

COPPICE
PRIMARY SCHOOL

Calculation Policy

Date	Review Date	Endorsed by	Approved by	Link Governor
Nov 2018	Oct 2020	FGB	Governing Body	Carolynne Spencer

Aspire, Believe & Achieve











Policy last reviewed:

Policy written by: Hannah Veall & Vicky Quaif

Addition and Subtraction

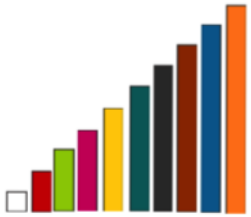
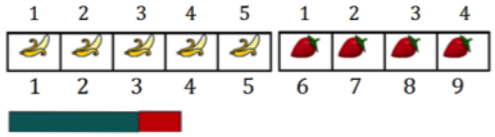
Key Stage 1:

- The principal focus of mathematics teaching in key stage 1 is to ensure that pupils develop confidence and mental fluency with whole numbers, counting and place value. This should involve working with numerals, words and the four operations, including with practical resources (for example, concrete objects and measuring tools).

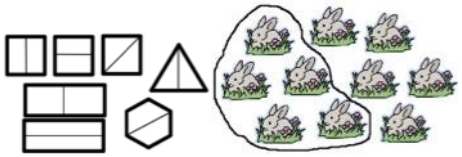
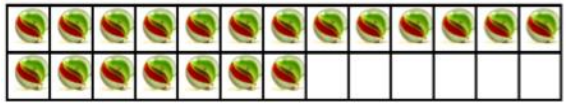
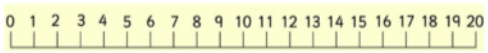
- By the end of year 2, pupils should know the number bonds to 20 and be precise in using and understanding place value. An emphasis on practice at this early stage will aid fluency.

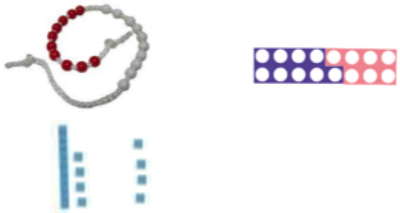
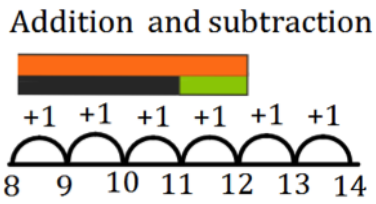
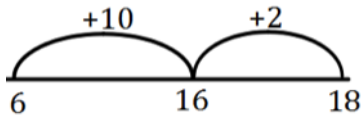
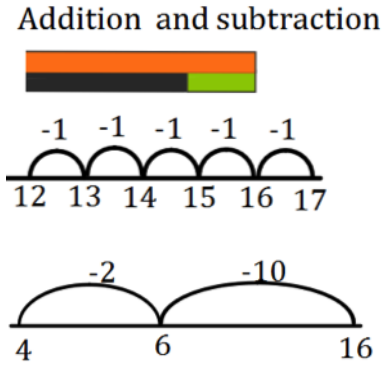
End of year expectations	Rapid recall	Mental calculation	Language	Using and applying
Year 1	Count to and across 100, forwards and backwards, beginning with 0 or one, or from any given number Count, read and write numbers to 100 in numerals; count in multiples of twos, fives and tens 1 more or less than a number	Add and subtract 1-digit and 2-digit numbers to 20, including 0	Put together Add Altogether Total Take away Difference between More than and less than Equal	I'm thinking of a number. I've subtracted 5 and the answer is 7. What number was I thinking of? Explain how you know. I'm thinking of a number. I've added 8 and the answer is 19. What number was I thinking of? Explain how you know. I know that 7 and 3 is 10. How can I find 8 + 3? How could you work it out? Show children a price list with items costing up to 20p. I have 20p to spend. If I spend 20p exactly, which two items could I buy? And another two, and another two.

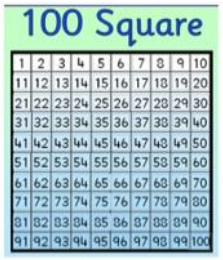
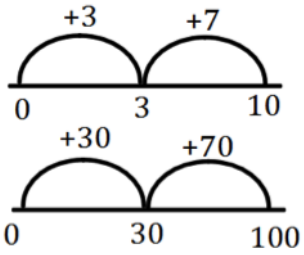
				If I bought one of the items how much change would I have? And another one, and another one.
Year 2	Count in steps of two, three, and five from 0, and in tens from any number, forward and backward	Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100 Add and subtract numbers using concrete objects, pictorial representations, and mentally, including: • a 2-digit number and ones • a 2-digit number and tens • two 2-digit numbers • adding three 1-digit numbers Show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot 5	Sum Difference Inverse Calculate Partition	Solve problems with addition and subtraction: using concrete objects and pictorial representations, including those involving numbers, quantities and measures applying an increasing knowledge of mental and written methods

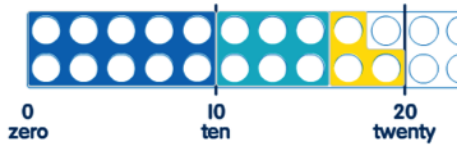
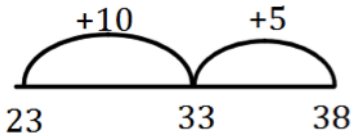
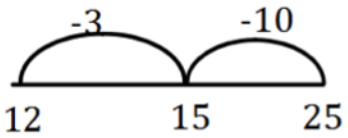
Year 1	Concrete	Pictorial	Conceptual	Using & applying
Identify one more or one less.	Counting on and back using familiar objects and resources.   One more  One less	Introduce bar models to compare quantities.  	Introduction to + - and = symbols to create number sentences. 5 – 1 = 4 4 + 1 = 5 Missing number problems. 4 = □ - 1 5 = □ + 1 □ – 1 = 5 □ + 1 = 8	5 people were on a bus. 1 **more** person got on. How many people are there **altogether**? I have £6. My brother has £1 **less** than me. How much money does he have? Use the numbers 3 to 8. How many pairs can you find which have **difference** of 1?
Use addition as combining groups (aggregation).	Counting using familiar objects and resources.   1, 2, 3, 4  1, 2, 3 1, 2, 3, 4, 5, 6, 7	Bar models.  	Using number sentences and beginning to calculate mentally. 7 + 2 = 9 2 + 7 = 9 9 = 2 + 7 9 = 7 + 2 Missing number problems. 8 = 3 + □ 9 = □ + 2 9 = □ + 5 4 = 9 - □	I bought 5 sweets. My friend gave me 4 more. How many do I have in **total**? How many different additions can find with a total of 9?

