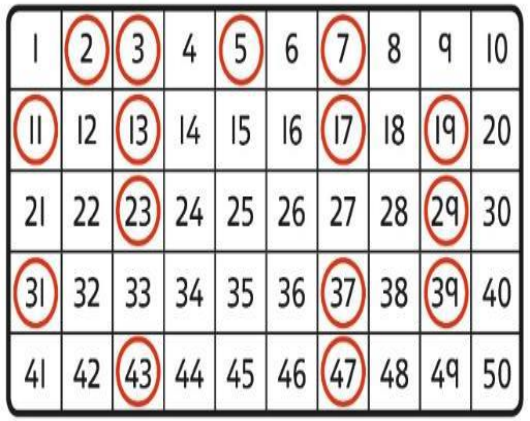
0·3 × 10 = ?
0·3 is 3 tenths.
10 × 3 tenths are 30 tenths.
30 tenths are equivalent to 3 ones.

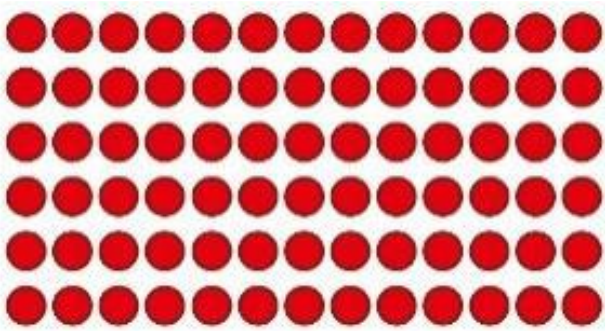
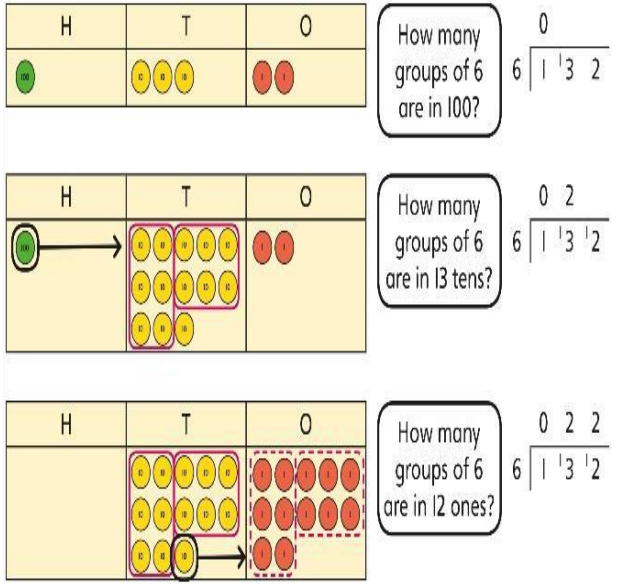


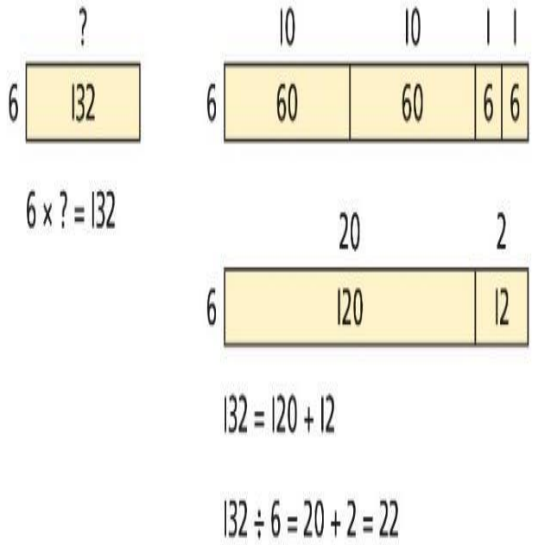
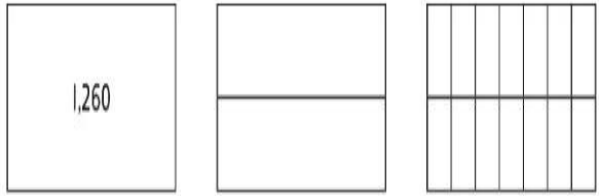
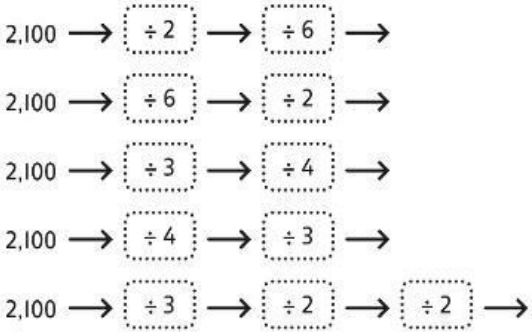


