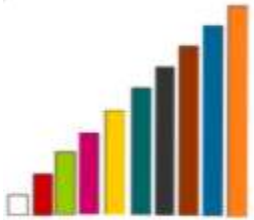
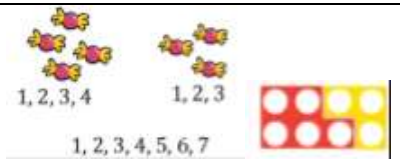
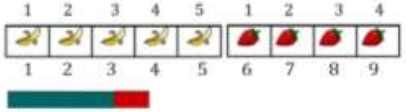
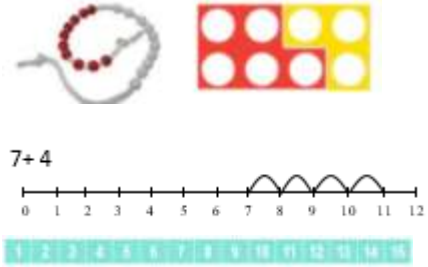
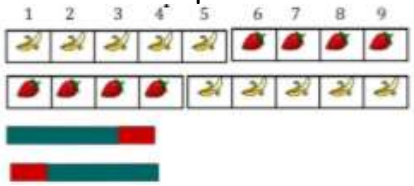
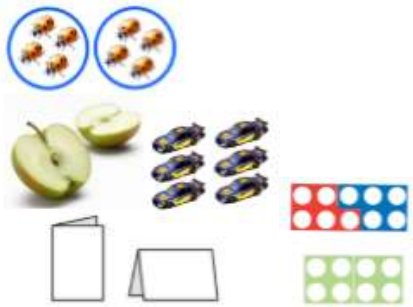
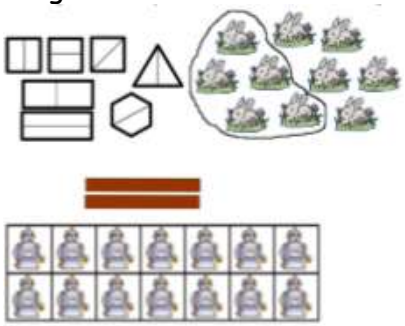
Bobbing and Iwade Federation
Timu Academy Trust

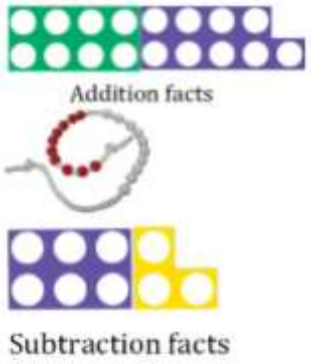
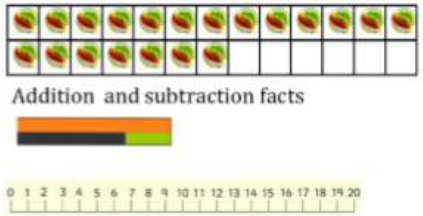
Calculation Policy Addition and Subtraction - Key Stage 1

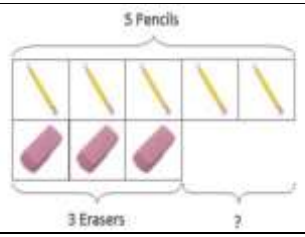
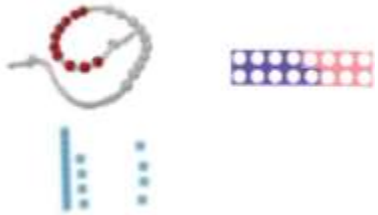
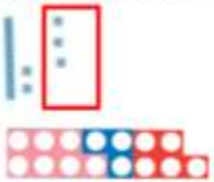
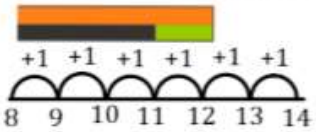
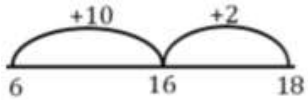
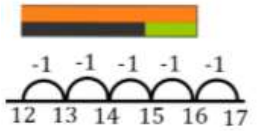
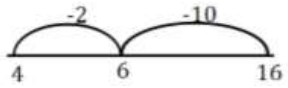
- *The principal focus of mathematics teaching in Key Stage 1 is to ensure that pupils develop confidence and mental fluency with whole numbers, counting and place value. This should involve working with numerals, words and the four operations, including practical resources (for example, concrete objects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