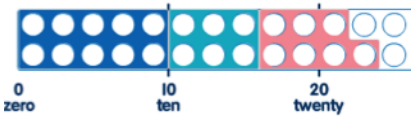
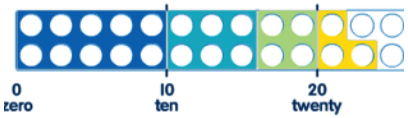
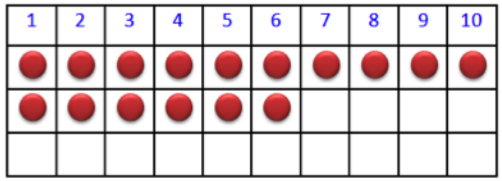
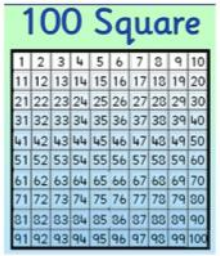
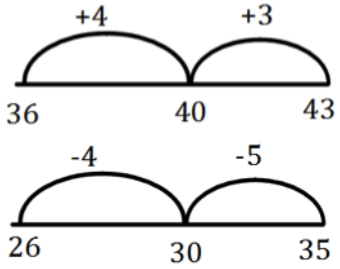
Addition as counting on (augmentation).	Counting using familiar objects and resources.  	Bar model comparisons. 	□ = 9 - 4	

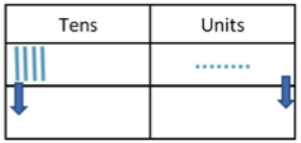
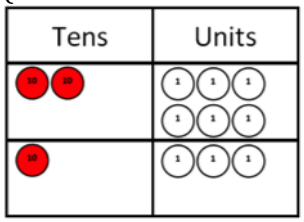
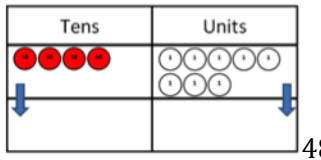
Year 1 cont	Concrete	Pictorial	Conceptual	Using and applying
Doubling and halving numbers within 20 (as repeated addition and subtraction).	Using familiar objects and resources.     	Using a variety of models and images.   	Using number sentences and beginning to calculate mentally. 6 + 6 = Double 9 = 14 = Double … Half of 18 = … 10 = half of…. 7 = 14 - □ 4 + □ = 8	I had 10 pennies. I gave my friend half of my money. How much do we each have? Class 1 has 8 girls. Class 2 has **double** the number of girls. How many girls are there in Class 2? How many **doubles** can you find which include the number 4? E.g. Double 4 = 8 Double 2 = 4 Double 7 = 14 etc.
Add and subtract 1-digit and 2-digit numbers to 20, including 0	Using familiar objects and resources.  Addition facts   Subtraction facts	Using bar models and beginning to look at number lines.  Addition and subtraction facts   0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	Using number sentences and calculating mentally. 13 + 4 = 17 17 = 13 + 4 4 + 13 = 17 17 = 4 = 13 17 – 4 = 13 13 = 17 - 4 17 – 13 = 4 4 = 17 - 13 Missing number problems. 15 = □ + 6 18 - □ = 4	My sister is 17. My brother is 9. What is the **difference between** their ages? Class 1 collected £7 for charity. Class 2 collected £8. If they **put** their money **together**, how much would they have? The answer is 11. How many different ways can you use addition or subtraction to solve this?

Year 1 cont	Concrete	Pictorial	Conceptual	Using and applying
Represent and use number bonds and related subtraction facts within 20 add and subtract 1-digit and 2-digit numbers to 20, including 0	Using familiar objects and resources. Addition facts  Subtraction facts 	Using bar models and number lines.  Jumping in 1s  Jumping in 10s and units 	Using number sentences and calculating mentally. 13 + 4 = 17 17 = 13 + 4 4 + 13 = 17 17 = 4 + 13 17 – 4 = 13 13 = 17 - 4 17 – 13 = 4 4 = 17 - 13 Missing number problems. 15 = □ + 6 18 - □ = 4	My foot is 19cm long. My friend's foot is 14cm long. **Calculate** the **difference** between the lengths. How many additions/ subtractions can you make with an even/odd answer? Which patterns can you see in the numbers you have used?

Year 2	Concrete	Pictorial	Conceptual	Using and applying
Derive and use related facts up to 100	Using familiar objects and resources.   3 + 7 = 10  30 + 70 = 100	Using 100 squares and number lines.  	Using number sentences and calculating mentally. 20 + 80 = 100 100 - 80 = 20 80 + 20 = 100 100 - 20 = 80 100 = 20 + 80 80 = 100 - 20 100 = 80 + 20 20 = 100 – 80 Missing number problems. 40 = 100 - □ 100 - □ = 70 50 + □ = 100	I am thinking of a number. If I add 80, the **sum** is 100. What is my number? How many different ways can you make £1 using 10p, 20p and 50p coins?

Year 2 cont	Concrete	Pictorial	Conceptual	Using and applying
Add and subtract numbers using concrete objects, pictorial represent ations, and mentally, including: a 2-digit number and ones Add and subtract numbers using concrete objects, pictorial represent ations, and mentally, including: a 2-digit number and tens	Using familiar objects and resources.    23 + 15  25 - 13  24 - 13 (Difference images)	Bar model images and number lines.  Addition and subtraction facts  Number lines:   	Number sentences and calculating mentally. 23 + 15 = 38 15 + 23 = 38 38 = 23 + 15 38 = 15 + 23 23 = 38 – 15 15 = 38 – 23 38 - 15 = 23 38 - 23 = 15 Missing numbers problems. 26 = □ – 10 □ – 10 = 32 □ + 10 = 51 29 = □ + 10	There are 29 children in Class 3. 13 children have packed lunch and the rest have school dinner. How many children have school dinners? Use the digits 2, 3, 4, and 5. Make two 2 digit numbers. How many different **totals** are there? Can you make the same total in more than one way?