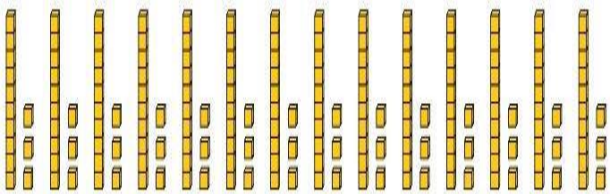
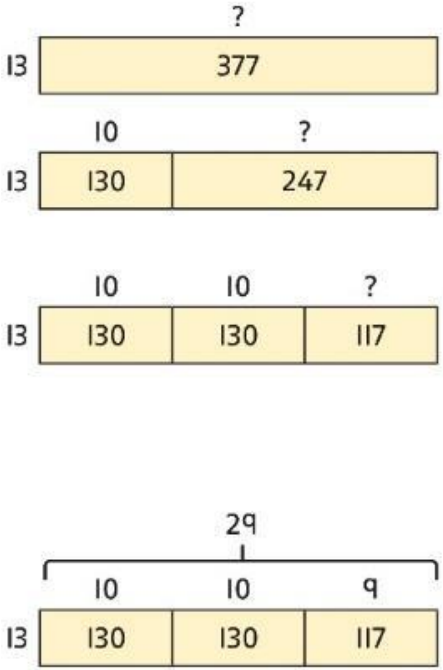
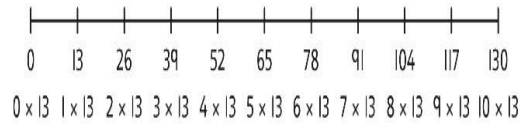
0·3 × 10 = 3

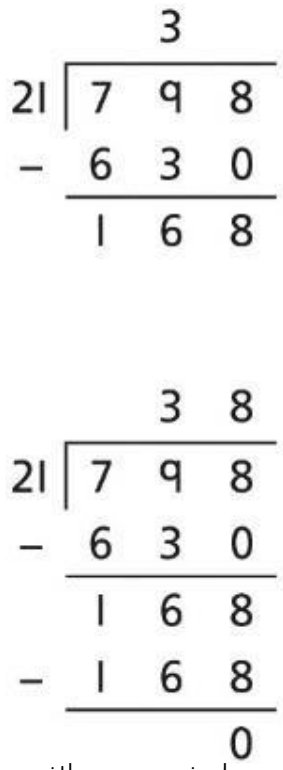
Multiplying decimals	Explore decimal multiplications using place value equipment and in the context of measures.  *3 groups of 4 tenths is 12 tenths.* *4 groups of 3 tenths is 12 tenths.*  *4 × 1 cm = 4 cm* *4 × 0·3 cm = 1.2 cm* *4 × 13 = 4 + 12 = 52 cm*	Represent calculations on a place value grid. 3 x 3 = 9 3 x 0·3 = 0·9  Understand the link between multiplying decimals and repeated addition.   	Use known facts to multiply decimals. *4 × 3 = 12* *4 × 0·3 = 1·2* *4 × 0·03 = 0·12* *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.