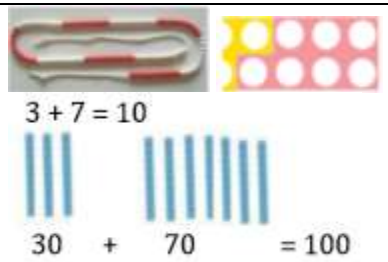
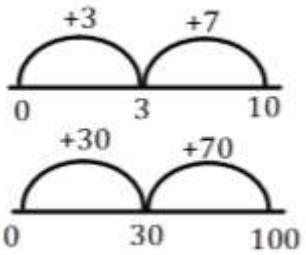
End of Year Expectations	Rapid Recall	Mental Calculation	Language	Using and Applying
Year 1	Bonds to 10 1 more or less than a number	Bonds to 20 O + Multiple of 10	Put together Add Altogether Total Take away Difference between More and less than Equal	Solve simple one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems. For example, 3 + ? = 14 7 = ? - 11
Year 2	Bonds to 20 Related ± bonds to 100 with multiples of 10. For example, 10 – 3 = 7, so, 100 – 30 = 70	TO ± O TO ± Multiple of 10 Adding three one-digit numbers Bonds to 100 with multiples of 10 and 5	Sum Difference Inverse Calculate Partition	Solve simple one-step problems with addition and subtraction using concrete objects and pictorial representations, including those involving numbers, quantities and measures.

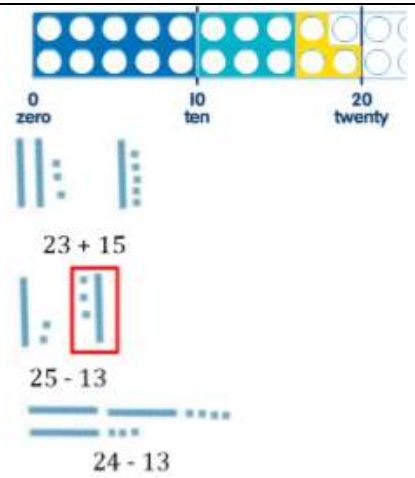
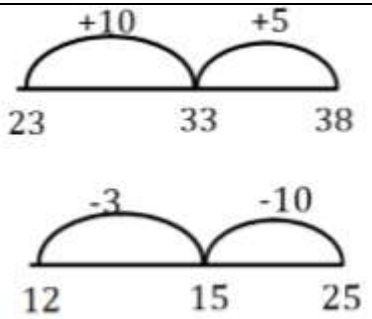
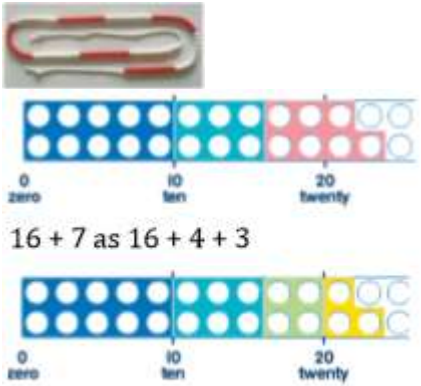
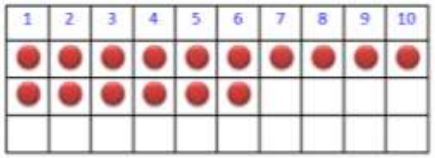
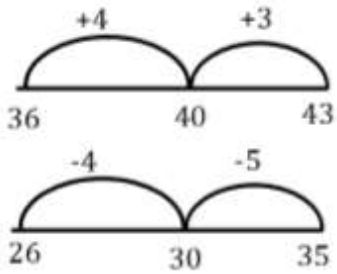
Year 1	Concrete	Pictorial	Conceptual	Using and Applying
Finding one or more less	Counting on and back using familiar objects and resources  One more  One less 	Introduce bar models to compare quantities  	Introduction to + - and = symbols to create number sentences. 5 – 1 = 4 4 + 1 = 5 (Children need to understand the concept of equality before using the '=' sign. Calculations should be written either side of the equality sign so that the sign is not just interpreted as 'the answer'.) 2 = 1 + 1 2 + 3 = 4 + 1 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 number 3 to 8. How many pairs can you find which have a **difference** of 1?
Use addition as combining	Counting using familiar objects and resources.	Bar models	Using number sentences and	I bought 5 sweets. My friend gave me 4

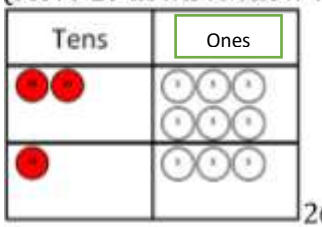
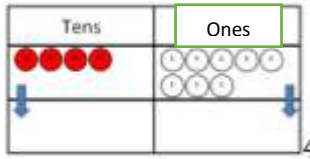
groups (aggregation)			beginning to calculate mentally 7 + 2 = 9 2 + 7 = 9 9 = 2 + 7 9 = 7 + 2 Missing number problems 8 = 3 + ? 9 = ? + 2 9 = ? + 5 4 = 9 - ? ? = 9 - 4	more. How many do I have in **total?** How many different additions can you find with a total of 9?
Addition as counting on (augmentation)	Counting using familiar objects and resources 	Bar model comparisons 		
Doubling and halving numbers within 20 (as repeated addition and subtraction).	Use 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?

				For example, double 4 = 8 Double 2 = 4 Double 7 = 14
Addition and subtraction facts within 20 Understand subtraction as 'take away' Understand subtraction as 'finding the difference'	Use familiar objects and resources  	Use bar models and **begin to** look at number lines  	Use number sentences and calculate mentally 13 = 4 = 17 so 17 = 13 + 4 4 + 13 = 17 so 17 = 4 + 13 17 – 4 = 13 so 13 = 17 – 4 17 – 13 = 4 so 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. What is the question? How many different ways can you use addition or subtraction to solve this?

