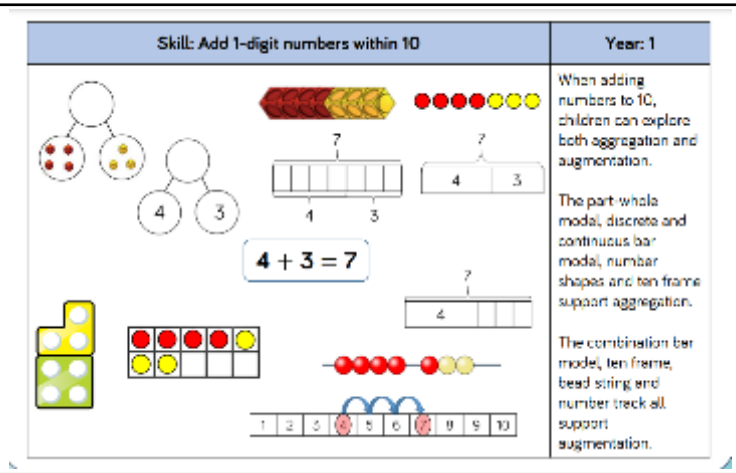
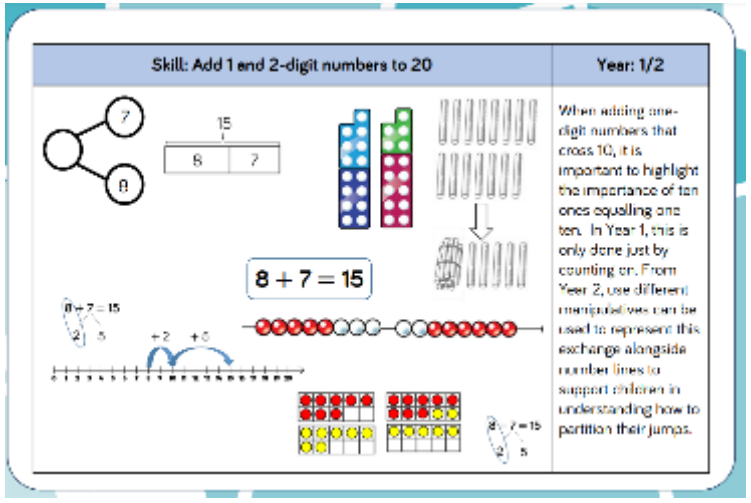
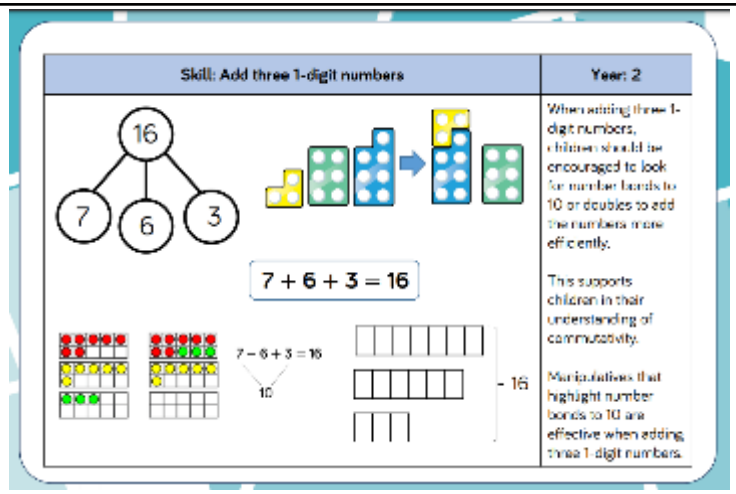
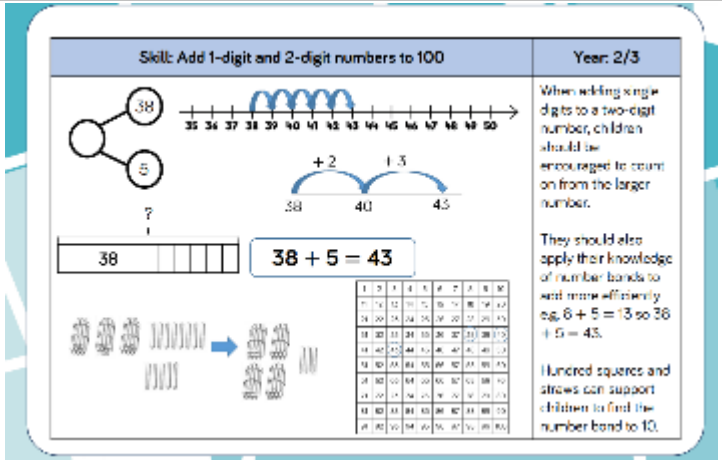
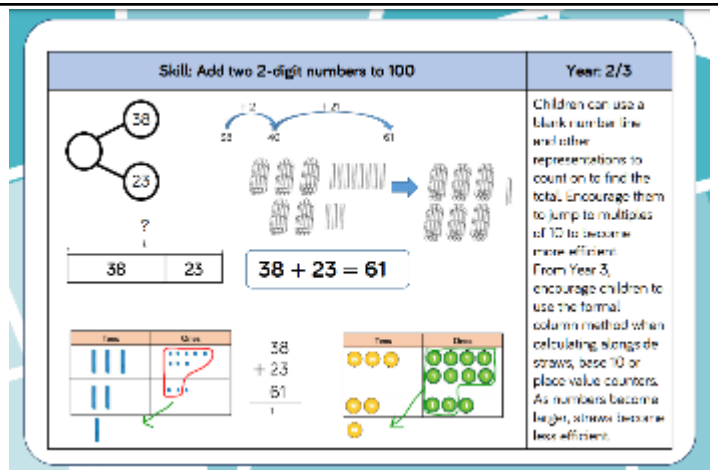
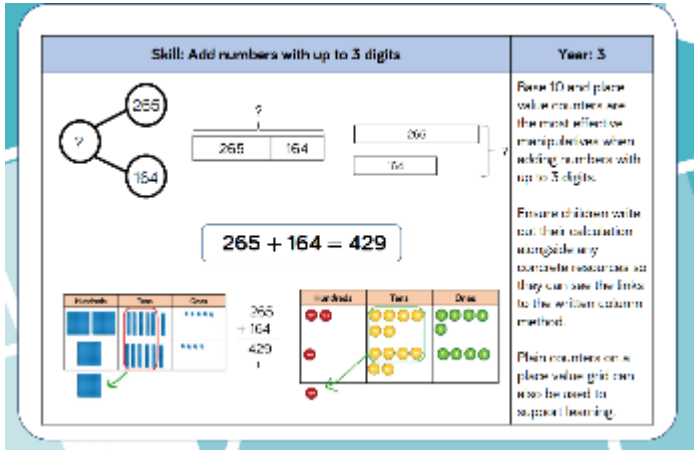
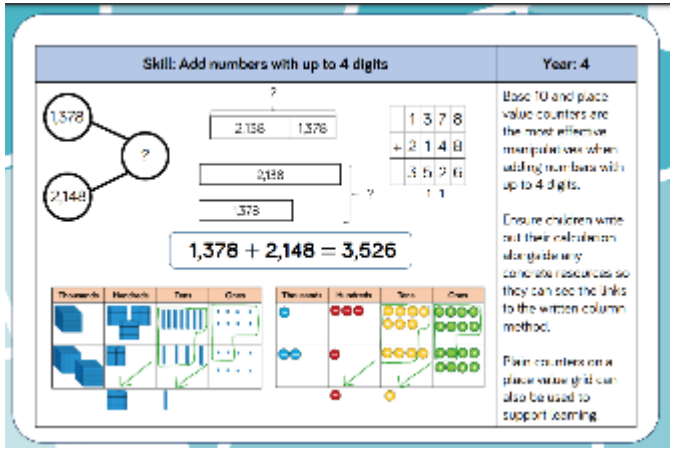
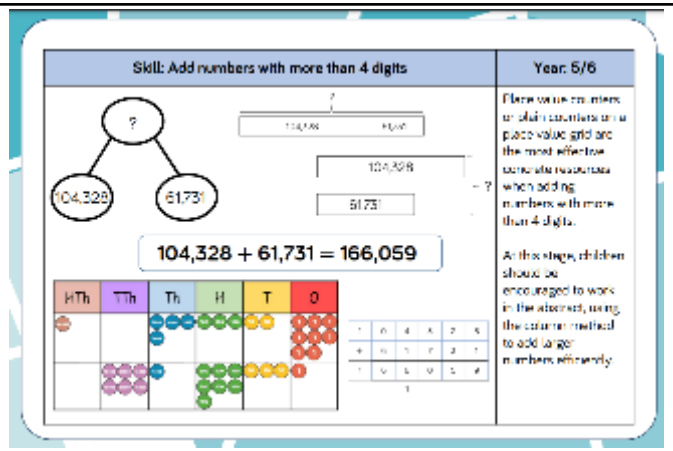
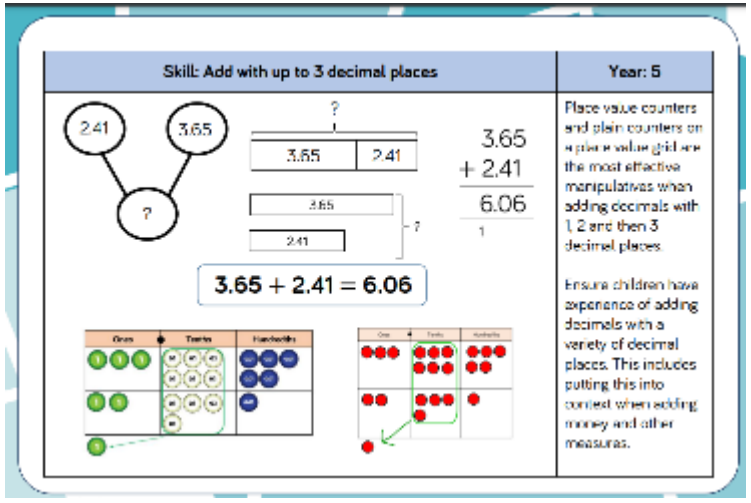
St Mary's Calculation and Problem Solving Progression of skills