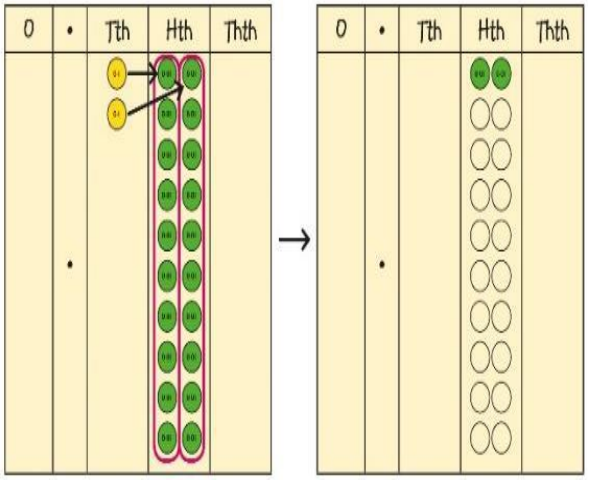
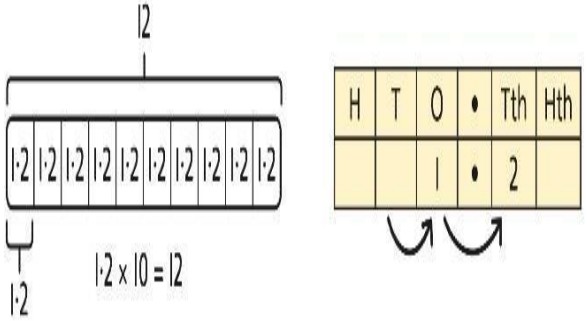
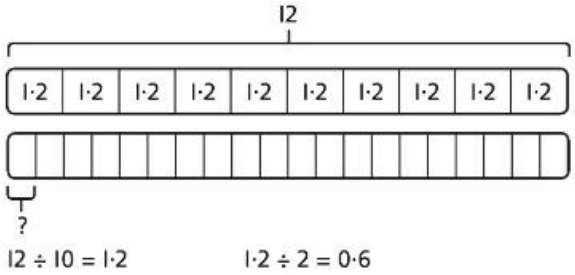
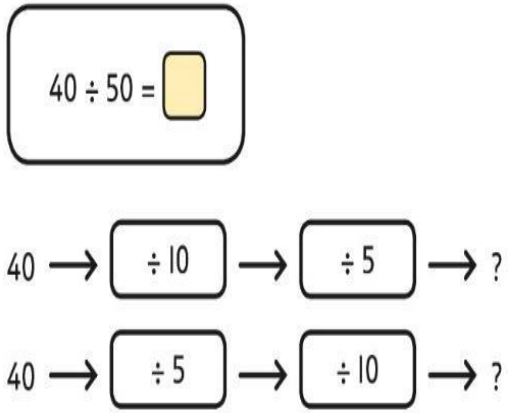
			
Year 6 Division			
Understanding factors	Use equipment to explore different factors of a number.  *4 is a factor of 24 but is not a factor of 30.*	Recognise prime numbers as numbers having exactly two factors. Understand the link with division and remainders. 	Recognise and know primes up to 100. Understand that 2 is the only even prime, and that 1 is not a prime number. 

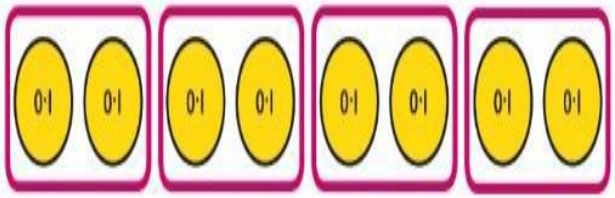
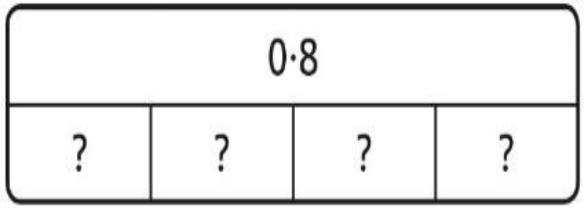
Dividing by a single digit	Use equipment to make groups from a total.  *There are 78 in total.* *There are 6 groups of 13.* *There are 13 groups of 6.*		Use short division to divide by a single digit. $6\overline{)13\,2}$ 0 $6\overline{)13\,2}$ 0 2 $6\overline{)13\,2}$ 0 2 2 Use an area model to link 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* *630 ÷ 7 = 90* *1,260 ÷ 14 = 90*	Use factors and repeated division where appropriate. *2,100 ÷ 12 = ?* 

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 = ?*  *798 ÷ 21=38* *An example of long division:*

			 Divisions with a remainder explored in problem-solving contexts.