Year 2 cont	Concrete	Pictorial	Conceptual	Using and applying
Add and subtract numbers using concrete objects, pictorial representations, and mentally, including: a 2-digit number and ones	Using familiar objects and  resources.  16 + 7 as 16 + 4 + 3  Or 23 – 7 as 23 – 3 - 4	Bar model images, 100 squares, number lines.  16 + 7 by counting to next 10 or 16 – 8 by counting back to ten.   	Using number sentences and solving mentally. 36 + 7 = 43 36 = 43 - 7 7 + 36 = 43 7 = 43 – 36 43 - 7 = 36 43 = 7 + 36 43 - 36 = 7 43 = 36 + 7 Missing number problems. □ + 7 = 43 43 - □ = 36 □ – 36 = 7	(Refer to examples in previous section).

Year 2 cont	Concrete	Pictorial	Conceptual	Using and applying
Add and subtract numbers using concrete objects, pictorial representations, and mentally, including: two 2-digit numbers	 26 + 13  48 – 15 (Move 15 down to show what's left)  26 + 13  48 – 15 (Move 15 down to show what's left)	Expanded written methods. 20 + 6 + 10 + 3 30 + 9 = 39 40 + 8 - 20 + 5 20 + 3 = 23	Compact written methods. 26 + 13 39 48 - 25 23	Use the digits 2, 3, 4, and 5. Make two 2 digit numbers and find the total. What's the highest/lowest **total** you can make? Can you make the same total in more than one way? What is the closest total to 70 you make?
Add and subtract numbers using concrete objects, pictorial representations, and mentally, including: adding three 1-digit numbers				

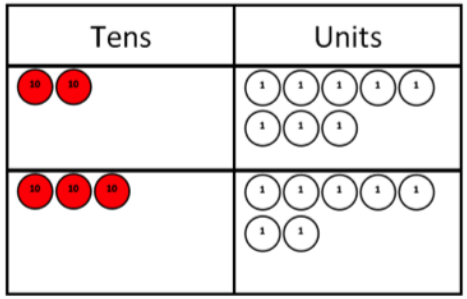
Lower Key Stage 2:

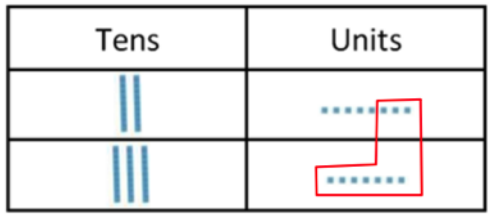
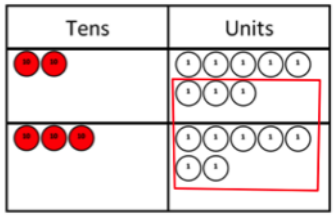
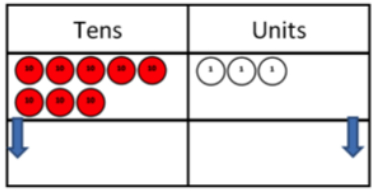
- The principal focus of mathematics teaching in lower key stage 2 is to ensure that pupils become increasingly fluent with whole numbers and the four operations, including number facts and the concept of place value. This should ensure that pupils develop efficient written and mental methods and perform calculations accurately with increasingly large whole numbers.

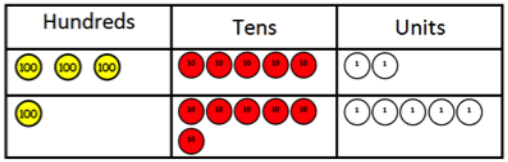
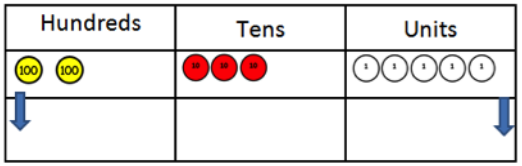
- At this stage, pupils should develop their ability to solve a range of problems, including with simple fractions and decimal place value. By the end of year 4, pupils should have memorised their multiplication tables up to and including the 12 multiplication table and show precision and fluency in their work.

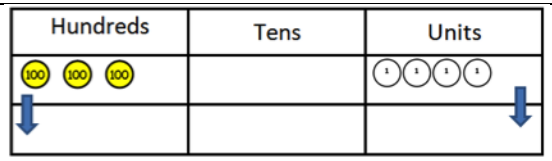
End of year expectations	Rapid recall	Mental calculation	Language	Using and applying
Year 3	Count from 0 in multiples of 4, 8, 50 and 100 Work out if a given number is greater or less than 10 or 100 Recognise the place value of each digit in a 3-digit number	Add and subtract numbers mentally, including: • a 3-digit number and ones • a 3-digit number and tens • a 3-digit number and hundreds	Carry Exchange Compact Expanded Boundary Column	Add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction Flo and Jim are answering a problem: Danny has read 62 pages of the class book, Jack has read 43. How many more pages has Danny read than Jack?

	(hundreds, tens, and ones)			Flo does the calculation 62 + 43. Jim does the calculation 62–43. Who is correct? Explain how you know.
Year 4	Count in multiples of 6, 7, 9, 25 and 1000 Count backwards through 0 to include negative numbers		Increase Decrease Tenths Hundredths	Add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate Solve addition and subtraction two-step problems in context, deciding which operations and methods to use and why Write three calculations where you would use mental calculation strategies and three where you apply a column method. **Explain the decision you made for each calculation**.

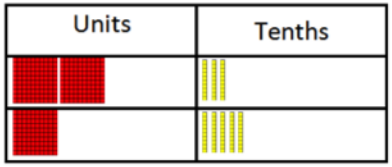
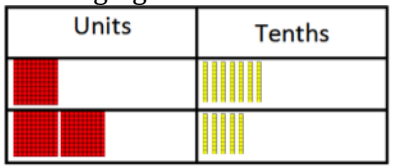
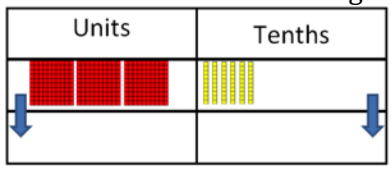
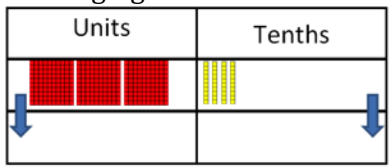
Year 3:	Concrete	Pictorial	Conceptual
TU + TU Expanded method: crossing tens boundaries *keeping* the new ten(s) with the units.	 28 + 37 NB: combining units but ***not*** exchanging for a 10 at this stage.  28 + 37	Expanded method $\begin{array}{r} 20 + 8 \\ +\,30 + 7 \\ \hline 50 + 15 \end{array} = 65$ **NB: new ten(s) are kept with the units at this stage.**	NB: TU ± TU should become a mental method; these examples are to help children develop the concept of exchanging and bridging across boundaries.