Addition

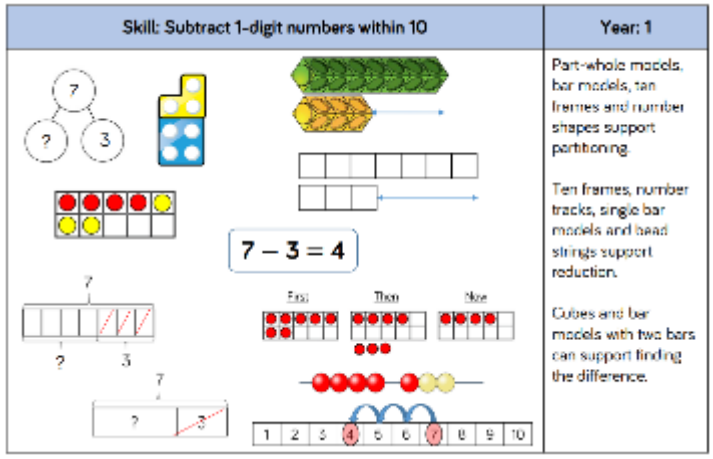
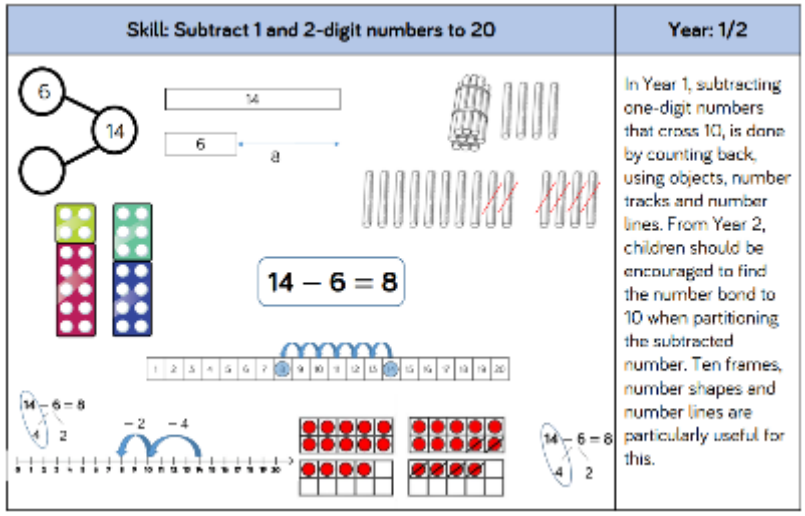
Skill	Year	Representations and models	
Add two 1-digit numbers to 10	1	Part-whole model Ten frames (within 10) Bar Model Bead strings (10) Number shapes Number tracks	
Add 1 and 2-digit numbers to 20.	1	Part-whole model Bead Strings (20) Bar Model Number tracks Number shapes Number lines (labelled) Ten frames (within 20) Straws	

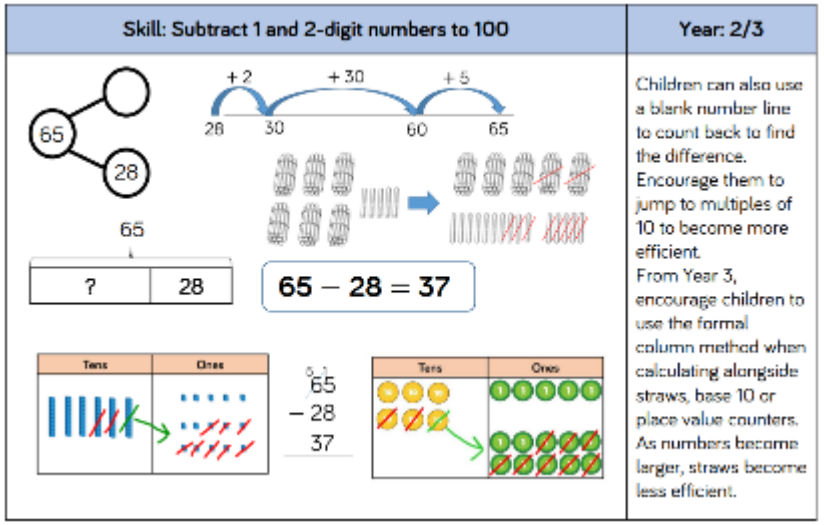
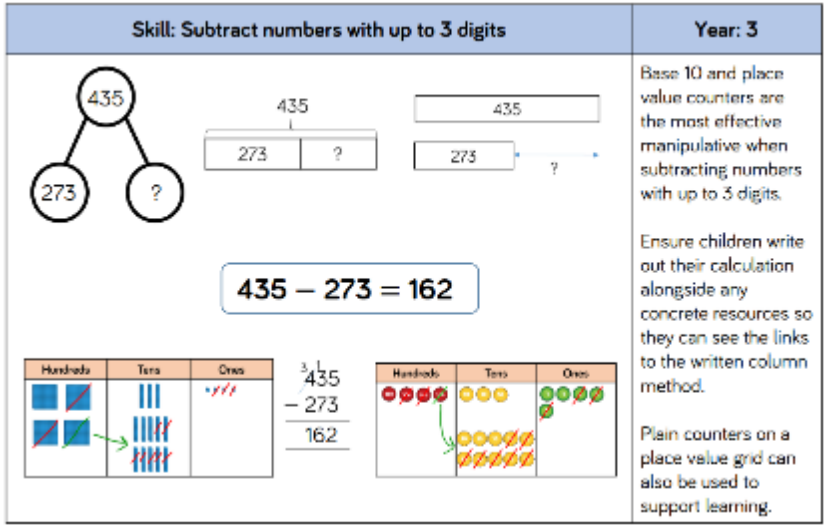
Add three 1-digit numbers	2	Part-whole model Ten frames (within 20) Bar model Number shapes	
Add 1 and 2-digit numbers to 100	2	Part-whole model Number lines (blank) Bar model Straws Number lines (labelled) Hundred Square	

