

Palace Wood Primary School

Progression in Calculations Policy



Palace Wood Primary School

Written by	Emily Carpenter
Date for Review	Spring 2021
Signed – Headteacher	

This policy has been impact assessed by Emily Carpenter in order to ensure that it does not have an adverse effect on race, gender or disability equality

Palace Wood Primary School – Calculation Progression

This policy is based on national expectations as outlined in the 2014 National curriculum. Year groups are included but teachers will need to use a degree of flexibility in deciding appropriate methods for different groups of children.

Updated by Emily Carpenter 2018

To be used in conjunction with all other progression documents linking to the programmes of study, notably fractions, reasoning and algebra.

Introduction:

The 2014 National Curriculum provides a structured and systematic approach to the teaching of calculation. The aim is for mental calculations and written procedures to be performed efficiently, fluently, accurately with understanding. Procedures and understanding are to be developed in tandem. End of key stage expectations are explicit in the programme of study.

At Palace Wood Primary School, we have a consistent approach to the teaching of written calculation methods in order to ensure continuity and progression across the school.

Age related expectations:

This calculation policy is organised according to age appropriate expectations as set out in the National Curriculum 2014, **however it is vital that pupils are taught according to the stage that they are currently working at**, being moved onto the next level as soon as they are ready, or working at a lower stage until they are secure enough to move on.

Providing a context for calculation:

It is important that any type of calculation is given a real life context or problem solving approach to help build children's understanding of the purpose of calculation, and to help them recognise when to use certain operations and methods. It is also important for children to be confident to use mental and/or written strategies to explain their thinking. This must be a priority within calculation lessons. Written methods need to be viewed as tools to enable children to solve problems and record their thinking in an organised way.

Aims:

Children should be able to use an efficient method, mental or written appropriate to the given task, with understanding. Children are encouraged to use a range of models and images, such as arrays, the bar method, number lines to ensure they understand the final compact method they are building up to. By the end of year 6, children will have been taught, and be secure with, a compact standard method for each operation.

To develop efficient written calculation strategies children need:

- Secure mental methods which are developed from early years
- A solid understanding of the number system and place value
- Practical hands on experience including a range of manipulatives spanning all of the year groups
- Visual models and images including number lines and arrays
- Experience of expanded methods to develop understanding and avoid rote learning

- The ability to explain each step of the calculation and explain WHY each step is done using appropriate vocabulary
- Secure understanding of each stage before moving onto the next.

Before carrying out a calculation, children will be encouraged to consider:

- Can I do it in my head? (using rounding, adjustment)
- The size of an approximate answer (estimation)
- Could I use jottings to keep track of the calculation?
- What is the most appropriate way to answer this calculation?
- Which resources to use to support their calculation.

When are children ready for written calculations?

Addition and subtraction:

- Do they know addition and subtraction facts to 20?
- Do they understand place value and can they partition numbers?
- Can they add three single digit numbers mentally?
- Can they add and subtract any pair of two digit numbers mentally?
- Can they explain their mental strategies orally and record them using informal jottings?
- Are the children able to explain the process of addition and subtraction?

Multiplication and Division:

- Do they know the 2, 3,4,5,6 and 10 times tables and corresponding division facts?
- Do they know the result of multiplying by 1 and 0?
- Do they understand 0 as a place holder?
- Can they multiply two and three digit numbers by 10 and 100?
- Can they double and halve two digit numbers mentally?
- Do they understand the relationship between multiplication and division?
- Can they use multiplication and division facts they know to derive mentally other multiplication and division facts that they do not know?
- Can they explain their mental strategies orally and record them using informal jottings?

These lists are not exhaustive but are a guide for the teacher as they structure the move from informal to formal methods of calculation. It is important that children's mental methods of calculation are practised, taught and secured alongside their learning and use of an efficient written method for each operation. Additionally, key number skills should be continually revisited to ensure that every child's understanding of concepts in number supports his/her development in calculation and these areas should be taught explicitly/revisited if the need arises either in whole class lessons or in guided groups.

A pathway to teaching calculation methods:

Expanded methods should be viewed as steps towards a standard method and not as methods in themselves.

Before beginning to record in a more refined written format, children must have had significant practical work reinforced with appropriate manipulative, models and images.

Teachers will guide pupils to refine their written methods of recording by modelling and asking questions such as “What is the same? What’s different? What mistakes can you spot?”

Learning will be planned to ensure pupils are encouraged to use and apply what they have learnt to problem solving tasks and a range of contexts.

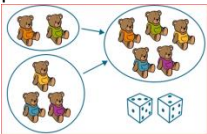
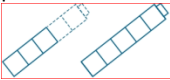



As children move along the pathway, it is vital that they practice, reinforce, consolidate, use and apply it to mathematical learning and NOT simply move onto the next step.

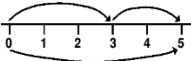


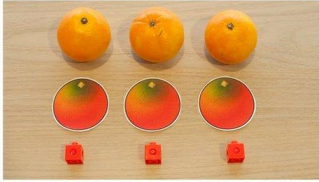
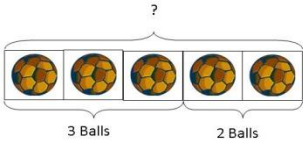
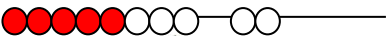
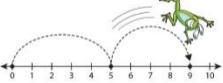
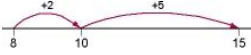
Points to note:

- To be successful in learning to calculate children must be able to; count reliably forwards and backwards, recognise individual digits, know what each digit represents, know that digits combine to make numbers and have some understanding of the concept of zero.
- The correct terminology should be used by **all** staff **and** children when referring to the value of digits to support the children’s understanding of place value. e.g. $68 + 47$ should be read ‘sixty add forty’ not ‘six add four’
- Teachers should refer to the programme of study for key vocabulary for each year group.

Palace Wood Primary school has a Maths Specialist Teacher hence we are following Canterbury Christ Church’s progression in calculations. Our thanks go to CCCU for allowing us to use and edit the following document.

