**CALCULATION POLICY**
**GBS 2023**

## Our Intent

*We want children to be secure in their knowledge and understanding of maths and fluent in their application of it, so that they can find enjoyment in solving mathematical problems with growing confidence and have the necessary skills to move on successfully to the next stage of their education.*

This policy outlines the resources, representations and methods that will be used throughout a child's time at Giles Brook School to help them achieve fluency in maths. What is included is not an exhaustive list but instead identifies the most important approaches that we will use. For each operation, the related progression statements are listed, alongside notes about the use of resources and examples of them. As a school we use White Rose Maths planning and resources, so this policy aligns with that so there is clear progression and consistency throughout the school.

In addition to the use of White Rose Maths, we also use a mastery approach to teaching mathematics. Teachers will adapt resources to best suit the need of the children in their class based on this approach. We use concrete, pictorial and abstract (C.P.A) to help children gain a greater depth of understanding within each concept. By viewing the maths that is happening in a variety of ways, children will be able to develop multiple connections within a concept, allowing them to achieve automaticity which is a vital component in mastery. This is further supported by the use of Mastery questions (What do you notice? What is the same/different?) and Mastery challenges (Create it, Draw it, Explain it) which are used increasingly as children progress through the school and are displayed in every classroom.

## Key Vocabulary for the Four Operations

Using key vocabulary can support children in their understanding and explanations of mathematical concepts. By the end of KS1 children should be familiar with the following vocabulary for addition and subtraction. By the end of Year 4, children should be familiar with the vocabulary for multiplication and division.

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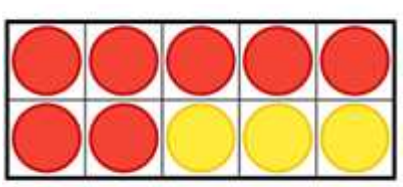
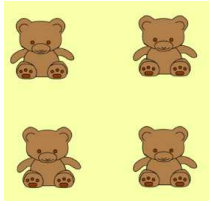
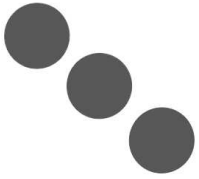
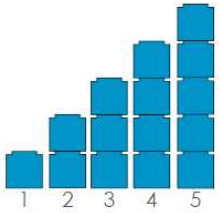
| **Addend** | The numbers which we add together. | **Factor** | A number that multiplies by another to make a product. |
| **Sum** | The result of an addition. | **Product** | The outcome of a multiplication. |
| **Minuend** | The number from which another number is being subtracted. | **Dividend** | The number that is divided. |
| **Subtrahend** | The number being subtracted from the minuend. | **Divisor** | The number you are dividing by. |
| **Difference** | The answer of a subtraction question. | **Quotient** | The answer to a division. |
| **Partition** | When you split a number into its constituent parts. | | |

**Nursery and Reception**

Children in Nursery and Reception work towards our 'Curricular Goals and Milestones', aiming to be 'Magic at Maths' in Nursery or a 'Master of Maths' in Reception. Adults use White Rose Maths, NCETM Mastering Number and EY Maths to create plans that are ambitious and tailored to our pupils. In this policy we highlight some of the main resources and representations that children in Nursery and Reception will use to achieve their goals related to number and the four operations.

| Year Group | End of Year Goals | Resources |
|---|---|---|
| **Nursery** | -Using number names to 10 and sometimes counting accurately;<br>-Representing numbers using marks, fingers or digits;<br>-Saying when two small groups have the same number of objects;<br>-Identifying numerals in the environment. |     |
| **Reception** | -Count to and across 100, forward and backward, beginning with 0 or 1, or from any given number;<br>-Count in multiples of 2s, 5s and 10s;<br>-Read and write numbers to 100 in numerals;<br>-Given a number, identify 1 more or 1 less;<br>-Read and write numbers from 1 to 20 in numerals and words;<br>-Read, write and interpret mathematical statements involving + - = signs;<br>-Represent and use number bonds and related subtractions facts within 20;<br>-Add and subtract 1-digit and 2-digit numbers to 20, |      |