				
Year 2	**Concrete**	**Pictorial**	**Conceptual**	**Using and applying**
Recall and use addition and subtraction facts to 20 **fluently** aiming to select the **<u>most efficient</u>** method	Use familiar objects and resources. Addition facts  Subtraction facts 	Use bar models and number lines. Addition and subtraction facts  Jumping in 1s  Jumping in 10s and 1s Addition and subtraction facts  	Use number sentences and calculate mentally 13 = 4 = 17 so 17 = 13 + 4 4 + 13 = 17 so 17 = 4 + 13 17 – 4 = 13 so 13 = 17 – 4 17 – 13 = 4 so 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?
Derive and use related facts up to 100	Use familiar objects and resources	Use 100 squares and number lines	Use number sentences and calculate mentally.	I am thinking of a number. If I add 80,

		 	20 + 80 = 100 so 100 – 80 = 20 80 + 20 = 100 so 100 – 20 = 80 100 = 20 + 80 so 80 = 100 – 20 100 = 80 + 20 so 20 = 100 – 80 Missing number problems 40 = 100 - ? 100 - ? = 70 50 + ? = 100	the **sum** is 100. What is my number? How many different ways can you make £1 using 10p, 20p and 50p coins?
TO ± 0 (without crossing 10s boundary) E.g. 16 ± 3 = TO ± T E.g. 38 ± 20 =	Use familiar objects and resources 	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	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

TO ± TO = (without ones crossing 10s boundary) E.g. 35 ± 13 =			Missing number problems 26 = ? – 10 ? – 10 = 32 ? + 10 = 51 29 = ? + 10	make the same total in more than one way?
TO ± O Bridging to 10 E.g. 17 + 8 = Or 35 – 9 =	Use familiar objects and resources 	Bar model images, 100 squares and number lines.  16 + 7 by counting to next 10 or 16 – 8 by counting back to ten. 	Use number sentences and solve mentally. 36 + 7 = 43 so 36 = 43 – 7 7 + 36 = 43 so 7 = 43 – 36 43 – 7 = 36 so 43 = 7 + 36 43 – 36 = 7 so 43 = 36 + 7	Refer to examples in previous section

TO ± TO Expanded methods without crossing 10s or 100s	 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 is 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 can make?

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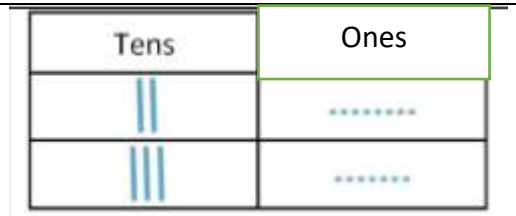
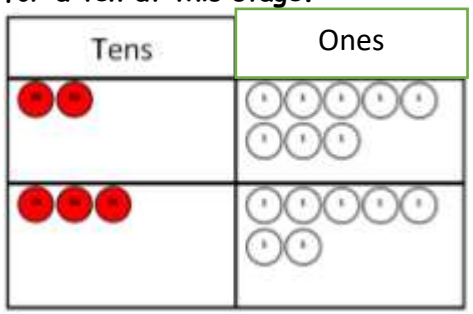
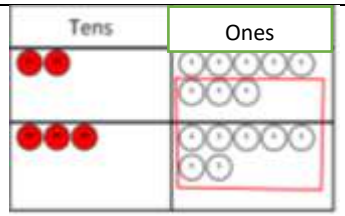
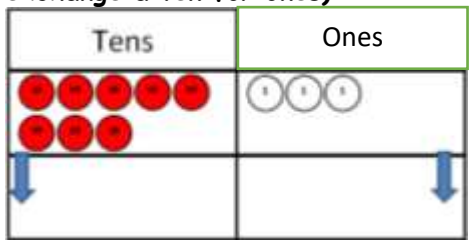
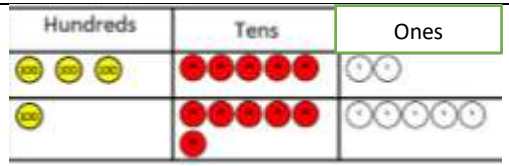
Calculation Policy
Addition and Subtraction – Lower Key Stage 2

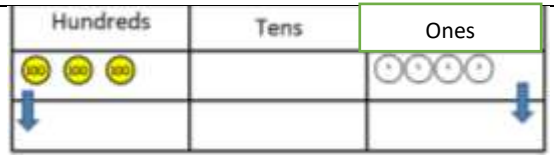
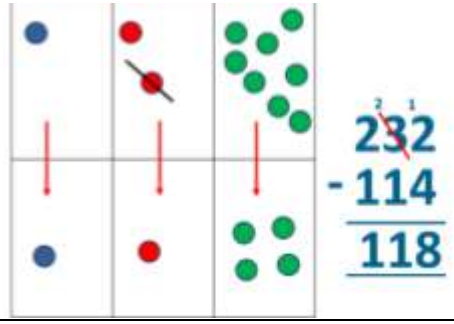
- *The principal focus of mathematics teaching in Lower Key Stage 2 is to ensure that pupils become increasingly fluent with whole numbers and the four operations, including number facts and the concept of place value. This should ensure that pupils develop efficient written and mental methods and perform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