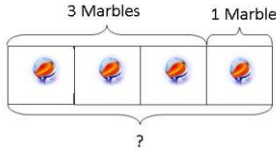
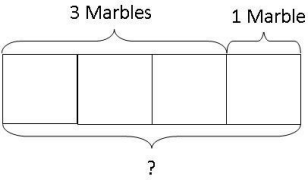
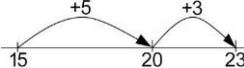
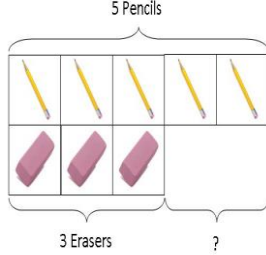
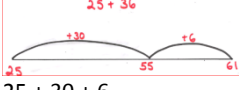
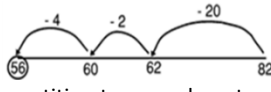
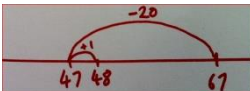
Year 1 Addition and subtraction

Term 1 and 2	Term 3 and 4	Term 5 and 6	End of year
<p>Combining two groups to solve addition problems</p>  <p>Increasing one group to solve addition problems</p>  <p>Partitioning one group in to two to solve subtraction problems</p>  <p>Take away from one group and use it to solve subtraction problems</p>  <p>Use addition or subtraction to solve problems about difference: What is the difference between 2 and 5? If I have 3 stickers how many more do I need to have 5?</p> 	<p>As before and</p> <p>Count forwards and backwards along a number line from any number and relate to addition and subtraction.</p> <p>Commutative law for addition, but not for subtraction, using concrete objects such as Cuisenaire rods and a number line to ‘prove’ this.</p> <p>Count on from the largest number to add, and know that I can count on from either number</p> <p>Make connections between addition and subtraction to 10, moving forwards and backward along a number line, and then using one number fact to list others</p> <p>Make connections between number facts eg use $4 + 4 = 8$ to calculate $4 + 5$</p> <p>Solve missing number problems, with the unknown in different places. Use the bar method.</p> <p>Use addition and subtraction facts to 10 to work out facts to 20 to solve</p>	<p>As before and</p> <p>Rapid, fluent recall of addition facts to 10</p> <p>Use number facts to 20 to solve one step problems and record with a number sentence and with practical resources and images such as number lines</p> <p>Reorder numbers to add them more easily using known number bonds to 10 eg $3 + 8 + 7$</p> <p>Make connections between addition and</p>	<p>read, write and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs</p> <p>represent and use number bonds and related subtraction facts within 20</p> <p>add and subtract one-digit and two-digit numbers to 20, including zero</p> <p>solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations,</p>

  <p>Count all to add, 4 fingers and 3 fingers, count them all 1,2,3,4,5,6,7.</p>  <p>Count on to add, using objects, cubes, a bead string and then a number track and then a number line or a bar.</p>  <p>There are 3 footballs in the red basket and 2 footballs in the blue basket. How many footballs are there altogether?</p>    <p>Count out to subtract $9 - 4$, 9 fingers up, count four to put down, count what is left</p> <p>Count on from the largest number to find the difference on a number track or line</p> <p>Count back from the largest number to take away on a number track or line</p> <p>The meaning of = is the same as or equal to, and use it to record work as a number sentence</p> <p>Use language of addition and subtraction, eg together, total, take away, difference, more than, less than, fewer than</p>	<p>problems</p> <p>Bridge through 10 to solve addition and subtraction problems to 20 $8 + 7$</p>  <p>Add and subtract zero</p> <p>Talk about patterns in facts to 10</p>	<p>subtraction facts to 20</p> <p>Reason with facts using the connections between facts eg near doubles</p>	<p>and missing number problems such as $7 = \square - 9$.</p>
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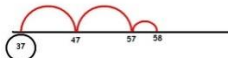
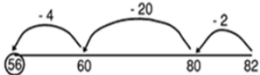
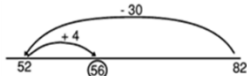
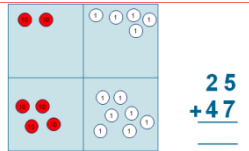
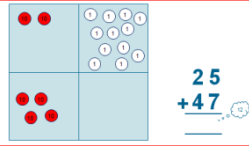
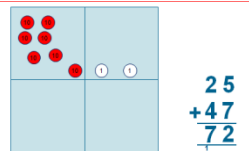
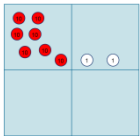
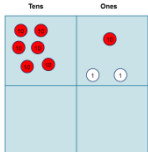
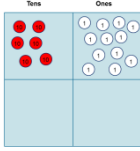
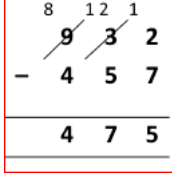
Year 2 Addition and subtraction

Term 1 and 2	Term 3 and 4	Term 5 and 6	End of year
<p>Begin to recall number facts to 20, including addition and subtraction facts, use patterns and connections between addition and subtraction</p>	<p>As before and</p> <p>Missing number problems up to 20</p>	<p>As before and</p> <p>Rapid , fluent recall of number facts to 20</p>	<p>solve problems with addition and subtraction: using concrete objects and pictorial representations,</p>
<p>Know all doubles of numbers up to 20</p>	<p>Make connections between number facts to 10 and 20, and number facts to 100, working with multiples of</p>	<p>Make connections between number facts to 10 and 20, and number facts to 100</p>	<p>including those involving numbers, quantities and</p>
<p>Solve problems including:</p>	<p>$7 + 3 = 10$</p>	<p>$7 + 3 = 10$</p>	<p></p>

<p>-Combining two groups -Adding to one group -Partitioning one group -Taking away -Comparing two amounts to state the difference, how many more or less, and how many to make them equal -Experience subtraction as difference and take way, counting back from the first number, or up from the smallest number on a number line</p> <p>Add and subtract numbers using concrete objects, pictorial representations and symbols, related to real life problems and measures. including: -add three one digit numbers (looking for facts to help such as reordering to match numbers which total 10) - add and subtract any unit number to a multiple of ten on a number line or with Dienes</p> <p>Show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot, using resources or a number line or the bar method Peter has 3 marbles. Harry gives Peter 1 more marble. How many marbles does Peter have now?</p>  <p>Progress from concrete to abstract.</p> 	<p>ten $7 + 3 = 10$ $70 + 30 = 100$</p> <p>Know all doubles of multiples of ten to 100</p> <p>To state what must be added to a number to take it to the next multiple of 10 $52 + ? = 60$</p> <p>Given one number fact to 100, list all related number facts</p> <p>Use and understand language of addition and subtraction, including sum and difference</p> <p>Add and subtract numbers using concrete objects, pictorial representations and symbols, related to real life problems and measures. including: -add and subtract any two digit number and a units number for example on a number line or empty number line, including bridging through a multiple of ten</p>  <p>-add and subtract any two digit number and a tens number on a number line or with Dienes - use the bar comparatively Peter has 5 pencils and 3 erasers. How many more pencils than erasers does he have?</p> 	<p>$23 + 67 = 100$ Using Dienes apparatus, a number line or the empty number line for example</p> <p>Solve problems and puzzles with numbers up to 100, including those with numbers, quantities and measures using concrete resources or images such as an empty number line or the bar method</p> <p>Check answers using the inverse operation, or by adding in a different order</p> <p>Add and subtract any two digit numbers -partition one number and keep one number whole Eg $25 + 36$</p>  <p>$25 + 30 + 6$ Or $82 - 26$ $82 - 20 - 2 - 4$</p>  <p>-partition two numbers to prepare for column addition; (addition only) $25 + 30$ $20 + 30 = 50$ $5 + 6 = 11$ $50 + 11 = 61$ Use dienes or place value counters -add or subtract 9, 19, 29, 11, 21 etc by adding and subtracting multiples of ten and adjusting on a number line</p>  <p>$67 - 19 = 67 - 20 + 1$ -Use near doubles Use $25 + 25 = 50$ to calculate $25 + 26$</p>	<p>measures applying their increasing knowledge of mental and written methods</p> <p>recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100</p> <p>add and subtract numbers using concrete objects, pictorial representations, and mentally, including: a two-digit number and ones; a two-digit number and tens; two two-digit numbers; adding three one-digit numbers</p> <p>show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot</p> <p>recognise and use the inverse relationship between addition and subtraction and use this to check calculations and missing number problems.</p>
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Palace Wood Primary Progression in Calculation document