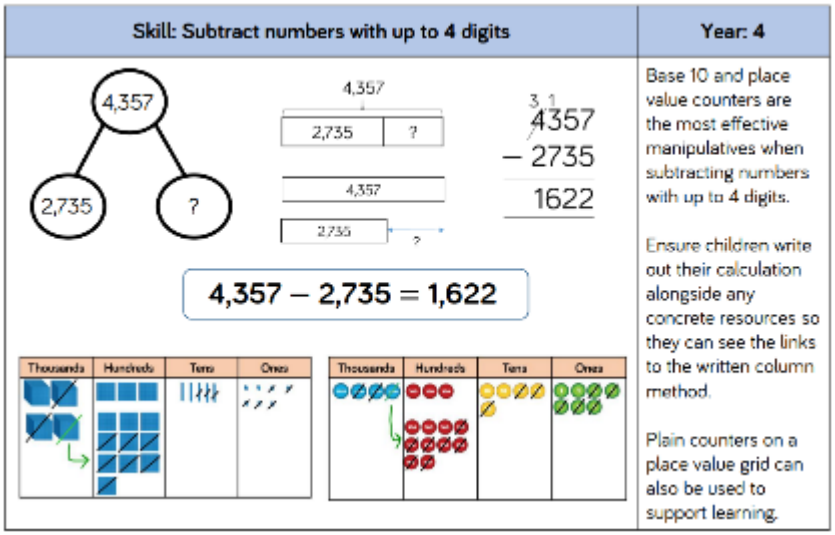
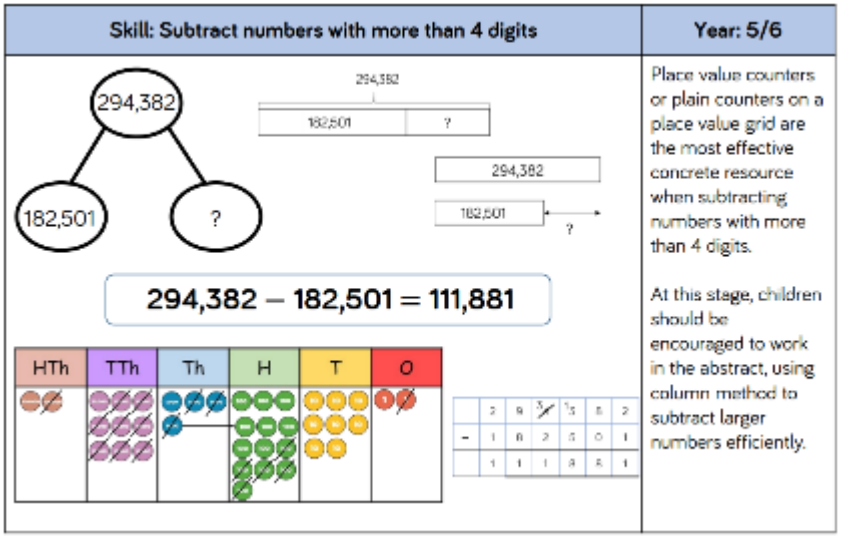
Add two 2-digit numbers	2	Part-whole model Base 10 Bar model Place value counters Number lines (blank) Straws	
Add with up to 3-digits	3	Part-whole model Base 10 Bar model Place value counters Column addition	
Add with up to 4-digits	4	Part-whole model Base 10 Bar model Place value counters Column addition	

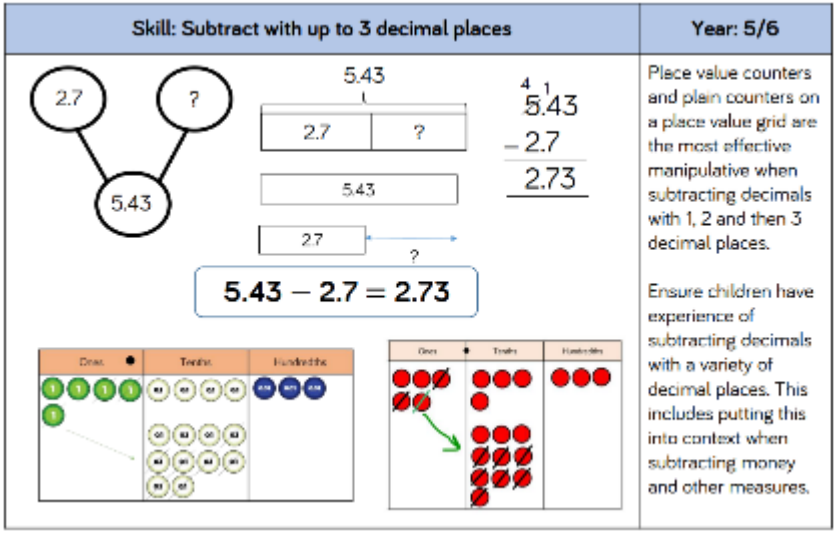
Add with more than 4 digits	5	Part-whole model Place value counters Bar model Column addition	
Add with up to 3 decimal places	5	Part-whole model Place value counters Bar model Column addition	

Subtraction

Skill	Year	Representations and models	
Subtract two 1-digit numbers to 10	1	Part-whole model Ten frames (within 10) Bar model Bead string (10) Number shapes Number tracks	
Subtract 1 and 2-digit numbers to 20	1	Part-whole model Bead string (20) Bar model Number tracks Number shapes Number lines (labelled) Ten frames (within 20) Straws	

Subtract 1 and 2-digit numbers to 100	2	Part-whole model Bar model Number lines (labelled) Number lines (blank) Straws Hundred square	
Subtract two 2-digit numbers	2	Part-whole model Bar model Number lines (blank) Straws Base 10 Place value counters	
Subtract with up to 3-digits	3	Part-whole model Bar model Base 10 Place value counters Column subtraction	

Subtract with up to 4-digits	4	Part-whole model Bar model Base 10 Place value counters Column subtraction	
Subtract with more than 4 digits	5	Part-whole model Bar model Place value counters Column subtraction	

Subtract with up to 3 decimal places	5	Part-whole model Bar model Place value counters Column subtraction	

NUMBER BONDS					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
represent and use number bonds and related subtraction facts within 20	recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100				
Continue the pattern 10 + 8 = 18 11 + 7 = 18 Can you make up a similar pattern for the number 17? How would this pattern look if it included subtraction? **Missing numbers** 9 + ☐ = 10 10 - ☐ = 9 What number goes in the missing box?	**Continue the pattern** 90 = 100 – 10 80 = 100 – 20 Can you make up a similar pattern starting with the numbers 74, 26 and 100? **Missing numbers** 91 + ☐ = 100 100 - ☐ = 89 What number goes in the missing box?				