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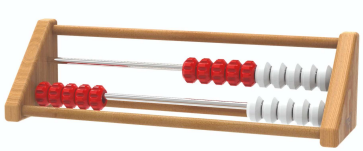
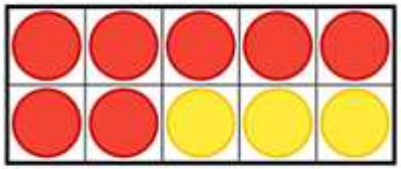
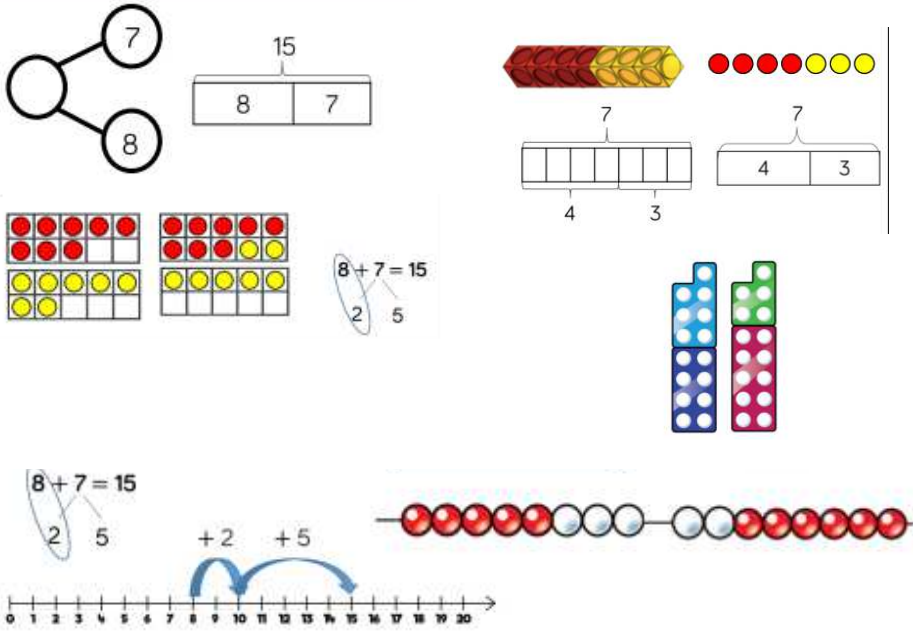
| | including zero. |   |

## Addition

| Year Group | Information | Methods |
|---|---|---|
| 1 | Progression Statement<br>-adding 1 digit numbers within 10.<br>-adding 1 and 2 digits to 20.<br><br>Use of Methods<br>These models support children in understanding partitioning, counting on and back, learning and applying number bonds to and within 10 and 20. Concrete resources and pictorial representations should be used alongside abstract methods such as part-whole and number lines.<br><br>EOY Expectations<br>By the end of the year, children should be able to answer a range of addition and subtraction questions that use these representations as well as abstract (digits and symbols) representation.<br><br>They should also be able to solve missing number problems such as 9 = _ + 5 when using resources, counting out the total amount, finding the known number and then counting what is left. It is important to verbalise processes like this in a STEM sentence. |   |

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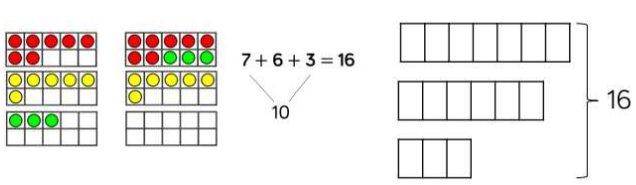
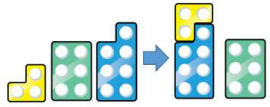
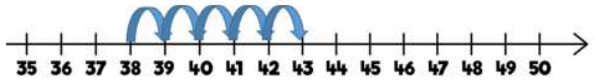
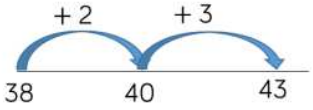
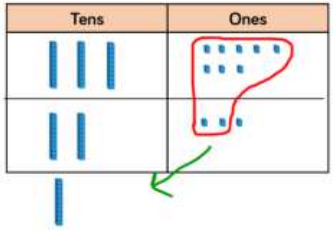
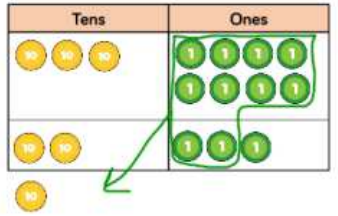
| **2** | <u>Progression Statements</u><br>-recall and use addition facts to 20 fluently, and derive and use related facts up to 100<br>-add 2 digit number and ones<br>-add 2 digit number and tens<br>-add two 2 digit numbers<br>-add 3 1 digit numbers<br>-add numbers within 100<br>-add across 10<br><br><u>Use of Methods</u><br>These methods continue to help children build their knowledge about the composition of numbers. Number bonds to and within 10 and 20 should continually be highlighted to help make mental and written calculations more efficient.<br><br>The number line can be developed into a blank number line so children can create their own. This also helps them to make 'jumps' in larger amounts or to the nearest ten first for efficiency.<br><br>When exploring the use of a formal written method, ensure exchanges are clearly shown by selecting the 10 that will then move into the next column. Explicitly link this to the exchanged number in the formal method which is clearly shown beneath the answer line in the tens column.<br><br><u>EOY Expectations</u><br>By the end of Year 2 children will be more familiar with abstract addition questions and more confident using abstract methods, such as number lines, blank number lines and place value grids. They should become familiar with the idea of commutativity in addition.<br><br>Children will also begin to see and use a formal written method for |  <br>  <br>  <br>7 + 6 + 3 = 16<br>  <br>  <br>38<br>+ 23<br>61<br>1<br>  |