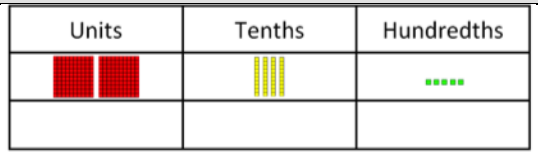
Year 3 cont:	Concrete	Pictorial	Conceptual	Using & applying:
TU + TU Crossing the tens boundary. (Autumn term)	 28 + 37 Combining the units and exchanging for a new 10.  28 + 37	Expanded method crossing the tens boundary. 20 + 8 + 30 + 7 60 + 5 = 65 10	Compact column method. 28 + 37 65 1 Missing number problems. 32 + 49 = □ □ + 73 = 94 16 + □ = 81	In a car park, there are 28 red cars and 37 blue cars. How many cars are there altogether? Use the digits 3, 4, 5 and 6. Make two 2 digit numbers. What's the highest/lowest **total** you can make? How can you make the same total in more than one way? What is the closest total to 90 you make?
TU – TU Expanded method with exchanging from the tens to the units. (Autumn Term)	 83 – 54 (Move 54 down to show what's left – exchange a ten for units). 	Expanded method. 70 ~~80~~ +13 - 50 + 4 40 + 7 = 47	Compact column method. 7 ~~8~~ 13 - 5 4 4 7 Missing number problems. 85 – 37 = □ □ – 26 = 55 91 - □ = 38	There were 83 cars in a car park. At lunchtime, 54 cars left. How many remained? Choose a 2 digit number between 81 and 99. How many subtractions can you create using your number which have a 4 in the answer?

				Can you find any patterns?
Year 3 cont: (Spring & summer terms)	**Concrete**	**Pictorial**	**Conceptual**	
Add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction	 352 + 165 Combining the tens and exchanging for a 100.  235 – 83 (Move 83 down to show what's left – exchange a hundred for tens).	Expanded methods crossing tens ***or*** hundreds boundaries but ***not*** both. 300 + 50 + 2 + 100 + 60 + 5 500 + 10 + 7 = 517 100 100 ~~200~~ + 130 + 5 - 80 + 3 100 + 50 + 2 = 152	Leading to compact column methods and missing number problems crossing tens ***or*** hundreds boundaries but ***not*** both. 352 + 165 517 1 1 ~~2~~13 5 - 8 3 1 5 2 352 – 165 = □ □ – 165 = 517 352 - □ = 517	Use the digits 1, 2, 3, 4 and 5. Make a 2 digit and a 3 digit number. Add them together. Find ways you can make 168, 483, 339. Use the digits 0, 1, 2, 3 and 4. Make a 3 digit number then reverse the digits. Add your two numbers. Repeat with other examples. What do you notice? Two 3 digit numbers have a difference of 125. The digits of one number add to make 8. What are the numbers? How many ways can you do this?

Year 3	Concrete	Pictorial	Conceptual	Using and applying
HTU ± HTU Add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction	Follow methods shown in Year 3 using apparatus to cross both boundaries. E.g. 438 + 385 = 624 – 257 =	Expanded methods.	Compact column methods.	My book has 426 pages. I am on page 137. How many more pages do I have to read until I am half way through my book? Use the digits 1 – 9. Choose six of them and make two 3 digit numbers. Find the total/difference. Score a point for every zero you can get in your total.
HTU - HTU Add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction	 304 – 137 (Move 137 down to show what's left – exchange a hundred for tens; then exchange a ten for units).	304 – 137 = 200 90 ~~300~~ + ~~100~~ + 14 - 100 + 30 + 7 100 + 60 + 7 = 167	304 – 137 = 2 9 ~~3~~ ~~0~~ 14 - 1 3 7 1 6 7	Use the digits 2 to 8 and make two 3 digit numbers. Find the difference. What's the closest difference you get to …400? How many pairs of numbers can you find where the difference is: a 3 digit number with consecutive digits? e.g. 572 – 449 = 123

Year 4	Concrete	Pictorial	Conceptual	Using and applying
Add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate	Follow process shown in Year 3. • Addition crossing one boundary. • Addition crossing more than one boundary. • Subtraction with exchanging through one boundary. • Subtraction with exchanging through more than one boundary. • Subtraction with exchanging through zero.	NB: it is expected that children should already be confident with using compact column methods at this stage.	Compact column methods.	I walked 1360m, 2764m and then 2188m. How much further do I have to walk until I have travelled 7 km? Use the following numbers: 2, 2, 3, 4, 4, 5, 7, 7, 8, 8 and 9. Make a pair of 4 digit numbers with a difference of: 1, 10, 100, 1000. How many ways can you do it?

U.t ± U.t	Addition without crossing boundaries:  2.3 + 1.5 Exchanging tenths for a new unit:  1.7 + 2.5 Subtraction without crossing boundaries:  3.6 – 2.1 (Move 2.1 down to show what's left). Exchanging a unit for tenths.  3.4 – 1.7 (Move 1.7 down to show what's left).	Expanded methods. 2 + 0.3 + 1 + 0.5 3 + 0.8 = 3.8 1 + 0.7 + 2 + 0.5 4 + 0.2 = 4.2 1 3 + 0.6 - 2 + 0.1 1 + 0.5 = 1.5 2 1.4 ~~3~~ + ~~0.4~~ - 1 + 0.7 1 + 0.7 = 1.7	Compact column methods and missing number sentences. 2.3 + 1.5 3.8 1.7 + 2.5 4.2 1 3.6 -2.1 1.5 2 ~~3~~.14 -1.7 1.7 5.7 - □ = 1.8 □ + 4.9 = 7.2 □ – 3.6 = 1.5	I ran across the playground in 9.4 seconds. My brother was 1.5 seconds faster than me. My sister was 2.7 seconds slower than my brother. How long did my sister take to run across the playground? Use the digits 0 to 9. Make two decimals (units and tenths). Add them together. How many pairs can you make with a total of 10?