MENTAL CALCULATION					
add and subtract one-digit and two-digit numbers to 20, including zero	add and subtract numbers using concrete objects, pictorial representations, and mentally, including: * a two-digit number and ones * a two-digit number and tens * two two-digit numbers * adding three one-digit numbers	add and subtract numbers mentally, including: * a three-digit number and ones * a three-digit number and tens * a three-digit number and hundreds		add and subtract numbers mentally with increasingly large numbers	perform mental calculations, including with mixed operations and large numbers
Working backwards Through practical games on number tracks and lines ask questions such as "where have you landed?" and "what numbers would you need to throw to land on other given numbers?" **What do you notice?** 11 – 1 = 10 11 – 10 = 1 Can you make up some other number sentences like this involving 3 different numbers?	**True or false?** Are these number sentences true or false?73 + 40 = 113 98 – 18 = 70 46 + 77 = 123 92 – 67 = 35 Give your reasons. **Hard and easy questions** Which questions are easy / hard? 23 + 10 = 93 + 10 = 54 + 9 = 54 + 1 = Explain why you think the hard questions are hard?	**True or false?** Are these number sentences true or false?597 + 7 = 614 804 – 70 = 744 768 + 140 = 908 Give your reasons. **Hard and easy questions** Which questions are easy / hard? 323 + 10 = 393 + 10 = 454 - 100 = 954 - 120 = Explain why you think the hard questions are hard?	**True or false?** Are these number sentences true or false?6.7 + 0.4 = 6.11 8.1 – 0.9 = 7.2 Give your reasons. **Hard and easy questions** Which questions are easy / hard? 13323 - 70 = 12893 + 300 = 19354 - 500 = 19954 + 100 = Explain why you think the hard questions are hard?	**True or false?** Are these number sentences true or false?6.17 + 0.4 = 6.57 8.12 – 0.9 = 8.3 Give your reasons. **Hard and easy questions** Which questions are easy / hard? 213323 - 70 = 512893 + 300 = 819354 - 500 = 319954 + 100 = Explain why you think the hard questions are hard?	**True or false?** Are these number sentences true or false?6.32 + □ = 8 □ = 1.68 Give your reasons. **Hard and easy questions** Which questions are easy / hard? 213323 - 70 = 512893 + 37 = 8193.54 - 5.9 = Explain why you think the hard questions are hard?
	Other possibilities □ + □ + □ = 14 What single digit numbers could go in the boxes? How many different ways can you do this?				

read, write and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs (appears also in Written Methods)	show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot				use their knowledge of the order of operations to carry out calculations involving the four operations

Fact families Which four number sentences link these numbers? 12, 15, 3 **What else do you know?** If you know this: 12 – 9 = 3 what other facts do you know? **Missing symbols** Write the missing symbols (+ - =) in these number sentences: 17 ☐ 3 ☐ 20 18 ☐ 20 ☐ 2	**Fact families** Which four number sentences link these numbers? 100, 67, 33 **What else do you know?** If you know this: 87 = 100 – 13 what other facts do you know? **Missing symbols** Write the missing symbols (+ - =) in these number sentences: 80 ☐ 20 ☐ 100 100 ☐ 70 ☐ 30 87 ☐ 13 ☐ 100				**Missing symbols** Write the missing signs (+ - x ÷) in this number sentence: 6 ◯ 12.3 = 61.9 ◯ 11.9 **What else do you know?** If you know this: 86.7 + 13.3 = 100 what other facts do you know?

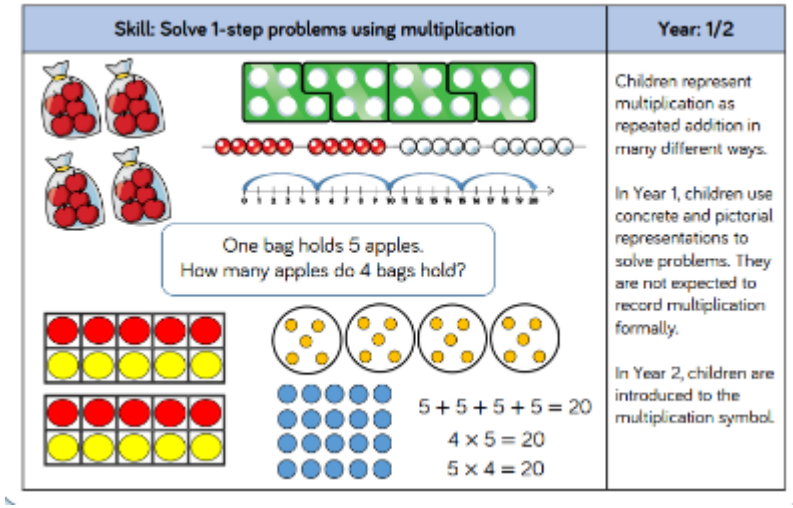
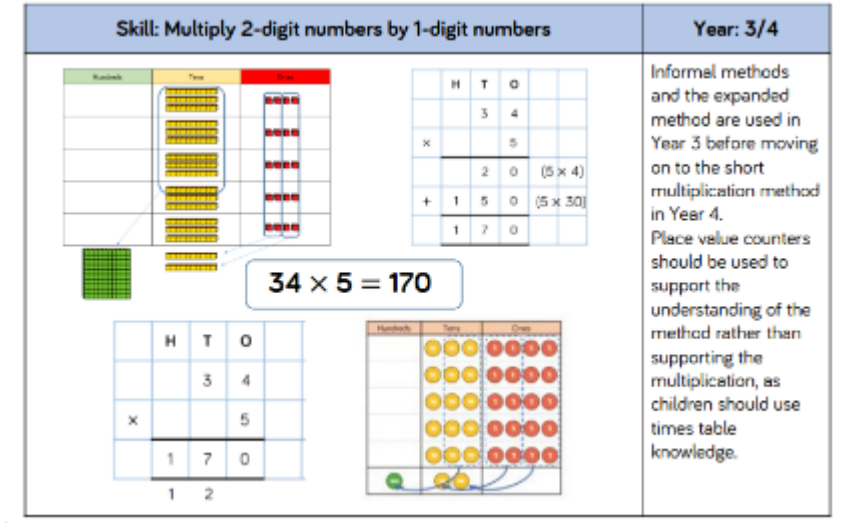
WRITTEN METHODS					
read, write and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs (appears also in Mental Calculation)		add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction	add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate	add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)	
Convince me In my head I have two odd numbers with a difference of 2. What could they be? Convince me **Missing numbers** Fill in the missing numbers (using a range of practical resources to support) 12 + □ = 19 20 - □ = 3	**Convince me** What digits could go in the boxes? 7□ - 2□ = 46 Try to find all of the possible answers. How do you know you have got them all? Convince me	**Convince me** □□+□□+□□ The total is 201 Each missing digit is either a 9 or a 1. Write in the missing digits. Is there only one way of doing this or lots of ways? Convince me	**Convince me** □ - 666 = 8□5 What is the largest possible number that will go in the rectangular box? What is the smallest? Convince me	**Convince me** □ + 1475 = 6□24 What numbers go in the boxes? What different answers are there? Convince me	**Convince me** Three four digit numbers total 12435. What could they be? Convince me