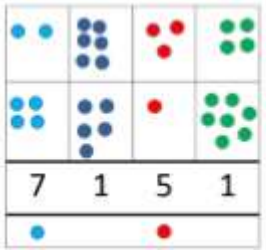
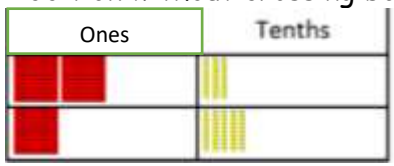
End of Year Expectations	Rapid Recall	Mental Calculation	Language	Using and Applying
Year 3	Bonds to 100 with multiples of 10 and 5 Bonds to 1000 with multiples of 100	HTO ± O HTO ± T HTO ± H TO ± TO by adjusting near multiples of 10 Any bond to 100, e.g. 34 + ? = 100, or 100 - ? = 27 **Mentally** calculate bonds to 1000 with multiples of 50, for example, 450 + ? = 1000 or 1000 - ? = 150 Note taking to round calculations in order to estimate	Carry Exchange Compact Expanded Boundary Column	Solve problems, including missing number problems, using number facts place value and more complex addition and subtraction.
Year 4	Bonds to 100 with any 2 digit number Bonds to 1000 with multiples of 50	TO ± TO Bonds to 1000 with multiples of 25	Increase Decrease Tenths Hundredths	Solve addition and subtraction **two-step** problems in contexts, deciding which operations and methods to use and why.

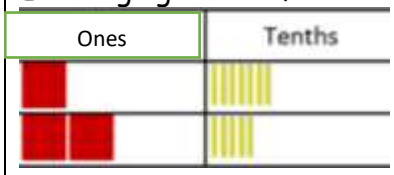
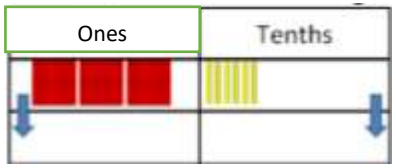
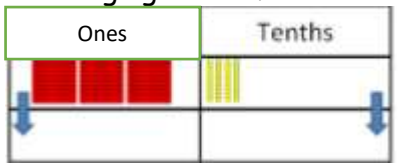
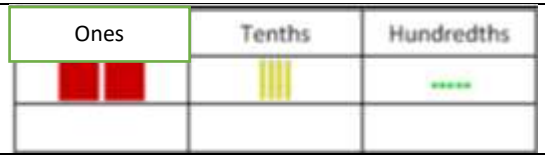
Year 3	Concrete	Pictorial	Conceptual	Using and Applying
TO + TO Expanded methods: crossing tens boundaries *keeping* the new ten(s) with the ones Introduce expanded column addition modelled with place value counters (Dienes could be used for those who need a less abstract representation)	 28 + 37 **NB: Combining ones but <u>not</u> exchanging for a ten at this stage.**  28 + 37	Expanded method $\begin{array}{r} 20 + 8 \\ +30 + 7 \\ \hline 50 + 15 = 65 \end{array}$ **NB: New ten(s) are kept with the Ones at this stage.**	TU ± TU should become a mental method; these examples are to help children develop the concept of exchanging and bridging across boundaries	
TO + TO Crossing the tens boundary	 28 + 37 Combining the Ones and exchanging for a new 10.	Expanded method crossing the tens boundary $\begin{array}{r} 20 + 8 \\ +30 + 7 \\ \hline 60 + 5 = 65 \\ 10 \end{array}$	Compact column method $\begin{array}{r} 28 \\ +37 \\ \hline 65 \\ 1 \end{array}$	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

	 28 + 37		Missing number problems 32 + 49 = ? ? + 73 = 94 16 + ? = 81	highest/lowest **total** you can make. How can you make the same total in more than one way? What is the closest to 90 you can make?
TO – TO Expanded method with exchanging from the tens to the Ones Introduce expanded column subtraction with no decomposition, modelled with place value counters. Then lead into exchanging, modelled using place value counters or Dienes.	 83 – 54 **(Move 54ndown to show what's left – exchange a ten for ones)** 	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 **Mental Methods:** Children should make choices about whether to use complementary addition or counting back, depending on the numbers involved.	There were 83 cars in a car park. At lunchtime, 54 cars were 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?