Year 4 cont	Concrete	Pictorial	Conceptual	Using and applying
U.th ± U.th	 Develop process shown in U.t ± U.t • Addition crossing one boundary. • Addition crossing more than one boundary. • Subtraction with exchanging through one boundary. • Subtraction with exchanging through more than one boundary. • Subtraction with exchanging through zero.	Expanded methods to develop concepts of place value with hundredths.	Compact column methods.	Any 2 books cost £8.00 in a sale. The price of my books would have been £3.89 and £5.75 before the sale. How much money did I save by buying the books in the sale? Use the digits 1 to 9. Make 3 decimals (units tenths and hundredths) and subtract them from 20. What's the closest answer to zero you can make? Use the digits 1 to 9. Make 2 decimals (unit, tenths and hundredths). Find the difference. How many differences can you find which equal 1.23?

Upper Key Stage 2:

- The principal focus of mathematics teaching in upper key stage 2 is to ensure that pupils extend their understanding of the number system and place value to include larger integers. This should develop the connections that pupils make between multiplication and division with fractions, decimals, percentages and ratio.

- At this stage, pupils should develop their ability to solve a wider range of problems, including increasingly complex properties of numbers and arithmetic, and problems demanding efficient written and mental methods of calculation. With this foundation in arithmetic, pupils are introduced to the language of algebra as a means for solving a variety of problems.

- By the end of year 6, pupils should be fluent in written methods for all four operations, including long multiplication and division, and in working with fractions, decimals and percentages.

End of year expectations	Rapid recall	Mental calculation	Language	Using and applying
Year 5	All times tables up to 12 x 12	Add and subtract numbers mentally with increasingly large numbers (e.g. 12 462 – 2300 = 10 162) Rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy.	Thousandths	Solve problems involving numbers up to three decimal places *(Taken from Y5 Fractions, Decimals and Percentages)*
Year 6	All times tables up to 12 x 12			Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why Use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy

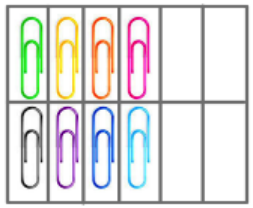
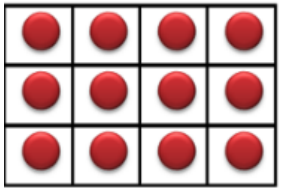
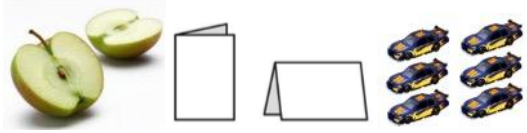
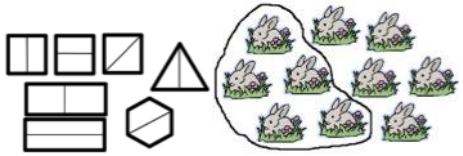
Year 5	• Add and subtract whole numbers with more than four digits, including using formal written methods (columnar addition and subtraction) • Add and subtract numbers mentally with increasingly large numbers (e.g. 12 462 – 2300 = 10 162) • Solve problems involving numbers up to three decimal places (Taken from Y5 Fractions, Decimals and Percentages) (Refer to process in Year 3 and 4. Children should be able to use column methods efficiently to work at this level).	I travelled to 3 different cities. The distances of my journeys were: 1982 m, 15642 m and 12108m. What was the total distance travelled in metres? How far did I travel in km? My friend travelled 31.9km, how much further did he travel than me? Use the digits 3, 4, 6 and 7. Make a 4 digit number and subtract it from 10,000. What are the largest and smallest answers? Which answer is closest to 5000? Find the digital roots of your answers. What do you notice? Use the digits 1 to 9. Make a 4 digit and a 5 digit number. Find the difference. Which pairs of numbers give you an answer closest to…80000, 75000, 70000 etc? Use the digits 1 to 9. Make 2 decimals (unit, tenths, hundredths and thousandths). Find the difference. How many differences can you find which equal 1.234? Use the digits 0 to 7. Make two decimals (units, tenths, hundredths and thousandths). Add them and find the nearest whole number to your answer. How many totals can you find where the nearest whole numbers is…4, 5, 12? Etc.
Year 6	• Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why • Use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy	

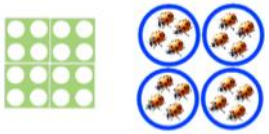
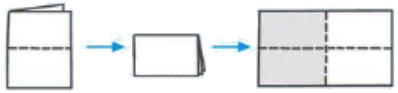
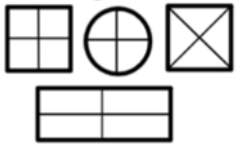
Multiplication and Division
Key Stage 1:

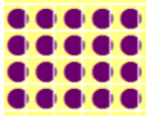
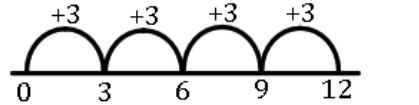
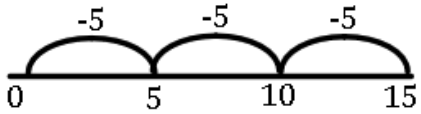
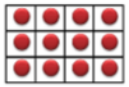
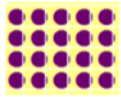
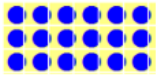
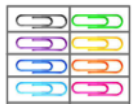
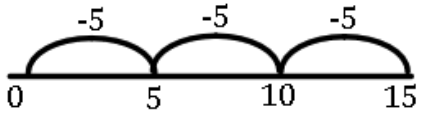
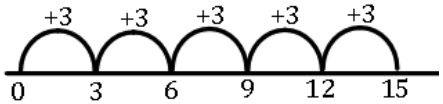
- The principal focus of mathematics teaching in key stage 1 is to ensure that pupils develop confidence and mental fluency with whole numbers, counting and place value. This should involve working with numerals, words and the four operations, including with practical resources (for example, concrete objects and measuring tools).

- By the end of year 2, pupils should know the number bonds to 20 and be precise in using and understanding place value. An emphasis on practice at this early stage will aid fluency.

End of year expectations	Rapid recall	Mental calculation	Language	Using and applying
Year 1		Count on and back in 2, 5 and 10.	Groups of Array Counting in Sharing Double Half Quarter	Solve simple one-step problems that involve using concrete objects and pictorial representations.
Year 2	Identifying odd and even numbers. Recall multiples of 2, 5 and 10 and related division facts.	Count in steps of 3 from 0 and in tens from any number, forward or backward.	Odd, even, Repeated addition/subtraction Grouping Inverse Multiply Multiple(s) of Divide Division Commutative Calculate Equivalent	Solve one-step problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts. They connect the 10 multiplication table to place value, and the 5 multiplication table to the divisions on the clock face.