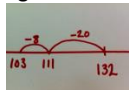
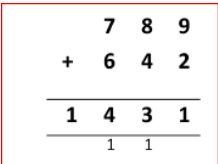
Year 3 Addition and subtraction

Term 1 and 2	Term 3 and 4	Term 5 and 6	End of year
<p>Recall of number facts to 100, including doubles and halves of numbers up to 100</p> <p>Count on and back in units, tens and hundreds</p> <p>State what needs to be added to a number to make the next multiple of 100</p> <p>Use of mental strategies covered in Year 2 for facts to 100 not remembered, such as:</p> <ul style="list-style-type: none"> -reordering numbers when adding to match pairs of numbers for example which total multiples of 10 or 100, Eg $24 + 37 + 36 = 60 + 37$ -partitioning one number and keeping one number whole, Eg 58 - 21  <ul style="list-style-type: none"> -partitioning both numbers for addition only, -bridging through multiples of ten, eg 82 - 26  <ul style="list-style-type: none"> -adding or subtracting a larger or small number and then adjusting <p>Eg 82 - 26</p>  <p>Add and subtract, using a number line or Dienes apparatus for example at first, and then mentally including;</p> <ul style="list-style-type: none"> -a three digit number and a unit number - a three digit number and a multiple of ten -a three digit number and a multiple of one hundred <p>Solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction.</p>	<p>As before and</p> <p>Estimate the answer to a calculation and use inverse operations to check solutions.</p> <p>Fluent mental addition and subtraction with numbers up to 100</p> <p>Column methods with addition and subtraction for two digit numbers, starting with an expanded form and moving to the formal method. Use of Dienes or place value counters for example alongside written methods. Link with place value and exchanging ten units for a ten. (Swap a block game.)</p> <p>Addition:</p>    <p>Subtraction:</p>    <p>Could move onto the expanded method for</p>	<p>As before and</p> <p>Fluent mental addition and subtraction with numbers above 100</p> <p>Column methods with addition and subtraction for three digit numbers, starting with an expanded form and moving to the formal method. Use of Dienes or place value counters for example alongside written methods. Link with place value and exchanging ten tens for a hundred. (Swap a block game.)</p> 	<p>add and subtract numbers mentally, including:</p> <ul style="list-style-type: none"> -a three-digit number and ones -a three-digit number and tens -a three-digit number and hundreds <p>add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction</p> <p>estimate the answer to a calculation and use inverse operations to check answers</p> <p>solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction.</p>

Palace Wood Primary Progression in Calculation document

	<p>addition/subtraction to ensure that children are able to fully understand and explain the value of the digits within the calculations</p> $ \begin{array}{r} 245 \\ + 352 \\ \hline 597 \end{array} $ $ \begin{array}{r} 300 \quad 60 \quad 3 \\ - 100 \quad 20 \quad 7 \\ \hline 200 \quad 30 \quad 6 \end{array} $		
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Year 4 Addition and subtraction

Term 1 and 2	Term 3 and 4	Term 5 and 6	End of year
<p>Rapid and fluent recall and use of facts up to and beyond 100.</p> <p>Strategies to work out facts which cannot be remembered such as;</p> <ul style="list-style-type: none"> -reordering numbers when adding, - keeping one number whole and partitioning the other number, counting forwards or backwards in ones, tens or hundreds perhaps with dienes or on an empty number line Eg 132 - 28  <p>eg $236 - 172 = 236 - 100 - 70 - 2$</p> <ul style="list-style-type: none"> -partitioning both numbers for addition only, -bridging through multiples of ten on an empty number line, -adding or subtracting a larger or small number and then adjusting Eg $367 - 198 = 367 - 200 + 2$ -- near doubles and halves eg 180 - 91 -subtract by finding the difference by counting up from the smaller number, especially when the numbers are close together or by taking away from the larger number on an empty number line <p>Estimate the answers to addition and subtraction problems, and use inverse operations to check solutions</p> <p>Solve addition and subtraction one step problems in contexts, deciding which operations and methods to use and why.</p>	<p>As before and</p> <p>Addition of numbers up to 4 digits using formal, column addition, drawing on place value knowledge that ten hundreds is one thousand, showing this with Dienes and place value counters.</p> 	<p>As before and</p> <p>Rapid and fluent recall of number facts involving tenths</p> <p>Subtraction of numbers with up to 4 digits using formal, column subtraction, drawing on place value knowledge that one thousand is ten hundreds, showing this with Dienes and place value counters.</p> <p>Solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why.</p> $ \begin{array}{r} 1073.00 \\ + 54.20 \\ \hline 7.09 \\ \hline 1134.29 \\ 11 \end{array} $	<p>add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate</p> <p>estimate and use inverse operations to check answers to a calculation</p> <p>solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why.</p>

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Year 5 Addition and subtraction