HTO ± TO **HTO ± HTO** NB: Crossing one boundary only at this stage. (Follow progression shown in **TO ± TO**	 352 + 165 Combining the tens and exchanging for 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!** $300 + 50 + 2$ $+ \underline{100 + 60 + 5}$ $\underline{500 + 10 + 7} = 517$ 100 100 ~~200~~ + 130 + 5 $- \underline{\quad 80 + 3}$ $\underline{100 + 50 + 2} = 152$	Leading to compact column methods and missing number problems crossing tens or hundreds boundaries **but not both.** 352 1 + 165 2135 517 - 83 1 152 352 – 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 our 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 4	**Concrete**	**Pictorial**	**Conceptual**	**Using and applying**
HTO ± HTO Crossing both boundaries	Follow methods shown in Year 3 using apparatus to cross both boundaries. For example: 438 + 385 = ? 624 – 257 = ?	Expanded methods – see Year 3	Compact column methods – see Year 3	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.
HTO ± HTO Exchanging through a zero	 304 – 137 Move 137 down to show what's left – exchange a hundred for tens; then exchange a ten for units  2 1 2 3 2 - 1 1 4 1 1 8	304 – 137 = 200 90 ~~300~~ + ~~100~~ + 14 - 100 + 30 + 7 100 + 60 + 7 = 167 If understanding of the expanded method is secure, children will move on to the formal method of decomposition, which again can be initially modelled with place value counters. See previous column.	304 – 137 2 9 ~~3~~ ~~0~~ 14 - 1 3 7 1 6 7 Missing number problems: 456 + ? = 710 1?7 + 6? = 200 60 + 99 + ? = 340 200 – 90 – 80 = ? 225 - ? = 150 ? – 25 = 67	Use the digits 2 to 8 and make two 3-digit numbers. Find the difference. What's the closest difference you can get to…400? How many pairs of numbers can ou find where the difference is: a 3 digit number with consecutive digits? For example, 572 – 449 = 123

ThHTO ± ThHTO	 2634 +4517 7151 Also follow the processes 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 (see Year 3)	Compact column methods (see Year 3) **Children should be able to make the choice of reverting to expanded methods if experiencing any difficulty.**	I walked 1360m, 2764m and then 2188m. How much further do I have to walk until I have travelled 7km? 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?
O.t ± O.t	Addition without crossing boundaries:  2.3 + 1.5	Expanded methods 2 + 0.3 + 1 + 0.5 3 + 0.8 = 3.8	Compact column methods and missing number sentences 2.3 + 1.5 3.8	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

	Exchanging tenths for a new one:  1.7 + 2.5 Subtraction without crossing boundaries:  3.6 – 2.1 (Move 2.1 down to show what's left) Exchanging a One for tenths:  3.4 – 1.7 (Move 1.7 down to show what's left)	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	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	to run across the playground? Use the digits 0 to 9. Make two decimals (Ones and tenths). Add them together. How many pairs can you make with a total of 10?
O.th ± O.th	 	Expanded methods to develop concepts of place value with hundreds	Compact column methods	Any 2 books cost £8.00 in a sale. The price of my

	Develop process shown in O.t ± **O.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.			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 (Ones, tenths and hundredths). Find the difference. How many differences can you find which equal 1.23?

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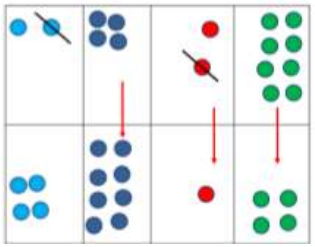
Calculation Policy
Addition and Subtraction – Upper Key Stage 2

- *The principal focus of mathematics in 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 Calculations	Language	Using and Applying
Year 5	Decimal bonds to 1d.p. to any whole number, for example, 3.6 up to 11.	Add and subtract numbers mentally with increasingly large numbers (for example, 12, 462 – 2300 = 10, 162) Rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy.	Thousandths	Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.
Year 6		Perform mental calculations, including with mixed operations and large numbers, for example, 3 x 700 + 115 = ? Rounding to check answers to calculations and determine, in the		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.

		context of a problem, levels of accuracy		Solve problems involving addition, subtraction, multiplication and division including interpreting remainders appropriately to the context of the problem.

Year 5	Concrete	Pictorial	Conceptual	Using and Applying
Adding and subtracting more than 4 digits		**Refer to the process in Year 3 and 4. Children should be able to use column methods efficiently to work at this level.**	Progress into column addition and subtraction when understanding of the expanded method is secure. **Missing number problems:** 119 - ? = 86 1, 000, 000 - ? = 999, 000 600, 000 + ? + 1000 = 671, 000 12, 462 – 2, 300 = ?	I travelled to 3 different cities. The distances of my journeys were: 1982m, 15642m and 12108m. what was the total distance travelled in metres? How far did I travel in km? 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…80, 000, 75, 000, 70, 000 etc? Use the digits 1 to 9. Make 2 decimals (ones, 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 (ones, tenths, hundredths and thousandths). Add them and find the nearest whole number to your
Add and subtract decimals values up to thousandths			172.83 + 54.68 227.51 1 1 1 **Place value counters can be used alongside the columnar method to develop understanding of addition with decimal numbers** **Missing number problems** 6.45 = 6 + 0.4 + ?	