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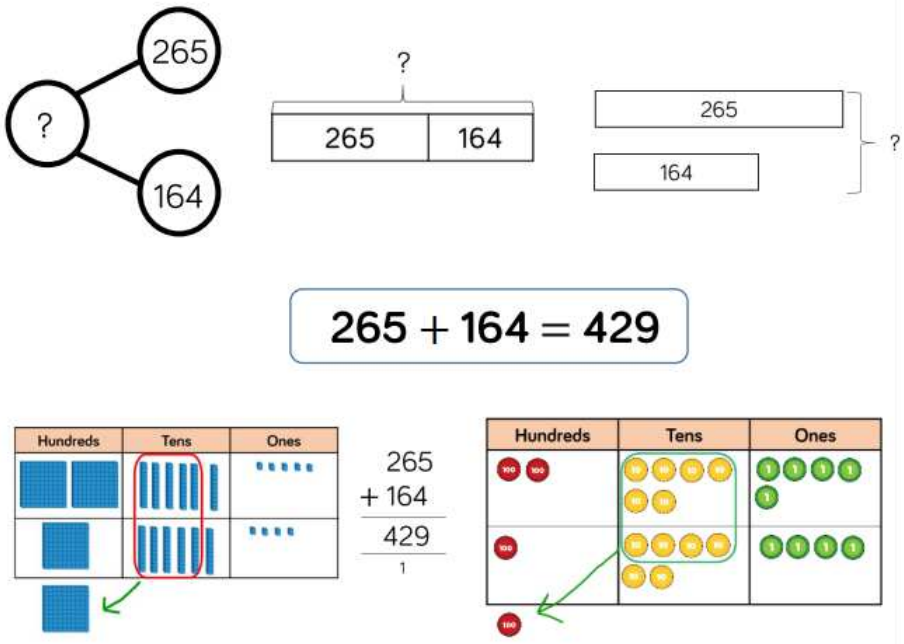
| | addition alongside the concrete and pictorial representations of the method. | |
| **3** | <u>Progression Statements</u><br>-add a 3 digit number and ones<br>-add a 3 digit number and tens<br>-add a 3 digit number and hundreds<br>-add and subtract up to 3 digit numbers using a formal method<br>-understand commutativity between addition and subtraction and how they can relate to a part-part-whole method.<br><br><u>Use of Methods</u><br>As the numbers increase in size, place value counters and base 10 cubes become the most efficient resources to use. Children should use concrete resources or pictorial representations alongside abstract, formal methods. Number bonds to and within 10 and 20, and related bonds to 100, 1000, etc should still be identified to improve efficiency of calculations.<br><br><u>EOY Expectations</u><br>By the end of the year, all children should be confident in using a formal written method for addition when adding two 3 digit numbers summing up to 1000. |  |