Year 1	Concrete	Pictorial	Conceptual
Multiplication and division as repeated addition and subtraction	Using familiar objects and resources.  Finding 'groups of' with repeated addition and subtraction. 	Repeated images E.g. How many legs? 	
Represent repeated addition as an array. Begin to use arrays to find repeated subtraction.	Make arrays on grids with counting objects 	Understand visual representations of arrays 	
Doubling and halving numbers within 20 (as repeated addition and subtraction).	Using familiar objects and resources.  	Using a variety of models and images.   	Using number sentences and beginning to calculate mentally. 6 + 6 = Double 9 = 14 = Double … Half of 18 = … ½ of □ = 5 10 = half of…. 7 = 14 - □ 4 + □ = 8

Year 1	Concrete	Pictorial	Conceptual	Using and applying
Recognise, find and name a half as one of two equal parts of an object, shape or quantity Recognise, find and name a quarter as one of four equal parts of an object, shape or quantity	Using familiar objects and  resources.    	Using a variety of models and images 	Recognise unit fraction notation: ½ and ¼	I had 8 balloons. I gave ¼ of them away. How many balloons did I give away? How many do I have left? Use the numbers 1 to 20. Which numbers can you find ½ / ¼ of? What do you notice about your answers?

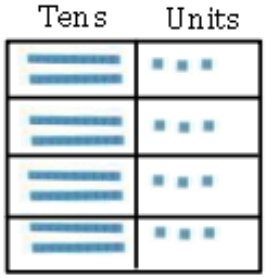
Year 2	Concrete	Pictorial	Conceptual	Using and applying
Use arrays to make or draw multiplications and find the corresponding division facts. Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) sign	Make arrays on grids using counting objects.   Identify arrays in everyday objects. 	Array images  Repeated addition and subtraction along a number line.   	Using number sentences and beginning to calculate mentally.  3 x 4 = 12 12 ÷ 4 = 3 Missing number problems.  20 = □ x 5  3 = □ ÷ 6	I had 20 lollies. I put them into **groups** of 5. How many groups were there? I had 20 lollies. I **shared** them between 5 people. How many lollies did each person get? I saved 5p **each** week for 6 weeks. How much did I save altogether? If I save 5p **each** week, how many weeks will it take me to save 40p?
Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot.	Make arrays on grids using counting objects.  2 x 4 = 8 Rotating arrays to find other multiplications.  4 x 2 = 8	Repeated addition and subtraction along a number line.  3 x 5 = 15  5 x 3 = 15	Using number sentences and beginning to calculate mentally. 3 x 5 = 15 5 x 3 = 15 15 ÷ 5 = 3 15 ÷ 3 = 5	There are 24 parents coming to watch our class assembly. How many different ways can you arrange the chairs? (In equal rows).

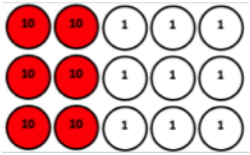
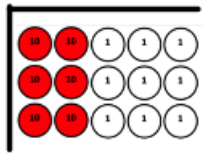
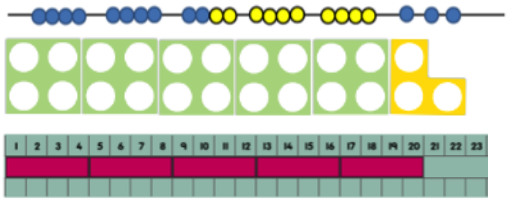
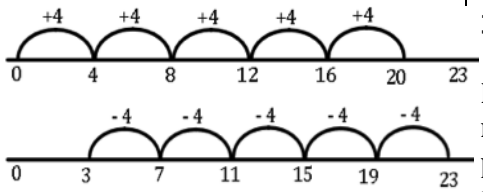
Lower Key Stage 2:

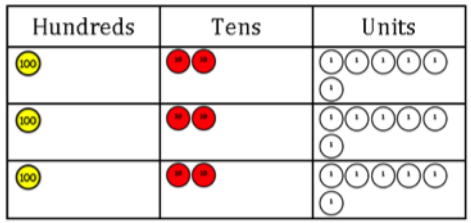
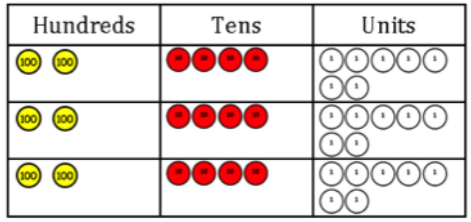
- The principal focus of mathematics teaching in lower key stage 2 is to ensure that pupils become increasingly fluent with whole numbers and the four operations, including number facts and the concept of place value. This should ensure that pupils develop efficient written and mental methods and perform calculations accurately with increasingly large whole numbers.

- At this stage, pupils should develop their ability to solve a range of problems, including with simple fractions and decimal place value. By the end of year 4, pupils should have memorised their multiplication tables up to and including the 12 multiplication table and show precision and fluency in their work.

End of year expectations	Rapid recall	Mental calculation	Language	Using and applying
Year 3	Recall multiples of 2, 5 and 10 and related division facts. Begin to recall multiples of 3, 6 and 4 and 8 and related division facts.	Count from 0 in multiples of 4, 8, 50 and 100.	Grid method Product Short division Remainder	Pupils should solve simple problems in contexts, including missing number problems, deciding which of the four operations to use and why, including measuring and scaling contexts, and correspondence problems in which m objects are connected to n objects (e.g. 3 hats and 4 coats, how many different outfits; 12 sweets shared equally between 4 children; 4 cakes shared equally between 8 children).
Year 4	Recall multiplication and division facts for multiplication tables up to 12 × 12	Count in multiples of 6, 7, 9, 25 and 1 000 Multiply 3 numbers U x U x U Recall factor pairs for a given number Multiply by 0 and 1 and divide by 1	Factor Factor pair Quotient Divisor	Pupils should solve **two-step** problems in contexts, choosing the appropriate operation, working with increasingly harder numbers. This should include correspondence questions such as three cakes shared equally between 10 children.