Year 6	Concrete	Pictorial	Conceptual	answer. How many totals can you find where the nearest whole number is 4, 5, 12? Etc.
Calculate using the four operations	Children are to use their knowledge of the order of operations to carry out calculations involving the four operations		**7 – 2 x 3 = ?** **(7 – 2) x 3 = ?** **(? – 2) x 3 = 15**	
Solve multi-step problems	Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.			

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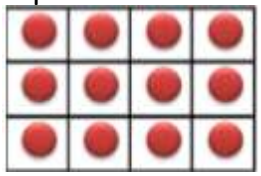
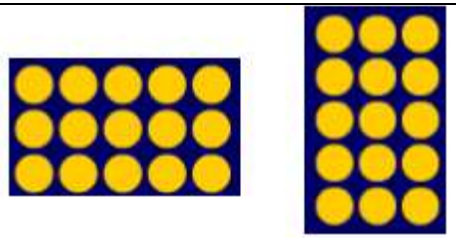
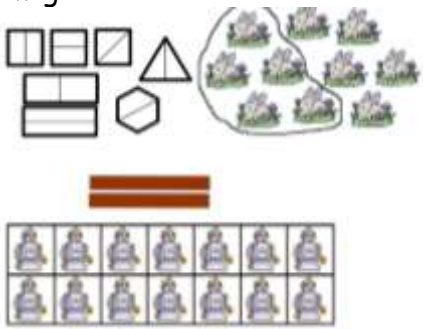
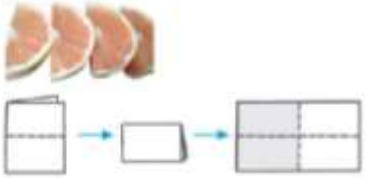
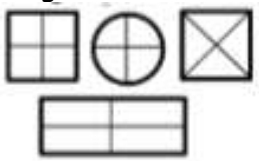
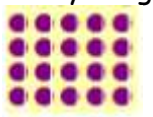
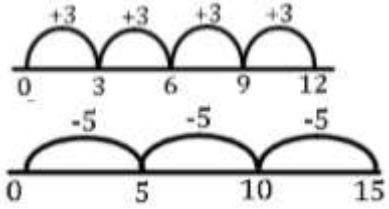
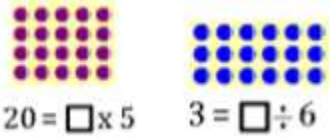
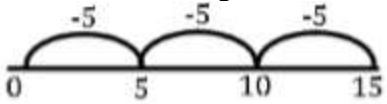
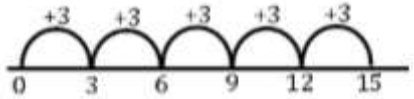
Calculation Policy
Multiplication and Division – Key Stage 1

- *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 and grouping (children must understand the difference between the 2 concepts) Double Half Quarter	Solve simple one-step problems that involve using concrete objects and pictorial representations **Children <u>must</u> be given opportunities to reason about what they notice in number patterns.**
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 and backward	Odd, even Repeated Addition/subtraction Grouping Inverse Multiply/multiples 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	Using and applying
Multiplication and division as repeated addition and subtraction	Using familiar objects and resources  Finding 'groups of' with repeated addition and subtraction. 	Repeated images, for example, 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.  Use of arrays as a pictorial representation for division 15 ÷ 3 = 5 There are 5 groups of 3. 15 ÷ 5 = 3 There are 3 groups of 5.		

				
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	
Find and name a half as one of two equal parts of a quantity. Find and name a quarter as one of four equal parts of a quantity.	Use familiar objects.  Use familiar resources. 	Use a variety of models and images. 	Recognise unit fraction notations: $\frac{1}{2}$ $\frac{1}{4}$	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. Write calculations using the multiplication, division and equals signs.	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 	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?
Use arrays to understand the commutative law of multiplication	Make arrays on grids using counting objects.  2 x 4 = 8 Rotate 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. 3x5=15 5x3=15 15 ÷ 3 = 5 15 ÷ 5 = 3	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?

				There are 24 parents coming to watch our class assembly. How many different ways can you arrange the chairs? (In equal rows)

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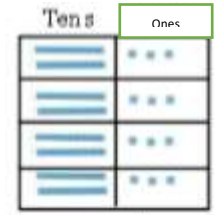
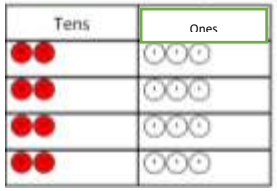
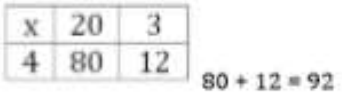
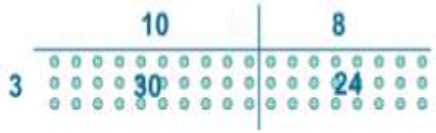
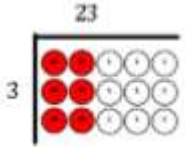
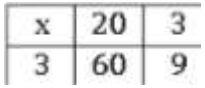
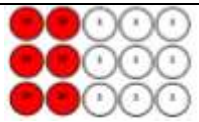
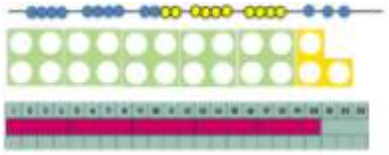
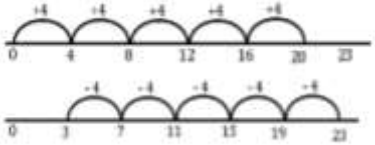
Calculation Policy Multiplication and Division – Lower Key Stage 2