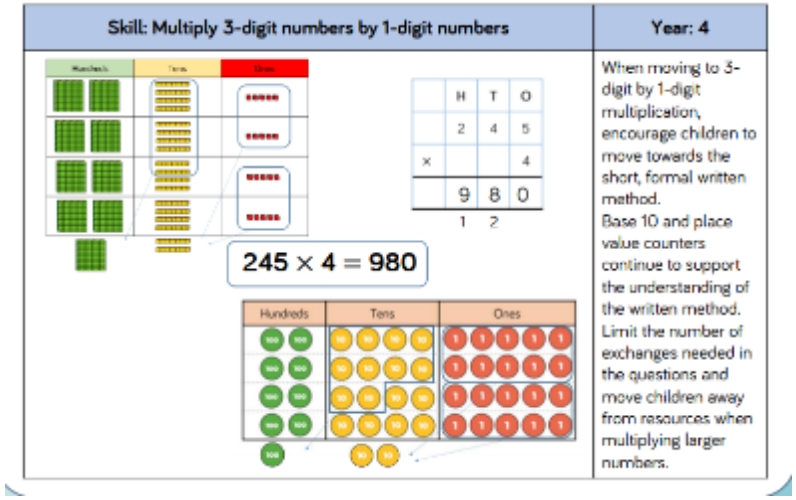
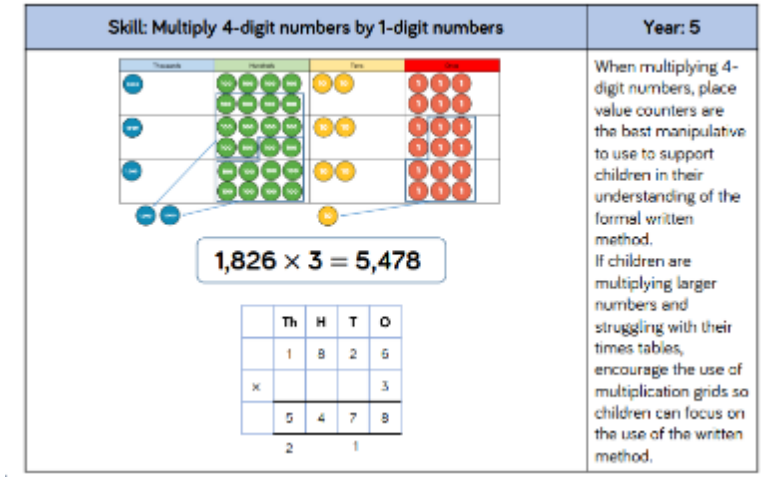
INVERSE OPERATIONS, ESTIMATING AND CHECKING ANSWERS					
	recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.	estimate the answer to a calculation and use inverse operations to check answers	estimate and use inverse operations to check answers to a calculation	use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy	use estimation to check answers to calculations and determine, in the context of a problem, levels of accuracy.
Making an estimate Pick (from a selection of number sentences) the ones where the answer is 8 or 9. **Is it true that?** Is it true that 3+4 = 4 + 3?	**Making an estimate** Which of these number sentences have the answer that is between 50 and 60 74 - 13 55 + 17 87 – 34 **Always, sometimes, never** Is it always, sometimes or never true that if you add three numbers less than 10 the answer will be an odd number	**Making an estimate** Which of these number sentences have the answer that is between 50 and 60 174 - 119 333 – 276 932 - 871 **Always, sometimes, never** Is it always, sometimes or never true that if you subtract a multiple of 10 from any number the units digit of that number stays the same. Is it always, sometimes or never true that when you add two numbers together you will get an even number	**Making an estimate** Which of these number sentences have the answer that is between 550 and 600 1174 - 611 3330 – 2779 9326 - 8777 **Always, sometimes, never** Is it always sometimes or never true that the difference between two odd numbers is odd.	**Making an estimate** Which of these number sentences have the answer that is between 0.5 and 0.6 11.74 - 11.18 33.3 – 32.71 **Always, sometimes, never** Is it always, sometimes or never true that the sum of four even numbers is divisible by 4.	**Making an estimate** Circle the number that is the best estimate to 932.6 - 931.05 1.3 1.5 1.7 1.9 **Always, sometimes, never** Is it always, sometimes or never true that the sum of two consecutive triangular numbers is a square number

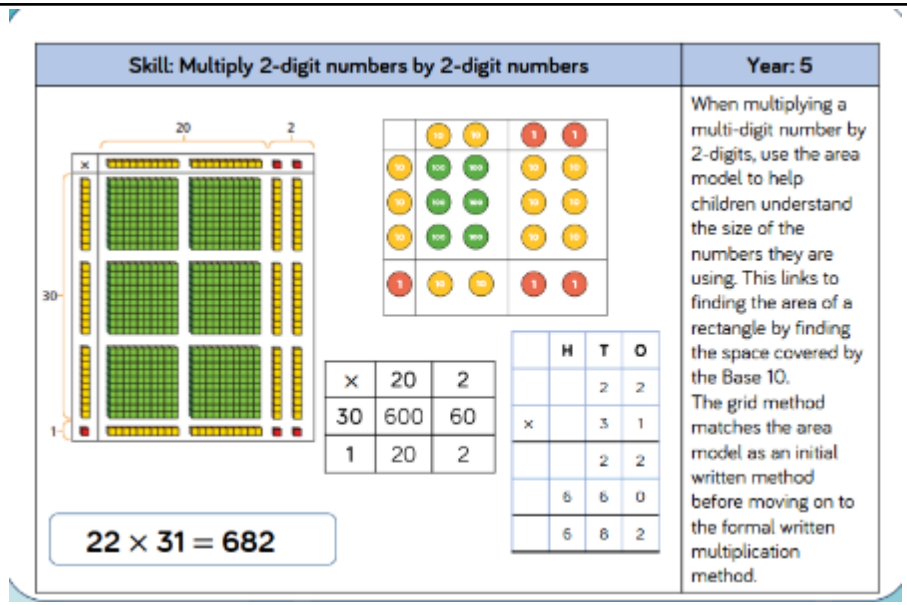
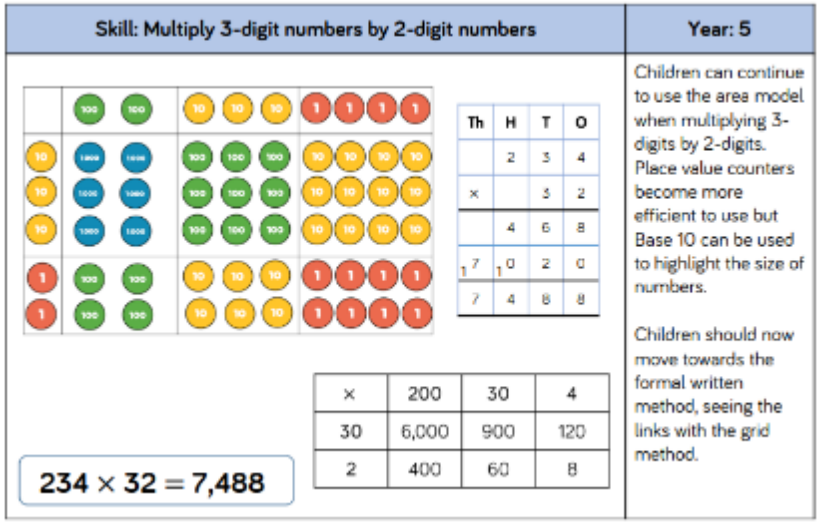
PROBLEM SOLVING					
solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as 7 = □ - 9	solve problems with addition and subtraction: * using concrete objects and pictorial representations, including those involving numbers, quantities and measures * applying their increasing knowledge of mental and written methods	solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction	solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why	solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why	solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why
	solve simple problems in a practical context involving addition and subtraction of money of the same unit, including giving change (copied from Measurement)				Solve problems involving addition, subtraction, multiplication and division