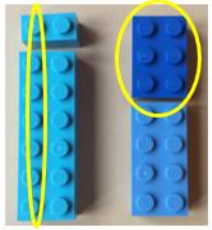
Dividing by 10, 100 and 1,000	Use place value equipment to explore division as exchange.  *0·2 is 2 tenths.* *2 tenths is equivalent to 20 hundredths.* *20 hundredths divided by 10 is 2 hundredths.*	Represent division to show the relationship with multiplication. Understand the effect of dividing by 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 ÷ 5 = 8* *8 ÷ 10 = 0·8* *So, 40 ÷ 50 = 0·8*

Dividing decimals	Use place value equipment to explore division of decimals.  *8 tenths divided into 4 groups. 2 tenths in each group.*	Use a bar model to represent divisions.  $4 \times 2 = 8$ $\quad 8 \div 4 = 2$ So, $4 \times 0{\cdot}2 = 0{\cdot}8$ $\quad 0{\cdot}8 \div 4 = 0{\cdot}2$	Use short division to divide decimals with up to 2 decimal places. $8 \overline{)4 \cdot 24}$ $8 \overline{)4 \cdot {}^{4}2\ 4}$ $\quad 0 \cdot$ $8 \overline{)4 \cdot {}^{4}2\ {}^{2}4}$ $\quad 0 \cdot 5$ $8 \overline{)4 \cdot {}^{4}2\ {}^{2}4}$ $\quad 0 \cdot 5\ 3$

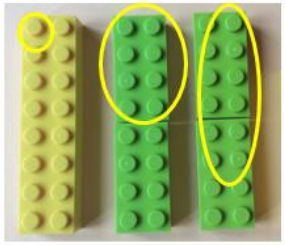
Progression in Fractions UKS2

Y5 Concrete	Y5 Pictorial	Y5 Abstract

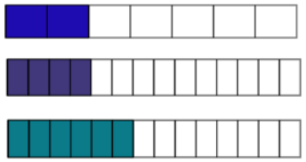
Objective 1: Compare and order fractions whose denominators are all multiples of the same number.



$\frac{1}{7}$ $\frac{6}{14} = \frac{3}{7}$



$\frac{1}{16}$ $\frac{1}{2}$ $\frac{3}{4} = \frac{6}{8}$

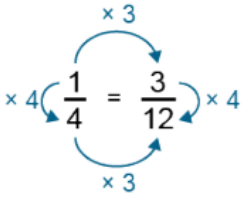


$\frac{2}{7} = \frac{4}{14}$ $\frac{6}{14} = \frac{3}{7}$

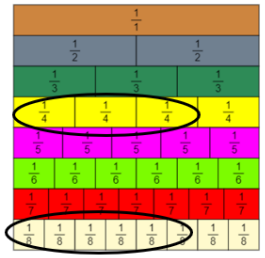
$\frac{3}{8}$

$\frac{7}{16}$

$\frac{12}{16} = \frac{3}{4}$



×	1	2	3	4
1	1	2	3	4
2	2	4	6	8
3	3	6	9	12
4	4	8	12	16
5	5	10	15	20
6	6	12	18	24
7	7	14	21	28

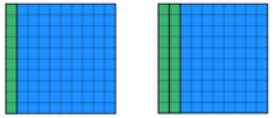


$\frac{3}{4} = \frac{6}{8}$

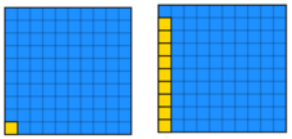
Complete the table to show three more fractions that are equivalent to the first:

Fraction	Equivalent fractions			
$\frac{1}{2}$	$\frac{2}{4}$			
$\frac{1}{4}$	$\frac{2}{8}$			
$\frac{1}{3}$				

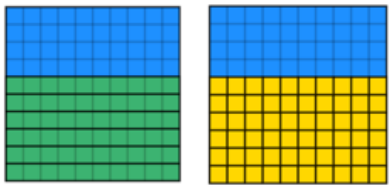
Objective 2: Identify, name and write equivalent fractions of a given fraction, represented visually, including tenths and hundredths.