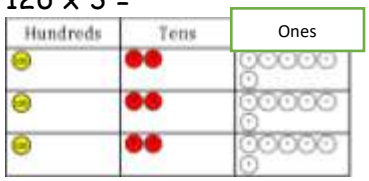
- *The principal focus of mathematics teaching in Lower Key Stage 2 is to ensure that pupils become increasingly fluent with whole numbers and the four operations, including number facts and the concept of place value. This should ensure that pupils develop efficient written and mental methods and perform 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 Calculations**	**Language**	**Using and applying**
Year 3	Recall multiples of 2, 5 and 10 and related division facts. Begin to recall multiples of 3, 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 12x12	Count in multiples of 6, 7, 9, 25 and 100. Multiply 3 numbers O x O x O Recall factor pairs for a given number	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 and applying
TO x O Extending understanding of arrays.	Use counting objects and resources. 23x4=92   Begin to link to inverse operations 92 ÷ 4 = 23	Use arrays to link to grid multiplications  18x3 =54  	Use 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 (O x TO) e.g. 2 x 53 = ? How many different totals can you find? How many multiplications have the same total?
TO ÷ O Sharing and grouping to create an array.	Use counting objects and resources.  69 ÷ 3 = 23	Extending divisions to resemble written method of short division.  69 ÷ 3 = 23	Short division $3\overline{)69}^{\,23}$ Check using multiplication inverse:  	69 children were **grouped** equally onto 3 buses for a trip. How many children went on each bus?

(**Not** exchanging from tens to ones at this stage).	 Check using multiplication inverse: 23 x 3 = 69	Check using multiplication inverse: 23 x 3 = 69	60 ÷ 9 = 69	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	Use 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 17 ÷ ? = 3 r2	A farmer had 33 eggs. He put them into boxes of 6. How many **full** 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?

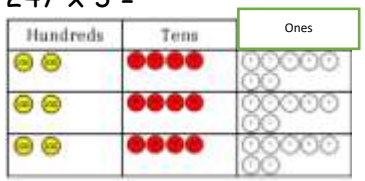
<table>
<tr><th>Year 4</th><th>Concrete</th><th>Pictorial</th><th>Conceptual</th><th>Using and Applying</th></tr>
<tr><td rowspan="2">HTO x O

(Consolidate TO x O and extend to 3 digit numbers)</td><td>Crossing one boundary.
126 x 3 =
 
</td><td>Beginning with grid method.
<table><tr><td>x</td><td>100</td><td>20</td><td>6</td></tr><tr><td>3</td><td>300</td><td>60</td><td>18</td></tr></table>300 + 60 + 18

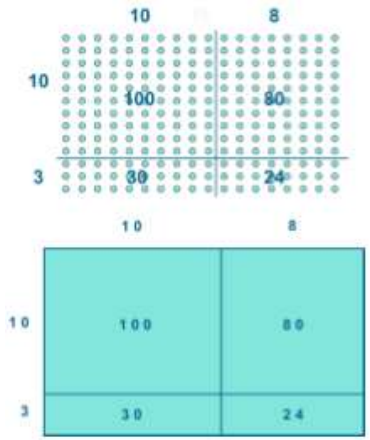
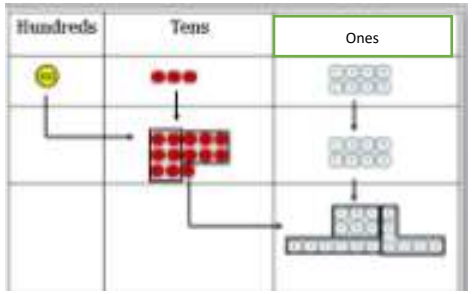
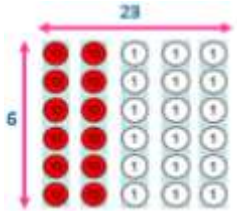
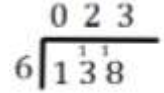
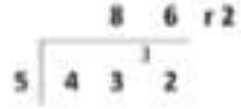
Leading to expanded vertical method
126
x 3
18 (3 x 6)
60 (3 x 20)
300 (3 x 100)
378</td><td>Compact vertical method
1 2 6
x 3
3 7 8
1</td><td rowspan="2">In one week, 163 people visited the museum each day. How many people visited in total?

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 O x HTO. How many different products are there? What are the largest and smallest products possible?