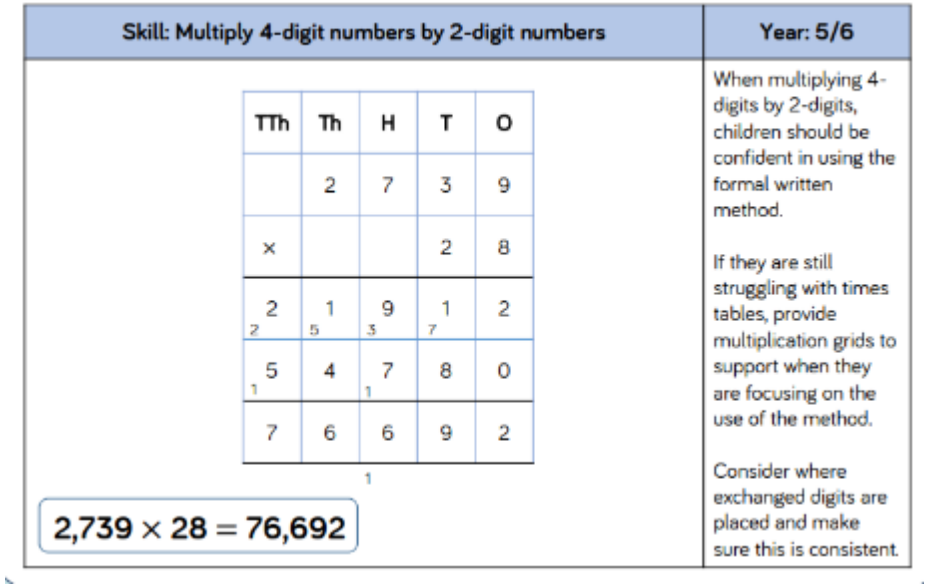
Multiplication

Skill	Year	Representations and models

Solve one-step problems with multiplication	1/2	Bar Model Ten Frame Number Shapes Bead Strings Counters Number Lines	
Multiply 2-digit by 1-digit numbers	3/4	Place Value Counters Base 10 Expanded Written Method Short Written Method	

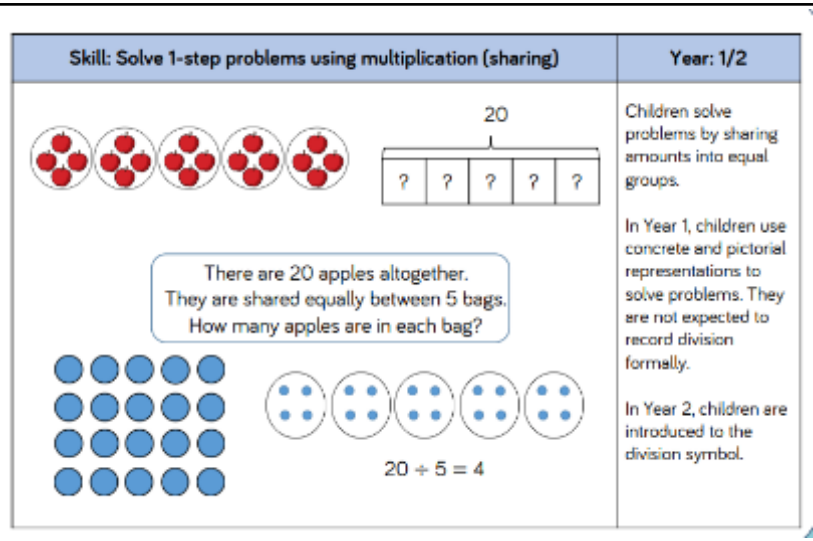
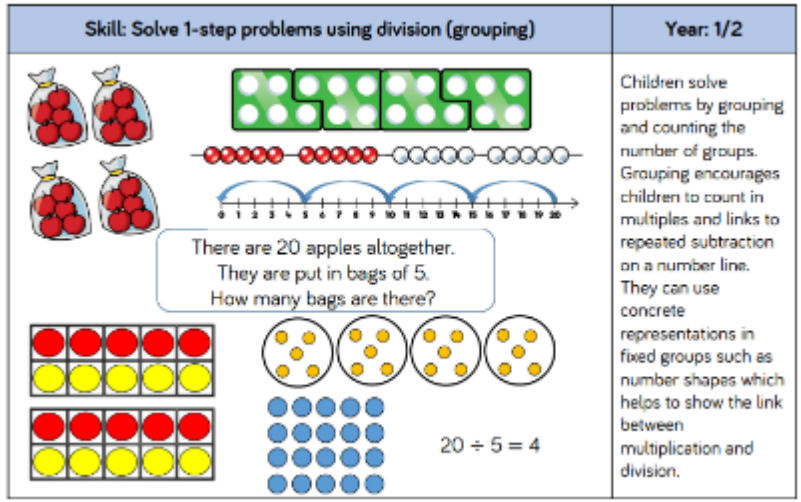
Multiply 3-digit by 1-digit numbers	4	Place Value Counters Base 10 Short Written Method	
Multiply 4-digit by 1-digit numbers	5	Place Value Counters Short Written Method	

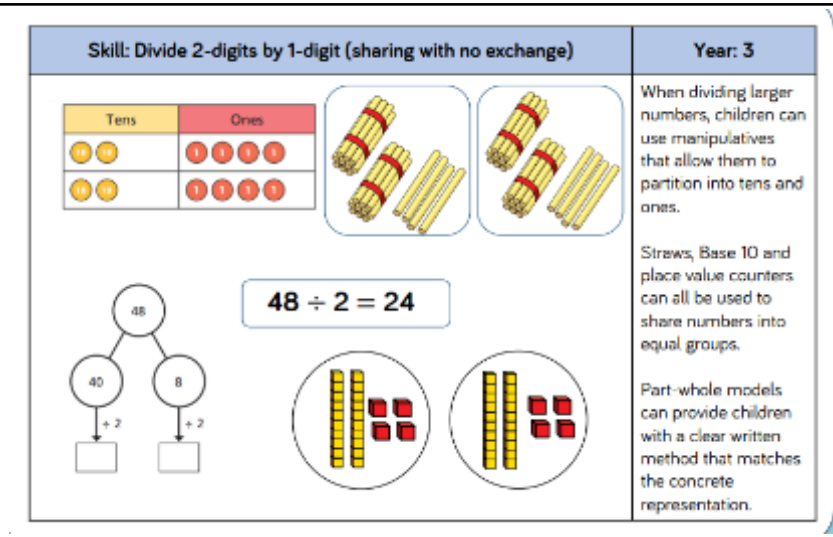
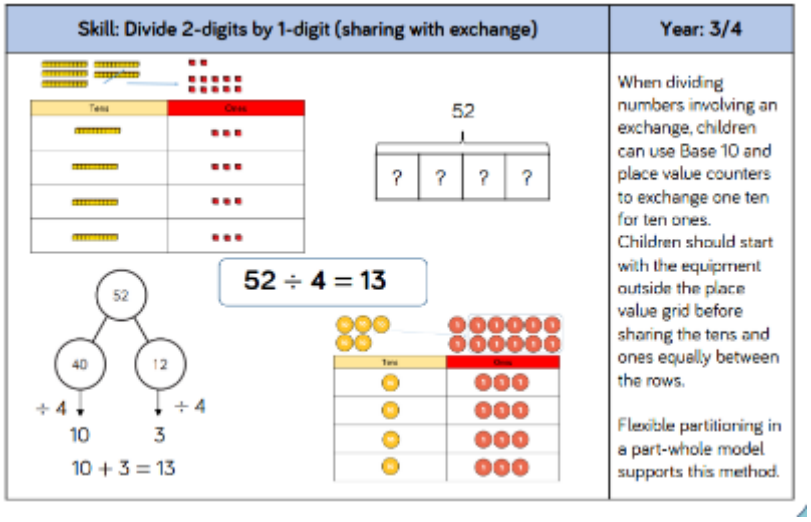
Multiply 2-digit by 2-digit numbers	5	Place Value Counters Base 10 Short Written Method Grid Method	
Multiply 2-digit by 3-digit numbers	5	Place Value Counters Short Written Method Grid Method	