$\frac{1}{10}$ $\frac{2}{10} = \frac{1}{5}$



$\frac{1}{100}$ $\frac{9}{100}$

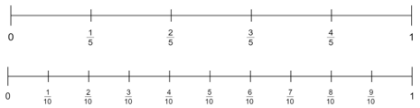


$\frac{6}{10} = \frac{60}{100}$

x10

$\frac{6}{10} = \frac{60}{100}$

x10

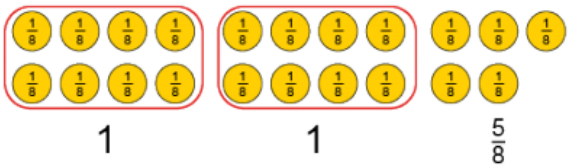


÷2

$\frac{4}{10} = \frac{2}{5}$

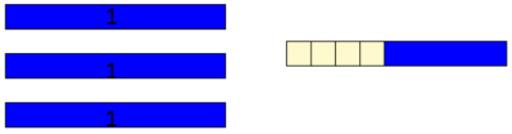
x2

Objective 3: Recognise mixed numbers and improper fractions and convert from one form to the other and write mathematical statements > 1 as a mixed number.



1 1 $\frac{5}{8}$

$\frac{21}{8} = 2\frac{5}{8}$



3 $\frac{4}{9}$

$3\frac{4}{9} = \frac{31}{9}$

$\frac{3}{5} + \frac{4}{5} = \frac{7}{5} = 1\frac{2}{5}$

Express the following improper fractions as mixed numbers.

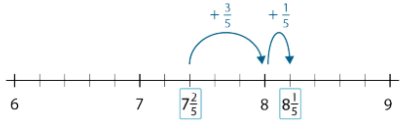
$\frac{17}{2}$ $\frac{13}{6}$ $\frac{28}{10}$ $\frac{41}{7}$

Express the following mixed numbers as improper fractions.

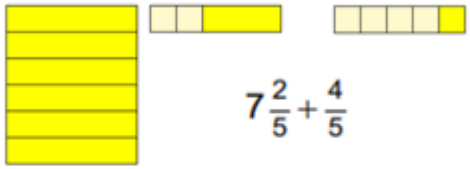
$4\frac{1}{8}$ $6\frac{4}{9}$ $3\frac{11}{12}$ $8\frac{2}{3}$

Objective 4: Add and subtract fractions with the same denominator and denominators that are multiples of the same number.

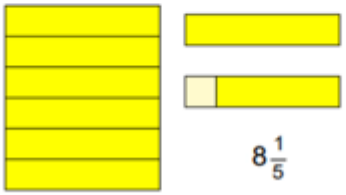
adding to reach the whole number, then adding the remaining fraction



$7\frac{2}{5}+\frac{4}{5}=8\frac{1}{5}$ $\quad$ $8\frac{1}{5}-\frac{4}{5}=7\frac{2}{5}$



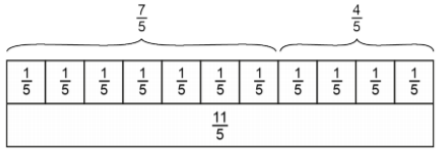
$7\frac{2}{5}+\frac{4}{5}$



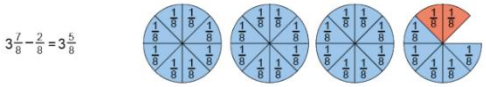
$8\frac{1}{5}$

Language focus

"7 one-fifths plus 4 one-fifths is equal to 11 one-fifths."



$\frac{7}{5}+\frac{4}{5}=\frac{11}{5}$



$3\frac{7}{8}-\frac{2}{8}=3\frac{5}{8}$

1. It is a $2\frac{3}{4}$km cycle ride to my friend's house, and a further $\frac{3}{4}$km ride to the park. How far do I have to cycle altogether?
2. I have 5m of rope. I cut off $\frac{4}{10}$m. How much rope is left?
3. Fill in the missing numbers.