Term 1 and 2	Term 3 and 4	Term 5 and 6	End of year
<p>Rapid recall and fluent use of addition and subtraction facts, including those with decimal numbers and with numbers above 1000</p> <p>Use of mental strategies to work out facts which cannot be remembered such as: -reordering numbers when adding, Eg $1.2 + 0.43 + 0.8 = 2 + 0.43$ - keeping one number whole and partitioning one number, counting forwards or backwards in hundredths, tenths, ones, tens or hundreds perhaps with dienes or on an empty number line Eg $2358 - 1136 = 2358 - 1000 - 100 - 30 - 6$ -partitioning both numbers for addition only, Eg $3.4 + 5.2$ $3 + 5$ $0.4 + 0.2$ -bridging through multiples of ten on an empty number line, -adding or subtracting a larger or small number and then adjusting eg $4.3 + 2.99 = 4.3 + 3 - 0.01$ -- near doubles and halves, and known number facts eg using $68 + 43$ to calculate $680 + 430$, $6.8 + 4.3$, $0.68 + 0.43$ -subtract by finding the difference by counting up from the smaller number, especially when the numbers are close together or by taking away from the larger number on an empty number line</p> <p>Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.</p>	<p>As before and</p> <p>Add and subtract whole numbers with more than 4 digits including decimals, using formal written methods in columns, using drawing on place value knowledge and showing this with Dienes and place value counters.</p>	<p>As before and</p> <p>Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy</p> <p>Solve increasingly complex addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.</p>	<p>add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)</p> <p>add and subtract numbers mentally with increasingly large numbers</p> <p>use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy</p> <p>solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.</p>

Palace Wood Primary Progression in Calculation document

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Year 6 Addition and subtraction

Term 1 and 2	Term 3 and 4	Term 5 and 6	End of year
<p>Perform mental calculations, including with mixed operations and large numbers, and those with digits after the decimal point using rapid recall and fluent use of strategies such as:</p> <ul style="list-style-type: none"> -count on and back in steps of thousands, or hundreds, tens, tenths hundredths, thousandths etc -use knowledge of place value to calculate new facts from those already known -partition numbers -add or subtract larger or smaller numbers and adjust the answer -bridge though whole numbers or multiples of ten -count on and back in measures problems such as time, bridging though 60 -use inverse operations <p>Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why</p> <p>Use brackets in simple number sentences</p> <p>Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why</p> <p>Use estimation to check answers to calculations and</p>	<p>As before and</p> <p>Explore the use of brackets for eg $2 + 1 \times 3$ and $(2 + 1) \times 3$ and precedence rules such as BODMAS and state as a general rule</p> <p>Use of formal written methods for addition and subtraction with any size number</p> <p>Round answers to a given degree of accuracy eg to the nearest 10, 20 or 50 but not to a specified number of significant figures.</p>	<p>As before and</p> <p>Explore addition and subtraction within algebra eg think of a number problem Think of a number (no bigger than 20)</p> <p>Add 5</p> <p>Double the answer</p> <p>Subtract 4</p> <p>Halve the answer</p> <p>Take away the number you first thought of</p> <p>Why is your answer always 3?</p>	<p>perform mental calculations, including with mixed operations and large numbers</p> <p>use their knowledge of the order of operations to carry out calculations involving the four operations</p> <p>solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why</p> <p>solve problems involving addition, subtraction, multiplication and division</p> <p>use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.</p>

Palace Wood Primary Progression in Calculation document

determine, in the context of a problem, an appropriate degree of accuracy.			
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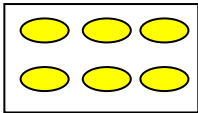
Year 1 Multiplication and Division

Term 1 and 2	Term 3 and 4	Term 5 and 6	End of year
<p>Explore multiplication as repeated addition using resources and real life contexts</p> <p>Talk about one to many relationships, eg one car, 4 wheels, one pair of gloves, two gloves etc</p> <p>Count in ones forwards and backwards</p> <p>Rhythmic counting in ones, eg shout and whisper alternate numbers</p> <p>Double amounts practically</p> <p>Explore division using resources and real life contexts as:</p> <ul style="list-style-type: none"> sharing with a focus on equal shares eg share 12 stickers between three children grouping or repeated subtraction with a focus on equal groups eg how many cars can you put wheels on if you start with 16 wheels? <p>Solving real problems, often in play and recording informally</p>	<p>As before and</p> <p>Explore multiplication as an array, showing items in rows or columns of 2, or 5 or 10.</p> <p>Half amounts practically</p> <p>Record halves and doubles informally</p> <p>Count in tens and twos</p>	<p>As before and</p> <p>Explore multiplication as scaling eg using cubes to make a tower and then make it twice as high</p> <p>Count in 2s, 5s and 10s, forwards and backwards. Recognise and use the patterns in the digits units in the multiples of 2, 5 and 10.</p> <p>Make connections between multiplication and division eg repeated addition and repeated subtraction or grouping</p> <p>Draw pictures to show equal sets.</p> <p>3 sets of 3 make 9 xxx xxx xxx</p> <p>2 sets of 4 make 8 xxxx xxxx</p> <p>Draw pictures to show sharing and grouping. Show inverse.</p> <p>9 shared between 3 xxx xxx xxx</p> <p>How many groups of 4 in 8? xxxx xxxx</p> <p>Solve one step problems involving multiplication and division</p> <p>Find simple fractions of objects, numbers and quantities and link to division eg $\frac{1}{2}$ or $\frac{1}{4}$</p> <p>Identify odd and even numbers to 20</p>	<p>Solve one-step problems involving multiplication and division, calculating the answer by using concrete objects, pictorial representations and arrays with the support of the teacher.</p>

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		<p>Make connections between arrays, patterns and counting in 2s, 5s and 10s.</p> <p>Rapid recall of doubles to 10 and corresponding halves</p>	
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Year 2 Multiplication and Division