O x HTO = 820. How many ways can you solve this?</td></tr>
<tr><td>Extending to crossing two boundaries.
247 x 3 =
 
</td><td>Beginning with grid multiplication.
<table><tr><td>x</td><td>200</td><td>40</td><td>7</td></tr><tr><td>3</td><td>600</td><td>120</td><td>21</td></tr></table>600 + 120 + 21

Leading to expanded vertical method
247
x 3
21 (3 x 7)
120 (3 x 40)
600 (3 x 200)
741</td><td>Compact vertical method
2 4 7
x 3
7 4 1
1 2</td></tr>
</table>

Progress to TO X TO and HTO x TO. Ensure this is still linked back to their understanding of arrays and place value counters.				
TO ÷ O (Where exchanging is required) HTO ÷ 0 (Where exchanging is required)	Grouping and sharing using place value counters. Exchanging counters which cannot be grouped. 138 ÷ 6 	Result of grouping/sharing counters during 'concrete' stage. 138 ÷ 6  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? What do you notice?
Sharing and Grouping		Children are to continue to explore division as sharing and grouping, and to represent calculations on a number line until they have a secure understanding (See Year 3)		

Children should only use table facts with which they are <u>fluent</u>

Children should be given division questions that follow a <u>logical progression</u>

1. **The divided just over 10x the divisor, e.g. 84** ÷ 7
2. **Dividend just over 10x the divisor when the divisor is a teen number, e.g. 173 ÷ 15**
3. **Dividend over 100x the divisor, e.g. 840** ÷ 7
4. **Dividend over 20x the divisor, e.g. 168** ÷ 7

Bobbing and Iwade Federation
Timu Academy Trust

Calculation Policy Multiplication and Division – Upper Key Stage 2

- *The principal focus of mathematics in 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 =	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	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.		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 the four operations including interpreting remainders appropriately within the context of the problem.

Year 5	Concrete	Pictorial	Conceptual	Using and Applying
Consolidate Year 4 formal vertical method HTO x O Lead to ThHTO x O	Refer to Year 4 (HTO x O) and extend the process of using place value counters to ThHTO x O	Refer to Year 4 grid method (HTO x O) and extend to ThHTO x O	Refer to Year 4 vertical method (HTO x O) and extend to ThHTO x O 2741 x 6 16446 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: ThHTO x O. How many products can you make between 5000 and 5500?
TO x TO	**NB:** Children working at this level are expected to have secured the use of place value counters to multiply by a 1-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 x36 42 (6x7) 240 (6x40) 210 (30x7) 1200 (30x40) 1692	Compact method: 47 x36 282 1410 2 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?

HTO x TO	Follow processes shown above (TO x TO)	Grid method leading to expanded vertical	Compact method 1 2 4 x 2 6 7 4 4 (6 x 124) 2 4 8 0 (20 x 124) 3 2 2 4 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 by 101. What do you notice? What happens?
ThHTO ÷ O (Displaying remainders in different forms)	Follow processes shown in Year 4 HTO ÷ O with place value counters	Showing remainder as a whole number: $3\overline{)2^{2}5^{1}7^{1}6}$ = 858 r 2 Answer: 858 remainder 2 Showing remainder as a fraction: $3\overline{)2^{2}5^{1}7^{1}6}$ = 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 m any divisions can you create which leaves a remainder of $\frac{4}{5}$, $\frac{2}{3}$ etc
HTO ÷ TO (Using factor pairs as divisors)	558 ÷ 18 = Step 1: Identify a pair of factors for the divisor, e.g. 18 = 3 x 6 Step 2: Divide by one of the factors $3\overline{)5^{2}5^{1}8}$ = 186 $6\overline{)1^{1}86}$ = 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

<table>
<tr><td></td><td colspan="3">Step 3: Divide the answer by the other factor.
Answer: 558 ÷ 18 = 31</td><td rowspan="2">you notice? Why does this happen?</td></tr>
<tr><td>HTO ÷ TO
(Beginning to look at chunking as a precursor to long division)</td><td colspan="3">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
558
- 360 (20 x 18)
198
- 180 (10 x 18)
18
- 18 (1 x 18)
0</td></tr>
<tr><td>Year 6</td><td>Concrete</td><td>Pictorial</td><td>Conceptual</td><td>Using and Applying</td></tr>
<tr><td>Multiply multi-digit numbers up to 4 digits by a 2-digit whole number using the efficient written method of multiplication</td><td>124
x 26
744 (6 x 124)
2480 (20 x 124)
3224
Answer: 124 x 26 = 3224</td><td>1735
x 43
5205 (3 x 1735)
69400 (40 x 1735)
74605
Answer: 1735 x 43 = 74605</td><td></td><td>Use similar examples (See Year 5) adjusting to context as appropriate.</td></tr>
<tr><td>Divide numbers up to 4 digits by a 2-digit whole number using the efficient written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding as appropriate for the context.</td><td>432 ÷ 15 becomes
28 r12
15 | 432
300
132
120
12
Answer: 28 remainder 12</td><td>432 ÷ 15 becomes
28
15 | 432
300 15×20
132
120 15×8
12
Answer: $28\frac{4}{5}$</td><td>432 ÷ 15 becomes
28·8
15 | 432·0
30 ↓
132
120 ↓
120
120
0
Answer: 28.8</td><td>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.</td></tr>
</table>

		How many boxes could 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?