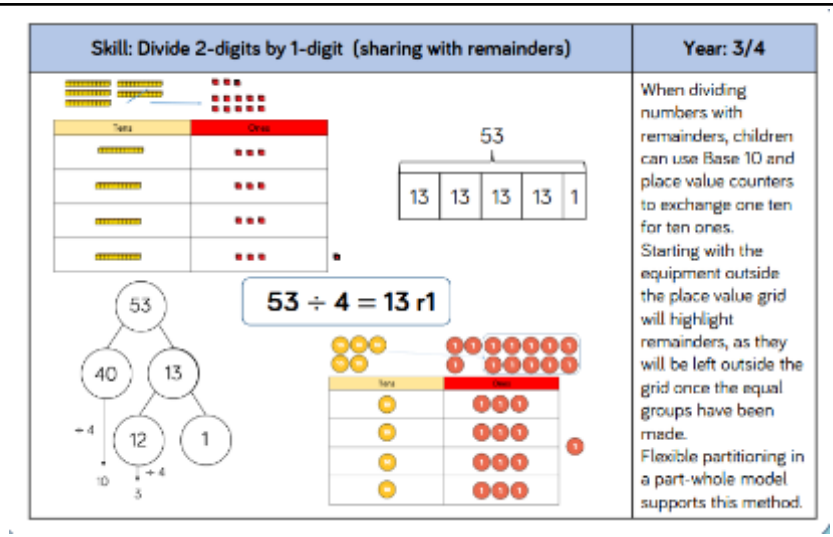
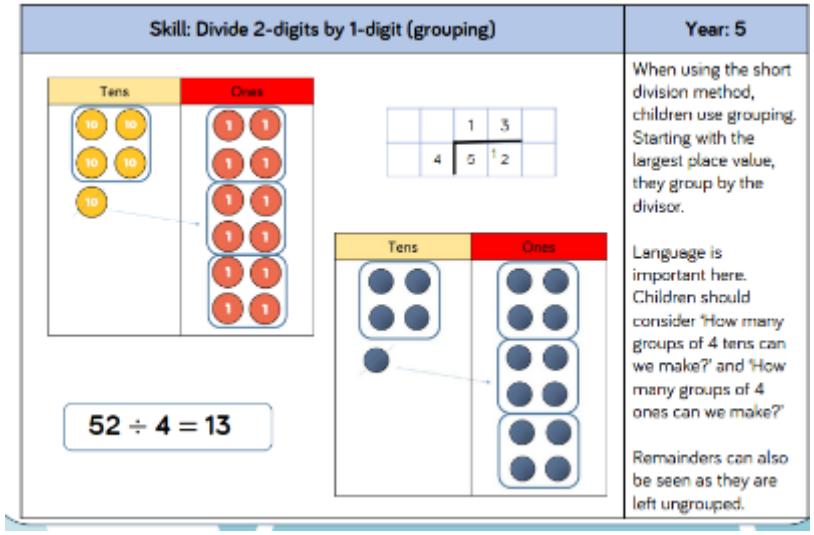
Multiply 2-digit by 4-digit numbers	5/6	Formal Written Method	

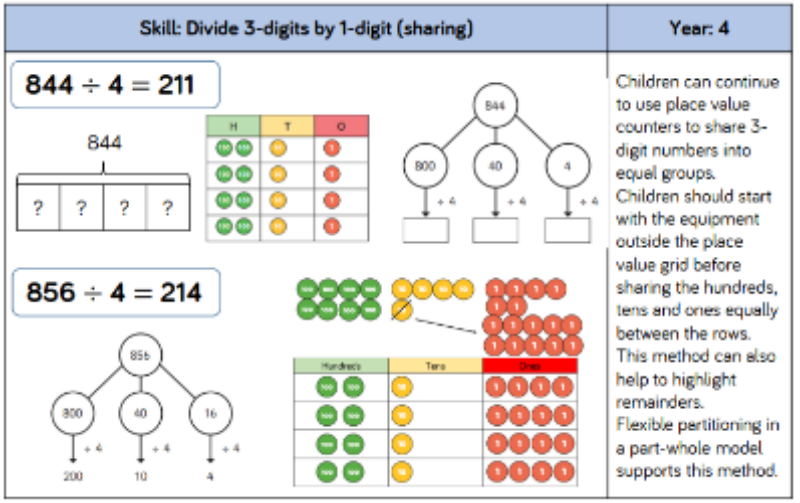
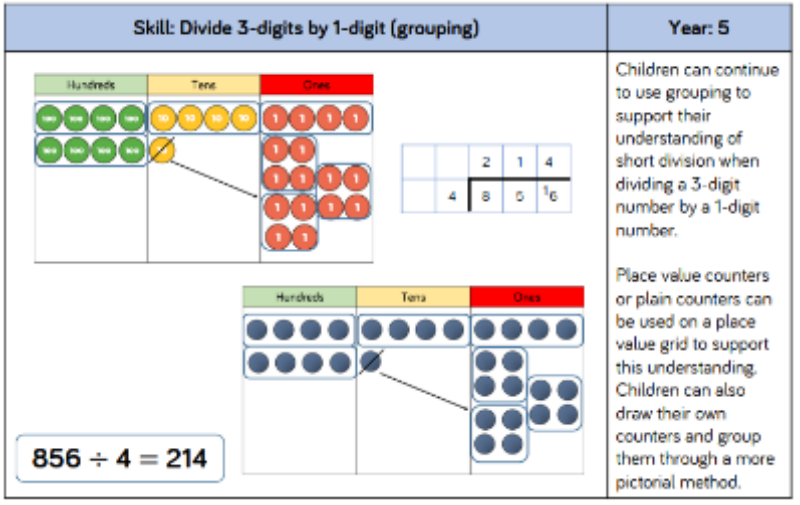
Division