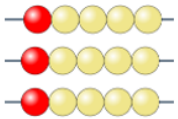
$2\frac{1}{7}$	$2\frac{4}{7}$			$3\frac{6}{7}$	

4. The table below shows the number of hours Josie read each day during a school week. For how long did Josie read altogether?

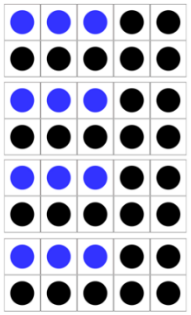
Mon	Tues	Wed	Thurs	Fri
$1\frac{3}{4}$ hours	1 hour	$1\frac{1}{4}$ hours	$1\frac{1}{4}$ hours	$2\frac{3}{4}$ hours

5. A tailor has $3\frac{7}{10}$m of ribbon. She uses $1\frac{9}{10}$m to complete a dress. How much ribbon is left?

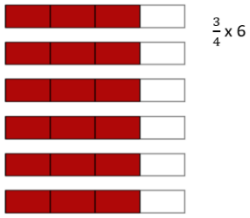
Objective 5: Multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams.



$$\frac{1}{5} \times 3 = \frac{3}{5}$$



$$\frac{3}{10} X\ 4 = \frac{12}{10} = 1\frac{1}{5}$$



$$\frac{1}{2} X\ 5 = \frac{1}{2} X \frac{5}{1}$$

x

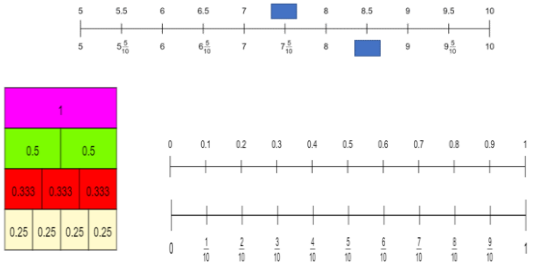
x

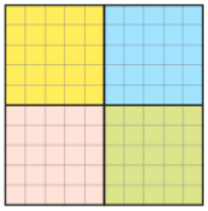
$$\frac{3}{5} X\ 4 = \frac{3}{5} X \frac{4}{1} = \frac{12}{5} = 2\frac{2}{5}$$

x

x

Objective 6: Read and write decimal numbers as fractions [for example, 0.71 = 71/100]





$$\frac{1}{4} = \frac{25}{100} = 0.25$$

Fill in the missing symbols (<, > or =).

$\frac{1}{10} \square\ 0.75$

$0.4 \square\ \frac{1}{4}$

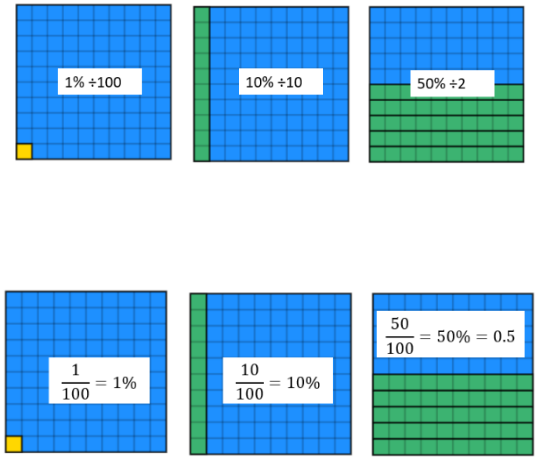
$0.5 \square\ \frac{1}{5}$

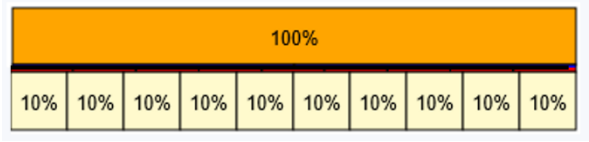
$\frac{3}{4} \square\ 0.75$

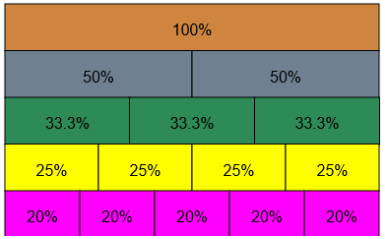
$0.8 \square\ \frac{4}{5}$

$\frac{1}{2} \square\ 0.2$

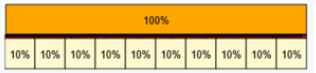
Objective 7: Recognise the per cent symbol (%) and understand that per cent relates to 'number of parts per hundred', and write percentages as a fraction with denominator 100, and as a decimal.