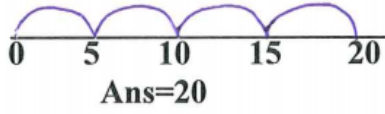
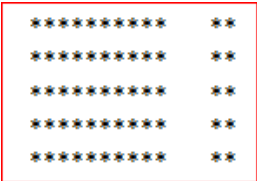
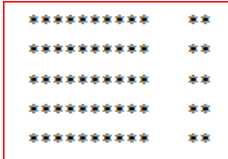
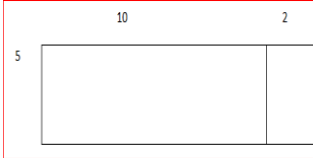
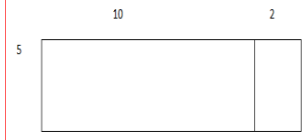
Term 1 and 2	Term 3 and 4	Term 5 and 6	End of year
<p>Explore 2x, 5x and 10x facts as repeated addition, and as an array, and as scaling, eg making a group or tower 2x, 5x or 10 larger</p> <p>Record multiplication and division facts for 2x, 5x and 10x using pictures and resources</p> <p>Solve problems eg find the total of numbers of objects when they are organised in groups of 2, 5 or 10, or divide objects into groups of 2, 5 or 10 or make groups of 2, 5 or 10 to solve division problems.</p> <p>Use a variety of language for multiplication eg groups of, twice as many, times, multiplied by, rows and columns</p> <p>Link multiplication and division facts for 2x, 5x and 10x</p> $7 \times 5 = 35$ $5 \times 7 = 35$ $35 \div 5 = 7$ $35 \div 7 = 5$ <p>Solve multiplication and division problems using resources and arrays practically or draw on squared paper.</p> <p>Use a variety of language for division, number of groups of, shared between</p> <p>3 lots of 2 2 lots of 3 'groups of' $3 \times 2 = 6$</p>  <p>Make connections between multiplication and division, showing this practically with resources, on a number line or with an array</p> <p>Explore the commutative law for 2x 5x and 10x eg $2 \times 5 = 5 \times 2$,</p>	<p>As before and</p> <p>Begin to recall and use 2x, 5x and 10x facts</p> <p>Begin to use symbols to record number facts</p> <p>Link 5x to the clock face</p> <p>Make connections between 10x and place value using Dienes</p> <p>Show that division is not commutative eg 10 divided by 2 is not the same as 2 divided by 10</p> <p>Identify odd and even numbers to 100</p> <p>Multiply and divide by 2, 5 and 10 with continuous quantities such as pieces of string, or water</p> <p>Link division to finding a fraction of an amount or quantity eg $3/4$</p> <p>Rapid recall and fluent use of doubles up to 20 and corresponding halves, rapid recall and fluent use of doubles of multiples of 10 to 50, and corresponding halves</p>	<p>As before and</p> <p>Rapid recall of and fluent use of 2x, 5x and 10x facts</p> <p>Record multiplication and division facts for 2x, 5x and 10x using symbols</p> $\square \times 2 = 20$ <p>Solve problems involving multiplication and division, using materials, arrays, repeated addition and subtraction, mental methods, and multiplication and division facts, including problems in contexts.</p> <p>Begin to explore multiplication by other numbers such as 3, 4 and 8 as repeated addition, as an array and as scaling, and division by other numbers such as 3, 4 and 8 as sharing and grouping.</p> <p>Find doubles of numbers up to 100 and corresponding halves by partitioning and doubling tens and units and recombining</p>	<p>recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers</p> <p>calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (\times), division (\div) and equals ($=$) signs</p> <p>show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot</p> <p>solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts.</p>

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showing this with repeated addition, on a number line and as an array			
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Year 3 Multiplication and Division

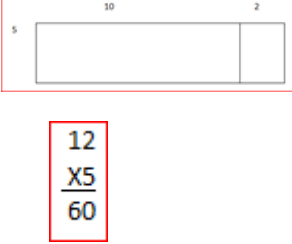

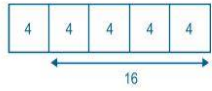

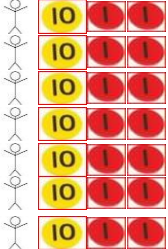




Term 1 and 2	Term 3 and 4	Term 5 and 6	End of year
<p>Explore 3x table as repeated addition, arrays and scaling, eg making a tower 3 times as tall or an amount 3 times as many e.g. $3 \times 3 =$ XXX XXX XXX</p> <p>Multiply whole numbers by 0, 1, 10, 100</p> <p>Look for patterns in the multiples of 3, make links between 2×3, 4×3, 8×3</p> <p>Practice recall of 3x table</p> <p>Make links between multiplying and dividing by 3, showing this practically or with an array or on a number line e.g. 5×4</p>  <p>Then demonstrate 20 divided by 5 is 4 (how many jumps there are).</p> <p>Explore multiplying TU numbers by 2, 5, and 10. Show this as an array and talk about the distributive law eg show with the array that 12×5 is the same as 10×5 add 2×5</p>  <p>Solve correspondence problems such as how many different meals can you order from a choice of 3 starters, three main courses and three desserts? Billy the clown wears a nose and bowtie for his show. He has a red nose and a blue nose, and a spotted bowtie and a striped bow tie. How many different outfits can he appear in? How many outfits if he buys a new nose and bow tie?</p> <p>Divide numbers by 2, 5, 10 or 3 using a sharing or a grouping strategy, recording with number sentences, discuss dividing by 1 and by the number itself.</p>	<p>As before and</p> <p>Explore 4x table as repeated addition, arrays and scaling, eg making a tower 4 times as tall or an amount 4 times as many</p> <p>Look for patterns in the 4x table, make links between 2×4, 4×4, 8×4 etc Make connections between multiplying by 2 and 4 by doubling</p> <p>Practice recall of 4 x table</p> <p>Make links between multiplying and dividing by 4 showing this practically or with an array or on a number line</p> <p>Rapid recall and fluent use of 4s table</p> <p>Explore multiplying TU numbers by 2, 5, 10, 3 and 4. Show this as an array and talk about the distributive law eg show with the array that 12×3 is the same as 10×3 add 2×3.</p> <p>Use jottings to show stages of calculation e.g. (TU x U) $32 \times 3 = (30 \times 3) + (2 \times 3)$ $= 90 + 6$ $= 96$</p> <p>Begin to talk about how the array can be shown as a grid, so that the items within the array are not shown individually, with the array and grid shown side by side.</p>  	<p>As before and</p> <p>Explore 8x table as repeated addition, arrays and scaling, eg making a tower 8 times as tall or an amount 8 times as many</p> <p>Look for patterns in the 8x table, make links between 2×8, 4×8, 8×8 etc Make connections between multiplying by 2, 4 and 8 by doubling</p> <p>Practice recall of 8x table</p> <p>Make links between multiplying and dividing by 8, showing this practically or with an array or on a number line.</p> <p>Rapid recall and fluent use of 3, 4x and 8x table, stating and using division facts for each multiplication fact</p> <p>Explore multiplying TU numbers by 2, 5, 10, 3, 4 and 8. Show this as an array and talk about the distributive law eg show with the array that 12×8 is the same as 10×8 add 2×8. Show this with the array, grid method and in a formal method, but with annotations</p>  <p>Divide numbers by 2, 5, 10, 3, 4 and 8 using a sharing strategy or a grouping strategy, recording with number sentences or formally using $\sqrt{\quad}$ for small numbers.</p> <p>Solve problems, including missing number problems, measures and scaling, deciding which operation to</p>	<p>recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables</p> <p>write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods</p> <p>solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects.</p>