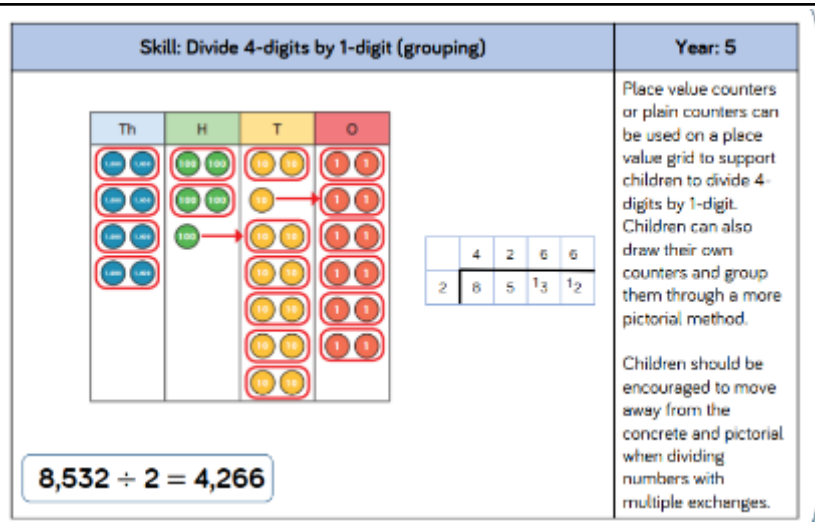
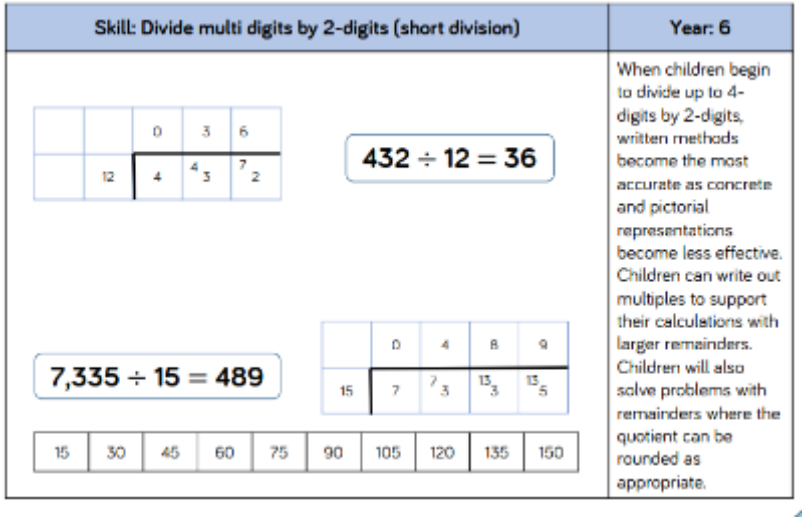
Skill	Year	Representations and models

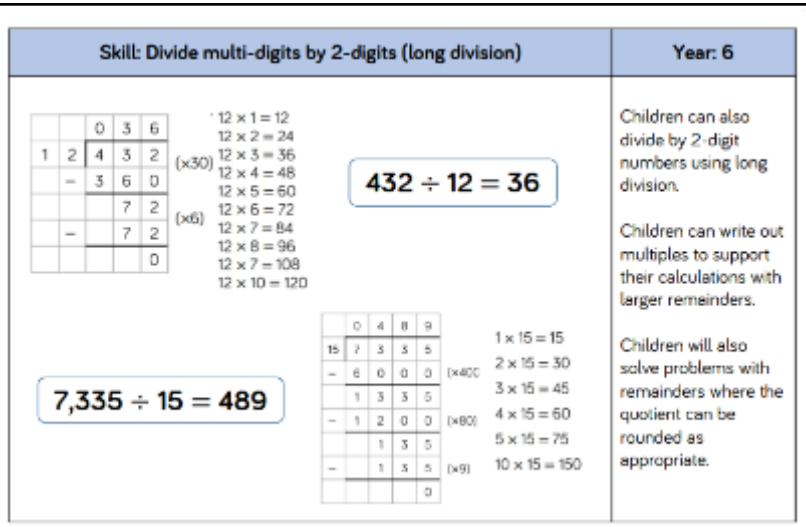
Solve one-step problems with division (sharing)	1/2	Bar Model Real Life Objects Arrays Counters	
Solve one-step problems with division (grouping)	1/2	Real Life Objects Number Shapes Bead Strings Ten Frames Number Lines Arrays Counters	

Divide 2-digits by 1-digit (no exchange sharing)	3	Straws Base 10 Bar Model Place Value Counters Part-whole model	
Divide 2-digits by 1-digit (sharing with exchange)	3	Straws Base 10 Bar Model Place Value Counters Part-whole model	

Divide 2-digits by 1-digit (sharing with remainders)	3/4	Straws Base 10 Bar Model Place Value Counters Part-Whole Model	
Divide 2-digits by 1-digit (grouping)	4/5	Place Value Counters Counters Place Value Grid Written Short Division	

Divide 3-digits by 1-digit (sharing with exchange)	4	Base 10 Bar Model Place Value Counters Part-whole Model	
Divide 3-digits by 1-digit (grouping)	4/5	Place Value Counters Counters Place Value Grid Written Short Division	

Divide 4-digits by 1-digit (grouping)	5	Place Value Counters Counters Place Value Grid Written Short Division	
Divide multi-digits by 2-digits (short division)	6	Written Short Division List of Multiples	

Divide multi-digits by 2-digits (long division)	6	Written Long Division List of Multiples	

MULTIPLICATION & DIVISION FACTS					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
count in multiples of twos, fives and tens (copied from Number and Place Value)	*count in steps of 2, 3, and 5 from 0, and in tens from any number, forward or backward* (copied from Number and Place Value)	*count from 0 in multiples of 4, 8, 50 and 100* (copied from Number and Place Value)	*count in multiples of 6, 7, 9, 25 and 1 000* (copied from Number and Place Value)	*count forwards or backwards in steps of powers of 10 for any given number up to 1 000 000* (copied from Number and Place Value)	
	recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers	recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables	recall multiplication and division facts for multiplication tables up to 12 × 12		
MENTAL CALCULATION					
		write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods (appears also in Written Methods)	use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers	multiply and divide numbers mentally drawing upon known facts	perform mental calculations, including with mixed operations and large numbers
	show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot		recognise and use factor pairs and commutativity in mental calculations (appears also in Properties of Numbers)	multiply and divide whole numbers and those involving decimals by 10, 100 and 1000	*associate a fraction with division and calculate decimal fraction equivalents (e.g. 0.375) for a simple fraction (e.g. $^{3}/_{8}$)* (copied from Fractions)

WRITTEN CALCULATION					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs	write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods (appears also in Mental Methods)	multiply two-digit and three-digit numbers by a one-digit number using formal written layout	multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers	multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication
				divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context	divide numbers up to 4-digits by a two-digit whole number using the formal written method of short division where appropriate for the context divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context
					use written division methods in cases where the answer has up to two decimal places (copied from Fractions (including decimals))

PROPERTIES OF NUMBERS: MULTIPLES, FACTORS, PRIMES, SQUARE AND CUBE NUMBERS					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
			recognise and use factor pairs and commutativity in mental calculations (repeated)	identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers.	identify common factors, common multiples and prime numbers
				know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers	*use common factors to simplify fractions; use common multiples to express fractions in the same denomination* (copied from Fractions)
				establish whether a number up to 100 is prime and recall prime numbers up to 19	
				recognise and use square numbers and cube numbers, and the notation for squared (^{2}) and cubed (^{3})	*calculate, estimate and compare volume of cubes and cuboids using standard units, including centimetre cubed (cm^3) and cubic metres (m^3), and extending to other units such as mm^3 and km^3* (copied from Measures)

ORDER OF OPERATIONS					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
					use their knowledge of the order of operations to carry out calculations involving the four operations
INVERSE OPERATIONS, ESTIMATING AND CHECKING ANSWERS					
		estimate the answer to a calculation and use inverse operations to check answers (copied from Addition and Subtraction)	*estimate and use inverse operations to check answers to a calculation* (copied from Addition and Subtraction)		use estimation to check answers to calculations and determine, in the context of a problem, levels of accuracy

PROBLEM SOLVING					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher	solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts	solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects	solve problems involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects	solve problems involving multiplication and division including using their knowledge of factors and multiples, squares and cubes	solve problems involving addition, subtraction, multiplication and division
				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 similar shapes where the scale factor is known or can be found* (copied from Ratio and Proportion)