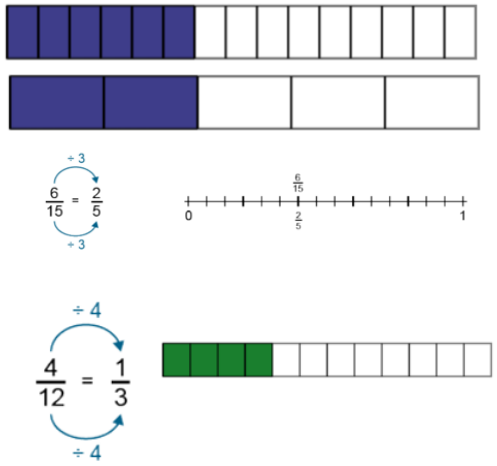
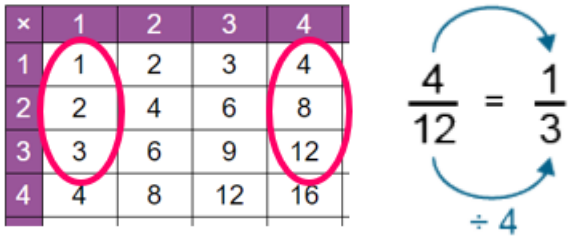
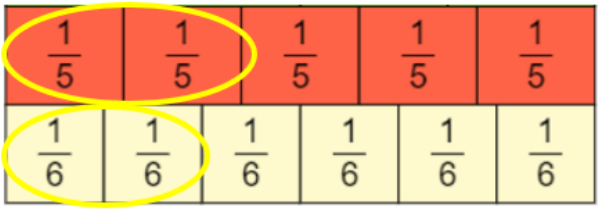
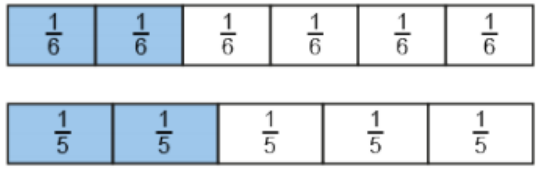


100% = 500
What is 10%?
What is 50%
Is 70% = 350

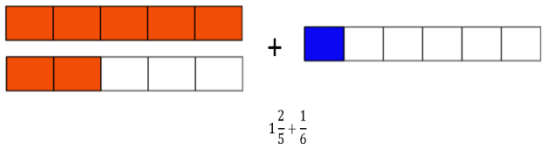


100% = £400
What is 30%?
Is 20% = £90?

100%	50%	25%	75%	10%
1000 m	500 m	250 m	750 m	100 m
160 kg	80 kg	40 kg	120 kg	16 kg
1080 mm	540 mm	270 mm	810 mm	108 mm

Y6 Concrete	Y6 Pictorial	Y6 Abstract
Objective 1: Use common factors to simplify fractions; use common multiples to express fractions in the same denomination.		
		Sort these fractions according to whether they are expressed in their simplest form or not. $\frac{3}{15}$ $\frac{2}{5}$ $\frac{4}{20}$ $\frac{25}{36}$ $\frac{1}{6}$ $\frac{7}{21}$ $\frac{18}{30}$ $\frac{9}{17}$ $\frac{5}{15}$ $\frac{11}{20}$ $\frac{23}{30}$ **Fraction in its simplest form** / **Fraction <u>not</u> in its simplest form**
Objective 2: Compare and order fractions, including fractions > 1.		
		$\frac{2}{5} = \frac{12}{30}$ LCM of 5 and 6 = 30 $\frac{2}{6} = \frac{10}{30}$ Without using a common denominator, put each set of fractions in order from smallest to largest. a. $\frac{10}{8}$ $\frac{7}{8}$ $\frac{5}{8}$ $\frac{3}{8}$ $\frac{8}{8}$ $\frac{4}{8}$ $\frac{2}{8}$

Objective 3: Add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions.