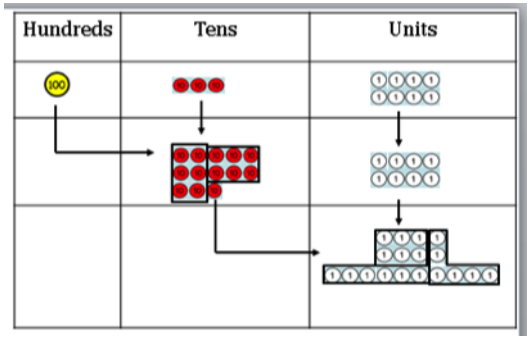
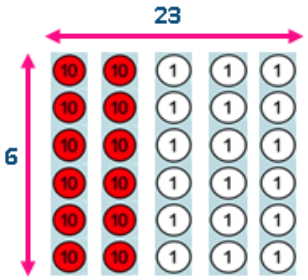
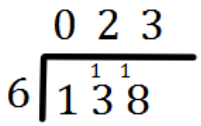
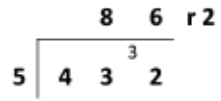
Year 3	Concrete	Pictorial	Conceptual	Using & applying
TU x U Extending understanding of arrays (TU x U), progressing to formal written methods	Using counting objects and resources. 23 x 4 = 92   Begin to link to inverse operations: 92 ÷ 4 = 23	Use arrays to link to grid multiplications. x 20 3 4 80 12 80 + 12 = 92	Using number sentences. 18 x 4 = □ 31 x 3 = □ Missing number problems. □ x 41 = 123 7 x □ = 84	Year 3 went on a trip. There were 6 groups with 14 children in each group. How many children went on the trip in total? Use the digits 2, 3, 4, 5 and 6. Make a multiplication (U x TU) e.g. 2 x 53 = Find different totals can you find? How many multiplications have the *same* total?

Year 3	Concrete	Pictorial	Conceptual	Using & applying
TU ÷ U Sharing and grouping to create an array. (***Not*** exchanging from tens to units at this stage).	Using counting objects and resources.  69 ÷ 3 = 23  Check using multiplication inverse: 23 x 3 = 69	Extending divisions to resemble written method of short division. 23 3  69 ÷ 3 = 23 Check using multiplication inverse: 23 x 3 = 69	Short division. $3\overline{)69}$ 23 Check using multiplication inverse: 60 + 9 = 69	69 children were **grouped** equally onto 3 buses for a trip. How many children went on each bus? 3 children **shared** £69 equally. How much did they each receive? How many different divisions can you make? 36 ÷ ? = ?
Understand the concept of remainders after division.	Using resources. 23 ÷ 4 = 5 r3 	Repeated addition and subtraction along a number line. 23 ÷ 4 = 5 r3  	Begin to solve mentally. 23 ÷ 4 = □ 31 ÷ 6 = □ Missing number problems. □ ÷ 3 = 4 r1 17 ÷ □ = 3 r2	A farmer had 33 eggs. He put them into boxes of 6. How many **full** boxes did he have? How many eggs did he have left over? If he put them into boxes of 12, how many would be left over now? Use each number in the 4x table. Make it with counters then share it into 3 groups. Write the remainder each time. What patterns do you notice? There are 75 children at sports day. If they were divided into 3 teams, 4 teams, 5 teams… etc. how many children would be left out each time?

Year 4	Concrete	Pictorial	Conceptual	Using and applying
HTU x U multiply 2-digit and 3-digit numbers by a 1-digit number using formal written layout	Crossing ***one*** boundary. 126 x 3 =  	Beginning with grid multiplication. 300 + 60 + 18 Leading to expanded vertical method. 126 x 3 18 (3 x 6) 60 (3 x 20) 300 (3 x 100) 378	Compact vertical method. 1 2 6 x 3 3 7 8 1	In one week, 163 people visited the museum each day. How many people visited in total? My sister and I were raising money for charity. We collected £127 every day for 6 days. We **shared** the money **equally** between two different charities. How much money did each charity receive? Use the digits 1, 2, 3 and 5. Make a multiplication U x HTU. How many different products are there? What are the largest and smallest products possible? U x HTU = 820. How many ways can you solve this?
	Extending to crossing ***two*** boundaries. 247 x 3 =  	Beginning with grid multiplication. 600 + 120 + 21 Leading to expanded vertical method. 247 x 3 21 (3 x 7) 120 (3 x 40) 600 (3 x 200) 741	Compact vertical method. 2 4 7 x 3 7 4 1 1 2	

x	100	20	6
3	300	60	18

x	200	40	7
3	600	120	21

Year 4	Concrete	Pictorial	Conceptual	Using and applying
TU ÷ U (Where exchanging is required) **HTU ÷ U** (Where exchanging is required)	Grouping and sharing using place value counters. Exchanging counters which cannot be grouped. 138 ÷ 6 = 23  	Result of grouping/sharing counters during 'concrete' stage.  Check using multiplication inverse.	Short division methods.  138 ÷ 6 = 23 432 ÷ 5 becomes  Answer: 86 remainder 2	A school ordered 432 pencils. They were put into packs of 5. How many packs were made? How many pencils were left over? Robbie has 150 stickers. He kept 12 and shared the rest equally between 6 friends. How many stickers did each of his friends get? 436 children need to be put into teams for sports day. How many different ways could the children be grouped equally? How many divisions can you make which have a remainder of 3? What patterns do you notice? Which numbers between 100 and 150 have a remainder of 1 when they are divided by 2, 3, 4, 5, and 6?

Upper Key Stage 2:

- The principal focus of mathematics teaching in upper key stage 2 is to ensure that pupils extend their understanding of the number system and place value to include larger integers. This should develop the connections that pupils make between multiplication and division with fractions, decimals, percentages and ratio.

- At this stage, pupils should develop their ability to solve a wider range of problems, including increasingly complex properties of numbers and arithmetic, and problems demanding efficient written and mental methods of calculation. With this foundation in arithmetic, pupils are introduced to the language of algebra as a means for solving a variety of problems.

- By the end of year 6, pupils should be fluent in written methods for all four operations, including long multiplication and division, and in working with fractions, decimals and percentages.

End of year expectations	Rapid recall	Mental calculation	Language	Using and applying
Year 5	Related decimal facts for tables E.g. 6 x 7 = 42 0.6 x 7 = 0.7 x 6 = 4.2÷7= etc.	Count forwards or backwards in steps of powers of 10 for any given number up to 1 000 000. ÷x 10, 100 or 1000 including decimals Recognise all factor pairs of a number and identify common factors of two numbers know and use the vocabulary of prime numbers, prime factors and composite (nonprime) numbers recognise and use square numbers and cube numbers, and the notation for squared (2) and cubed (3)	Prime number Composite number Common factors Square / cube numbers	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 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.