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<p>Explore associative law eg $2 \times 12 \times 4 = 8 \times 12$</p>	<p>Divide numbers by 2,5,10, 3 and 4 using a sharing strategy or a grouping strategy, recording with number sentences, and link with multiplication</p> <p>Use place value to link facts eg $4 \times 3 = 12, 40 \times 3 = 120, 4 \times 30 = 120, 120 \div 4 = 30$ etc</p>	<p>use. Talk about remainders in contexts</p>	
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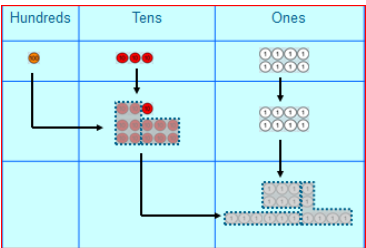
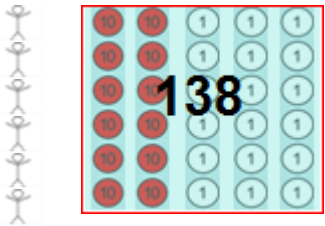
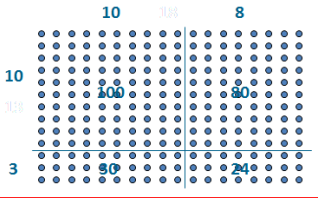
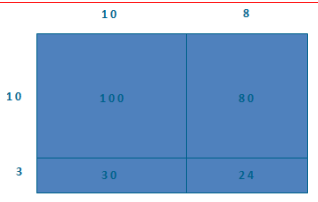
Year 4 Multiplication and Division

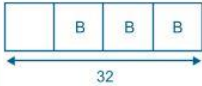
Term 1 and 2	Term 3 and 4	Term 5 and 6	End of year								
<p>Explore 6x and 9x table in terms of repeated addition, arrays and scaling, eg making a tower 6 times as tall or an amount 6 times as many</p> <p>Look for patterns in the multiples of 6 and 9, make links with 3x</p> <p>Practice recall of 6 and 9x table</p> <p>Make links between multiplying and dividing by 6 and 9, showing this practically or with an array or on a number line</p> <p>Multiply whole numbers by 0, 1, 10, 100, 1000, divide by 1, 10,, 100, 1000 etc</p> <p>Use place value knowledge to derive new facts eg $6 \times 9 = 54$ so $60 \times 9 = 540, 540 \div 60 = 9$ etc</p> <p>Solve problems involving multiplying and dividing, including missing number problems</p> <p>Multiply TU by U, revising the use of the array, grid and formal method eg 12×5</p> <div data-bbox="188 1720 451 1906" style="border: 1px solid red; padding: 5px;"> <p>***** **</p> <p>***** **</p> <p>***** **</p> <p>***** **</p> <p>***** **</p> </div>	<p>As before and</p> <p>Explore 7, 11 and 12 table in terms of repeated addition, arrays and scaling. Look for patterns in the multiples and make links between tables</p> <p>Practice recall of 7, 11 and 12 table</p> <p>Make links between multiplying and dividing by 7, 11 and 12, showing this practically or with an array or on a number line</p> <p>Multiply three numbers together, using associative law and commutative eg $4 \times 8 \times 5 = 20 \times 8$</p> <p>Multiply HTU by U using the grid method and then as formal long multiplication</p> <p>Eg 123×5</p> <div data-bbox="539 1518 775 1581" style="border: 1px solid red; padding: 5px;"> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;"></td> <td style="width: 33%; text-align: center;">100</td> <td style="width: 33%; text-align: center;">20</td> <td style="width: 33%; text-align: center;">5</td> </tr> <tr> <td style="border: 1px solid black; height: 20px;"></td> <td style="border: 1px solid black; height: 20px;"></td> <td style="border: 1px solid black; height: 20px;"></td> <td style="border: 1px solid black; height: 20px;"></td> </tr> </table> </div> <p>123 $\underline{\quad} \times 5$ $\underline{615}$ 11</p> <p>Some children may choose to use the expanded method of multiplication to understand before moving onto short method e.g.</p>		100	20	5					<p>As before and</p> <p>Fluent and rapid recall of all table facts to 12×12 and related division facts</p> <p>Explore square numbers pictorially</p> <p>Identify factor pairs for numbers and use to solve multiplication eg $16 \times 7 = 4 \times 4 \times 7$</p> <p>Multiply two-digit and three-digit numbers by a one-digit number using formal written layout, referring to the grid to show conceptual understanding</p> <p>Begin short division of TU by U which cannot be solved using table facts alone, with numbers such as $3 \sqrt{96}$ with no exchange and then with exchange, using the fact that one ten can be exchanged for ten units and showing this with dienes and / or place value counters eg $7 \sqrt{84}$ Model as sharing and grouping eg 84 shared between 7 people and how many groups of 7 can you make from 84 (repeated subtraction)</p> <p>Sharing</p> <div data-bbox="836 1760 927 2007"> </div>	<p>recall multiplication and division facts for multiplication tables up to 12×12</p> <p>use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers</p> <p>recognise and use factor pairs and commutativity in mental calculations</p> <p>multiply two-digit and three-digit numbers by a one-digit number using formal written layout</p> <p>solve problems involving multiplying and adding, including using the distributive law to multiply two-digit</p>
	100	20	5								

 <p>Solve division problems including in grouping and sharing contexts, eg share 42 stickers between 6 children, or</p> <p>1. Peter has four books. Harry has five times as many books does Harry have?</p> <p>Peter's books </p> <p>Harry's books </p> <p>Harry has 16 more books.</p> <p>how many teams of 6 can you make from 42 children? Use table facts eg $24 \div 8$ or derived facts from known table facts $600 \div 3$, and record with $\sqrt{\quad}$ Talk about remainders in contexts</p>	$\begin{array}{r} 325 \\ \times 7 \\ \hline 2100 \\ 2275 \end{array}$ <p>Solve correspondence problems for example How many different ice creams can you make if you choose one scoop of either chocolate or strawberry ice cream with a plain or chocolate cone? Add in other flavours of ice cream, different types of cone, and then chocolate or toffee sauce on top</p> <p>Solve integer scaling problems such as making an amount 7, 11 or 12 times larger, or calculating how much tickets for a family of 5 would cost if tickets were £7, including problems to do with relationships and ratio eg talking about patterns of beads or shapes, or putting three toys and 7 sweets into each party bag, how many party bags could we fill with how 42 sweets? How many toys needed if we use 35 sweets?</p> <p>Use the bar method to solve multiplication problems.</p>	 <p>$7 \times 8 = 4$</p>  <p>$\begin{array}{r} 12 \\ 7 \overline{) 84} \end{array}$</p> <p>Grouping or repeated subtraction</p>  <p>1 group of 7 tens</p>    <p>1 group of 7 tens 2 groups of 7 units</p> <p>$\begin{array}{r} 12 \\ 7 \overline{) 84} \end{array}$</p> <p>Use multiplication and division to solve two step problems in contexts, choosing which operation to use</p>	<p>numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects.</p>
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Year 5 Multiplication and Division