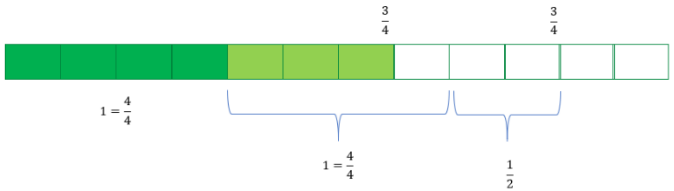


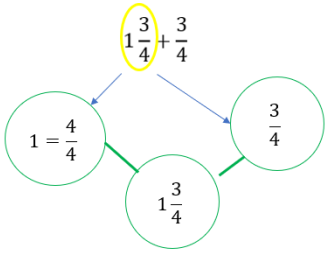
$1\frac{2}{5}+\frac{1}{6}$

$$\frac{7}{5}+\frac{1}{6}$$

$$\frac{42}{30}+\frac{5}{30}=\frac{47}{30}$$

$$\frac{47}{30}=1\frac{17}{30}$$





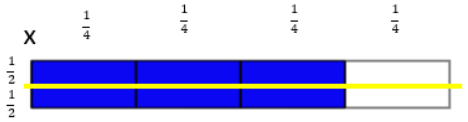
$$2\frac{1}{2}+\frac{3}{4}=$$

$\frac{7}{10}+\frac{5}{10}+\frac{3}{10}$ $\quad$ $\frac{8}{9}+\frac{8}{9}-\frac{1}{9}$ $\quad$ $3\frac{7}{10}+2\frac{9}{10}$

$\frac{13}{8}+\frac{11}{8}$ $\quad$ $7\frac{1}{6}-1\frac{2}{6}$ $\quad$ $\frac{17}{3}-\frac{5}{3}$

$$\frac{6}{7}+\frac{2}{3}=\frac{18}{21}+\frac{14}{21}$$

Objective 4: Multiply simple pairs of proper fractions, writing the answer in its simplest form [for example, 1/2 × 3/4 = 3/8].



$$\frac{1}{2}X\frac{3}{4}=\frac{3}{8}$$

$$\frac{1}{2}X\frac{3}{4}=\frac{3}{8}$$

$$\frac{3}{5}X\frac{1}{4}=\frac{3}{20}$$

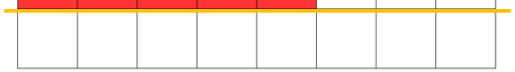
Objective 5: Divide proper fractions by whole numbers [for example, 6/8 ÷ 3 = 1/4]

Dividing by 2 is the same as multiplying by $\frac{1}{2}$

$\frac{1}{8} \div 2$

$\frac{5}{8} \div 2 =$

The denominator is now 16.



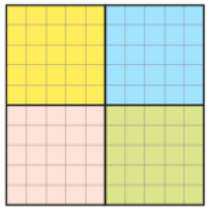
The reciprocal:

$$\frac{1}{8} \div 2 = \frac{1}{8} \div \frac{2}{1}$$

$$\frac{1}{8} x \frac{1}{2} = \frac{1}{16}$$

Objective 6: Associate a fraction with division and calculate decimal fraction equivalents [for example, 0.375] for a simple fraction [for example, 3/8] .

1.25

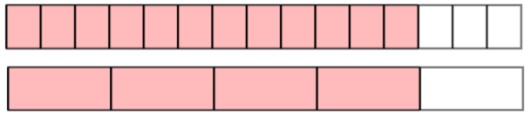


$\frac{1}{4} = \frac{25}{100} = 0.25$

$$\begin{array}{r} 28 \\ 15 \overline{)\,432} \\ 30 \quad (15 \times 2) \\ \hline 132 \\ 120 \quad (15 \times 8) \\ \hline 12 \end{array}$$

$$28\frac{12}{15} = \frac{4}{5}$$

$$28\frac{4}{5} = 28.8$$



216 r 2

$216\frac{2}{8}$

$216\frac{1}{4}$

1730 ÷ 8