Year 6		Perform mental calculations, including with mixed operations and large numbers E.g. 3 x 700 + 115 = Use estimation to check answers to calculations and determine, in the context of a problem, levels of accuracy. identify common factors, common multiples and prime numbers use their knowledge of the order of operations to carry out calculations involving the four operations		Use their knowledge of the order of operations to carry out calculations involving the four operations. 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 including interpreting remainders appropriately within the context of the problem.

Year 5	**Concrete**	**Pictorial**	**Conceptual**	**Using and applying**
Multiply numbers up to **four digits by a 1 or 2-digit** number using a formal written method, including **long multiplication for 2-**	Refer to Year 4 (HTU x U) and extend the process of using place value counters to ThHTU x U	Refer to Year 4 grid method (HTU x U) and extend to ThHTU x U	Refer to Year 4 vertical method (HTU x U) and extend to ThHTU x U 2 7 4 1 x 6 1 6 4 4 6 4 2 Answer: 2741 x 6 = 16446	There are 5 kittens, each weighing 1352g. What is their total mass in Kg? Use the digits 1 to 5. Make a multiplication: ThHTU x U How many products can you make between 5000 and 5500?

digit numbers				
TU x TU	NB: Children working at this level are expected to have secured the use of place value counters to multiply by a one digit number. Therefore, they should proceed to pictorial methods.	Grid method: 47 x 36 = x | 40 | 7 30 | 1200 | 210 6 | 240 | 42 1200 + 240 210 42 1692 Leading to expanded vertical: 47 x 36 42 (6x7) 240 (6x40) 210 (30x7) 1200 (30x40) 1692	Compact method: 47 x36 282 1410 1692 Answer: 47 x 36 = 1692	I saved £36 every week for a year. At the end of the year, I gave half of it to charity. How much money did I donate? Try this with several numbers: choose a prime number greater than 3, square it and divide the answer by 12. Look at the remainder. What do you notice? Why does this happen?
Year 5	**Concrete**	**Pictorial**	**Conceptual**	**Using and applying**
HTU x TU	Follow processes shown above (TU x TU).	Grid method leading to expanded vertical.	Compact method: 124 x 26 744 (6 x 124) 2480 (20 x 124) 3224 Answer: 124 x 26 = 3224	There are 24 bottles in a crate. Each bottle has a capacity of 720ml. what is the total amount in litres? Make 5 different 2 digit numbers e.g. 56, 74, 31, 65, 83. Multiply them each by 101. What do you notice? What happens

				when you multiply each one by 1001?
ThHTU ÷ U divide numbers up to four digits by a 1-digit number using the formal written method of short division and interpret remainders appropriately for the context	Follow processes shown in Year 4 HTU ÷ U with place value counters	Showing remainder as a whole number: $3\overline{)2^{2}5^{1}7^{2}6}$ = 858 r 2 Answer: 858 remainder 2 Showing remainder as a fraction: $3\overline{)2^{2}5^{1}7^{2}6}$ = 858 r 2 Answer: $858\ \frac{2}{3}$		6 people won £8724 on the lottery. They spent £650 on a party to celebrate then shared the rest. How much did they each receive? How many divisions can you create which leave a remainder of 4/5, 2/3…etc?

Year 6	**Concrete**	**Pictorial**	**Conc**
divide numbers up to four digits by a 2-digit number using the formal written method of	558 ÷ 18 = Step 1: Identify a pair of factors for the divisor e.g. 18 = <u>3 x 6</u> Step 2: Divide by one of the factors. Step 3: Divide the answer by the other factor. $3\overline{)5^{2}5^{1}8}$ = 186 $\quad 6\overline{)1^{1}8\,6}$ = 31 Answer: 558 ÷ 18 = 31	Try this with several numbers: choose a prime number greater than 3, square it and divide the answer by 12. Look at the remainder. What do you notice? Why does this happen?	

short division where appropriate, interpreting remainders according to the context **HTU ÷ TU** (Using factor pairs as divisors)		
HTU ÷ TU (beginning to look at chunking as a precursor to long division)	Using a tool kit of known facts to find *efficient* chunks. 558 ÷ 18 = Tool kit - I know that: • 10 x 18 = 180 so… • 5 x 18 = … • 20 x 18 = … • 100 x 18 = … 4 18 ⟌ 5 5 8 - 3 6 0 (20 x 18) 1 9 8 - 1 8 0 (10 x 18) 1 8 - 1 8 (1 x 18) 0 Answer: 558 ÷ 18 = 31	

Year 6	Concrete	Pictorial	Conceptual	Using and applying
Multiply multi-digit numbers up to 4 digits by a two-digit whole number using the efficient written method of long multiplication.	1 2 4 x 2 6 7 4 4 (6 x 124) 2 4 8 0 (20 x 124) 3 2 2 4 1 1	1 7 3 5 x 4 3 5 2 0 5 (3 x 1735) 6 9 4 0 0 (40 x 1735) 7 4 6 0 5 1		Use similar examples (as above) adjusting to context as appropriate.

	Answer: 124 x 26 = 3224 Answer: 1735 x 43 = 74605	
divide numbers up to four 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 for the context	432 ÷ 15 becomes 2 8 r 12 1 5 | 4 3 2 3 0 0 1 3 2 1 2 0 1 2 Answer: 28 remainder 12 432 ÷ 15 becomes 2 8 1 5 | 4 3 2 3 0 0 15×20 1 3 2 1 2 0 15×8 1 2 $\frac{\cancel{12}}{\cancel{15}} = \frac{4}{5}$ Answer: $28\frac{4}{5}$ 432 ÷ 15 becomes 2 8 · 8 1 5 | 4 3 2 · 0 3 0 ↓ 1 3 2 1 2 0 ↓ 1 2 0 1 2 0 0 Answer: 28·8	There are 432 guests at a wedding. Each table at dinner seats 15 people. How many tables are needed? A farmer had 450 eggs. 18 smashed so he put the rest into boxes of 15. How many boxes did he use? How many divisions can you create which result in a recurring decimal? Can you find a pattern in the numbers you used? Choose a 4 digit number and investigate fractional and decimal remainders when you divide by 9. What patterns do you notice?