Term 1 and 2	Term 3 and 4	Term 5 and 6	End of year
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<p>Fluent and rapid recall of number facts to 12 x 12 and related division facts, and use these to derive other facts eg using place value $6 \times 7 = 42$, $0.6 \times 7 = 4.2$</p> <p>Use tables to identify all factor pairs of any number. Use and understand the term multiple.</p> <p>Consolidation of multiplying and dividing whole and decimal numbers by 10, 100 and 1000, especially when converting between metric units of measurement eg m and km, g and kg.</p> <p>Recap the use of the array, grid method, expanded short multiplication and formal multiplication of HTU by U numbers as in Year 4. Use the distributive law eg calculate 123×6 with 100×6, 20×6 and 3×6 and combining. Extend to ThHTU by U</p> <p>Divide numbers up to HTU by one digit using the formal method of short division as set out in Year 4. Model exchange of one hundred with ten tens and one ten with ten units, with Dienes or place value counters. Explore as sharing and grouping (repeated subtraction) eg 138 divided by 6 as making groups of 6</p>  <div style="border: 1px solid red; padding: 5px; width: fit-content; margin: 10px auto;"> $\begin{array}{r} 23 \\ 6 \overline{) 138} \end{array}$ </div> <p>138 divided by 6 as sharing between 6 people</p>  <div style="border: 1px solid red; padding: 5px; width: fit-content; margin: 10px auto;"> $\begin{array}{r} 23 \\ 6 \overline{) 138} \end{array}$ </div>	<p>As before and</p> <p>Find the common factors of pairs of numbers.</p> <p>Define prime numbers as those with exactly two factors and find numbers which are prime and composite (not prime) up to 100</p> <p>Multiply TU by TU using the array, grid and then expanded long multiplication and then formal long multiplication</p>   <p>18 13 54 180 234</p> <p>Use short division to divide ThHTU by one digit numbers as in terms 1 and 2, showing that one thousand can be exchanged for ten hundreds with dienes or place value counters for conceptual understanding</p> <p>Use multiplication and division as inverses to solve problems and check solutions</p>	<p>As before and</p> <p>Multiply and divide numbers mentally drawing on known facts</p> <p>Recall prime numbers up to 19 Identify the prime factors of numbers, use and understand this language</p> <p>Explore properties of square numbers</p> <p>Multiply HTU by TU and ThHTU by TU using the grid and then expanded long multiplication and then formal multiplication</p> <p>Consolidate use of short division for dividing numbers up to 4 digits by a one digit number. Interpret remainders in context eg talk about rounding an answer up or down based on the problem, decide and justify why they have shown as remainder, a fraction or a decimal based on the problem they are solving.</p> <p>Multiply and divide whole numbers and those involving decimals by 10, 100 and 1000</p> <p>Recognise and use cube numbers, and the notation cubed (3)</p> <p>Use the notation for squared and cubed numbers to write number sentences in different ways eg $3 \times 270 = 3 \times 3 \times 9 \times 10 = 9^2 \times 10$</p> <p>Solve problems involving addition, subtraction, multiplication and division and a</p>	<p>identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers</p> <p>know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers</p> <p>establish whether a number up to 100 is prime and recall prime numbers up to 19</p> <p>multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers</p> <p>multiply and divide numbers mentally drawing upon known facts</p> <p>divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context</p> <p>multiply and divide whole numbers and those involving decimals by 10, 100 and 1000</p> <p>recognise and use square numbers and cube numbers, and the notation for squared (2) and</p>
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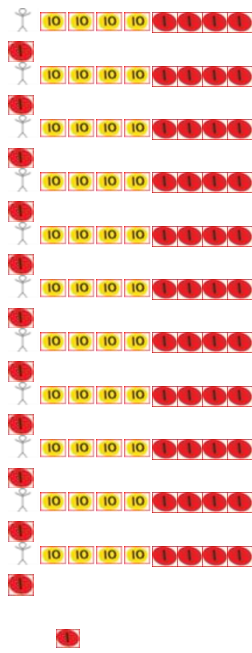
<p>Recognise and use square numbers, and the notation for squared (2). Explore investigations with squared numbers such as how many squares on a chess board and the reindeer investigation (100 elves put 100 reindeers away for the night. Elf 1 turns the lock to the stables of reindeer 1,2,3,4 etc. Elf 2 turns the lock to the stables of reindeers 2,4,6,8... Elf 3 turns the lock to the stanbles of reindeers 3,6,9 etc. and so on. Which reindeer are locked up and which are not?)</p>		<p>combination of these, including understanding the meaning of the equals sign and deciding which operation to use</p> <p>Solve problems involving multiplication and division, including scaling by simple fractions and problems involving simple rates, eg making something $\frac{3}{7}$ as long, or find $\frac{4}{5}$ of an amount. Explore 3 for 2 offers. Calculate rates such as the total for a family of 4 to go to a zoo knowing the price for adult and child tickets. Interpret scale drawings for example multiplying or dividing by 10, 100, 1000 etc</p> <p>Use the bar method to solve ratio problems</p>	<p>cubed (3)</p> <p>solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign</p> <p>solve problems involving multiplication and division, including scaling by simple fractions and problems involving simple rates.</p>
		<p>2. There are 32 children in a class. There are 3 times as many boys as girls. How many girls?</p>  <p>Each square is 8, so there are 8 girls and 24 boys.</p>	

Palace Wood Primary Progression in Calculation document

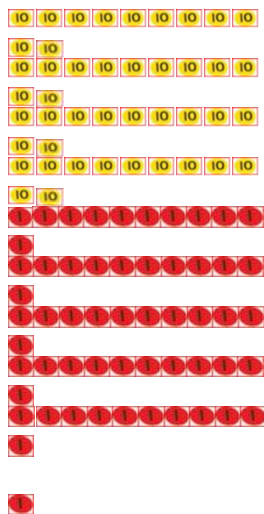
Year 6 Multiplication and Division

Term 1 and 2	Term 3 and 4	Term 5 and 6	End of year																
<p>Fluent and rapid recall of number facts and use of mental calculations including solving problems with more than one operation and using large numbers</p> <p>Recap long multiplication of numbers up to 4 digits by a one digit number, including with decimal numbers, using the grid method to secure conceptual understanding, and then moving to formal long multiplication Eg 2.37×3</p> <table style="margin-left: 40px;"> <tr> <td></td> <td style="text-align: right;">2</td> <td style="text-align: right;">0.3</td> <td style="text-align: right;">0.07</td> </tr> <tr> <td style="text-align: right;">3</td> <td style="text-align: right; background-color: yellow;">6</td> <td style="text-align: right; background-color: yellow;">0.9</td> <td style="text-align: right; background-color: yellow;">0.21</td> </tr> </table> <p style="margin-left: 40px;"> $\begin{array}{r} 2.37 \\ \times 3 \\ \hline 7.11 \\ 12 \end{array}$ </p> <p>Consolidate short division method, dividing numbers up to 4 digits by a two digit number, modelling this as sharing and grouping with place value counters and dienes, exchanging one thousand for ten hundreds, one hundred for ten tens and one ten for ten units. Eg</p> <div style="border: 1px solid red; padding: 5px; margin: 10px 0;"> <table style="margin-left: 40px;"> <tr> <td></td> <td style="text-align: right;">4</td> <td style="text-align: right;">5</td> <td style="text-align: right;">r1</td> </tr> <tr> <td style="text-align: right;">11</td> <td style="text-align: right;">4</td> <td style="text-align: right;">9</td> <td style="text-align: right;">6</td> </tr> </table> </div> <p>Sharing Eg sharing 496 between 11 people. 4 hundreds cannot be shared between 11 people so exchange 4 hundreds for 40 tens, making 49 tens in total. Each person has 4 tens. Exchange the remaining 5 tens into 50 units making 56 in total. Share these between the 11 people, giving 5 to each, leaving</p>		2	0.3	0.07	3	6	0.9	0.21		4	5	r1	11	4	9	6	<p>As before and</p> <p>Recap long multiplication of numbers up to 4 digits by a two digit number, including with decimal numbers, using the grid method to secure conceptual understanding, and then moving to formal long multiplication, as set out in terms 1 and 2.</p> <p>Divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, as sharing and grouping For example:</p> $15 \overline{)1815}$ <div style="margin: 10px 0;"> </div> <p>Sharing between 15 people: We can't share one thousand between 15 people, so exchange it for 10 hundreds making 18 hundreds in total. Share one hundred to each of 15 people, subtract these from 1815. Three hundred and 15 remain. Exchange the three hundreds for 30 tens making 31 tens altogether. Share 2 tens to each of 15 people, subtract these from 315. 15 remain Exchange the one ten for ten units, making 15 in total Share one unit to each of 15 people, subtract these from 15. None remain.</p> <p>Making groups of 15: We can't form a group of 15 from one thousand, so exchange it for 10 hundreds making 18 hundreds in total. Make one group of 15 hundreds, subtract this from 1815. Three hundred and 15 remain. Exchange the three hundreds for 30 tens making 31 tens altogether. Make 2 groups of 15 tens, subtract these from 315. 15 remain Exchange the one ten for ten units, making 15 in total Share one unit to each of 15 people, subtract these from 15. None remain.</p> <p>Interpret answers to long division in the context of the problem, eg as whole number remainders, or as fractions or by rounding up or down, justifying their decision according to the problem they are solving.</p>	<p>As before and</p> <p>Understand the use of brackets. Explore the effect of changing the order of calculations eg $2 + (1 \times 3) = 5$ and $(2 + 1) \times 3 = 9$ Use their knowledge of the order of operations to carry out calculations involving the four operations</p> <p>Solve problems involving addition, subtraction, multiplication and division, using estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.</p> <p>Identify and explore common factors, common multiples and prime numbers eg which numbers have odd totals of factors? Link common factors to finding</p>	<p>multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication</p> <p>divide numbers up to 4 digits by a two-digit whole number using the formal method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context</p> <p>divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context</p> <p>perform mental calculations, including with mixed operations and large numbers</p>
	2	0.3	0.07																
3	6	0.9	0.21																
	4	5	r1																
11	4	9	6																

one remainder.
Model as follows:



Grouping or repeated subtraction (or addition) of multiples of the divisor
Eg 4 hundreds into 40 tens making 49 tens in total. Make 4 groups of 11 tens.
Exchange the remaining 5 tens into 50 units making 56 in total. Make in to 5 groups of 11 units, with a remainder of one.
Model as follows:



Interpret answers to short

Talk about when to use short and long division

432 ÷ 15 becomes

$$\begin{array}{r}
 28 \text{ r}12 \\
 15 \overline{)432} \\
 \underline{300} \\
 132 \\
 \underline{120} \\
 12
 \end{array}$$

Answer: 28 remainder 12

432 ÷ 15 becomes

$$\begin{array}{r}
 28 \\
 15 \overline{)432} \\
 \underline{300} \\
 132 \\
 \underline{120} \\
 12
 \end{array}$$

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

Answer: 28 $\frac{4}{5}$

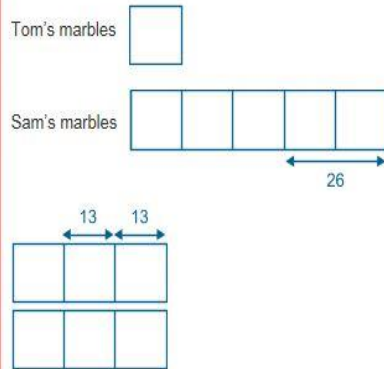
432 ÷ 15 becomes

$$\begin{array}{r}
 28.8 \\
 15 \overline{)432.0} \\
 \underline{300} \\
 132 \\
 \underline{120} \\
 120 \\
 \underline{120} \\
 0
 \end{array}$$

Answer: 28.8

Use the bar method to solve multi-step problems.

3. Sam had 5 times as many marbles as Tom. If Sam gives 26 marbles to Tom, the two friends will have exactly the same amount. How many marbles do they have altogether?



Each part is 13, so 78 marbles altogether

equivalent fractions

Round answers to problems to a specified degree of accuracy eg to the nearest 10, 20 or 50 etc but not to a specified number of significant figures

identify common factors, common multiples and prime numbers
use their knowledge of the order of operations to carry out calculations involving the four operations

solve problems involving addition, subtraction, multiplication and division

use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.

Palace Wood Primary Progression in Calculation document

division in the context of the problem, eg as whole number remainders, or as fractions or by rounding up or down, justifying their decision according to the problem they are solving.			
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