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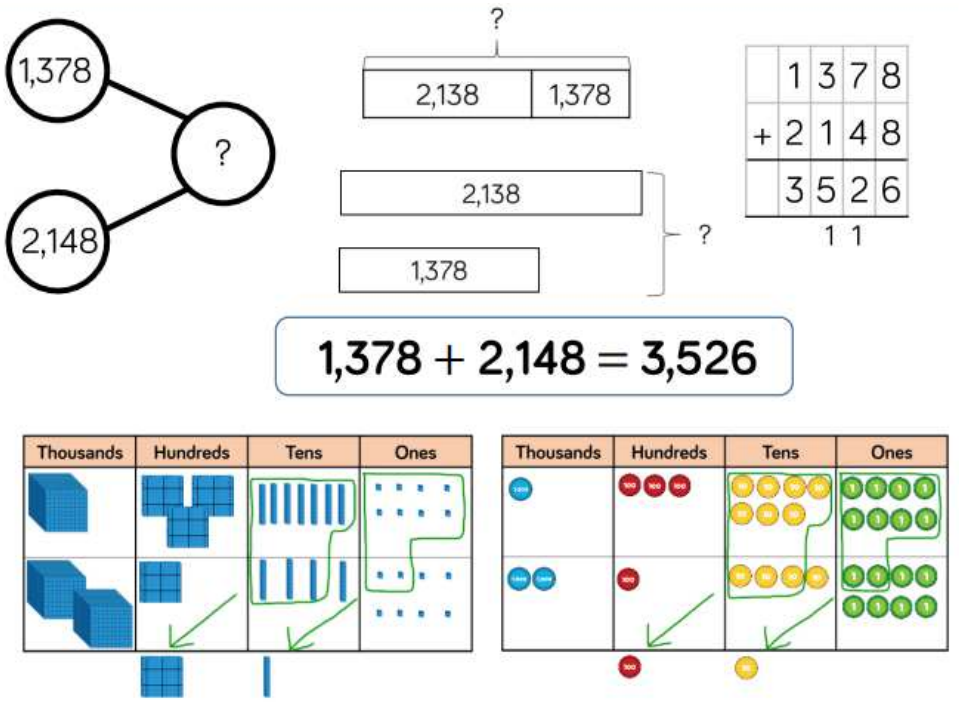
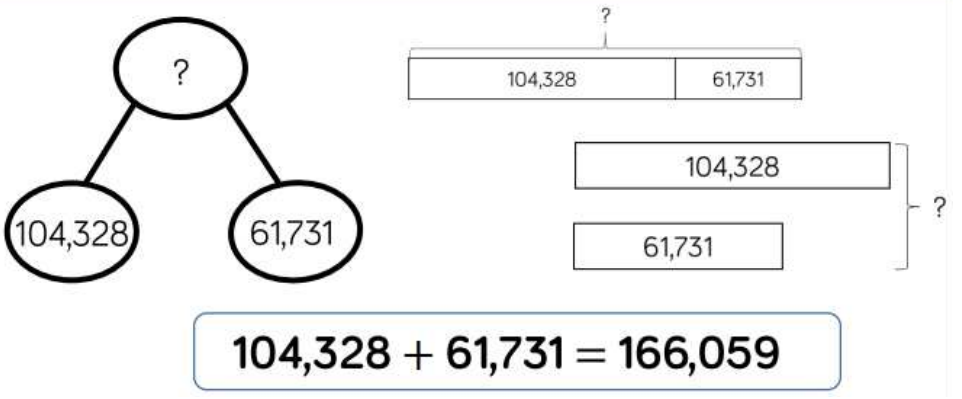
| **4** | <u>Progression Statements</u><br>-add numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate<br><br><u>Use of Methods</u><br>Methods used in Year 3 continue to be used in Year 4 but with larger numbers. It is important to still show concrete or pictorial representations of formal methods when modelling, and children must have access to resources if they require. Number bonds to and within 10 and 20, and related bonds to 100, 1000, etc should still be identified to improve efficiency of calculations.<br><br><u>EOY Expectations</u><br>Children in Year 4 should be using a formal written method for addition and should be able to explain how the method works using concrete resources or pictorial representations. They should also be able to solve two-step problems in context, choosing the correct operation to use at each stage. |  |
| **5** | <u>Progression Statements</u><br>-add whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)<br>-solve problems involving numbers up to three decimal places<br><br><u>Use of Methods</u><br>There is more emphasis now on abstract representation of number and addition, however concrete resources and pictorial representations should still remain available to all children.<br><br>When adding decimals numbers using a formal method, it is vital that children understand that the decimal point does not move. They should also be taught to include a decimal point in the answer row when laying |  |

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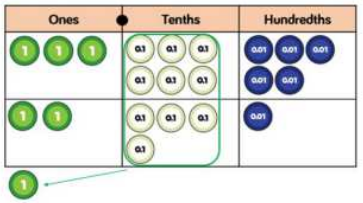
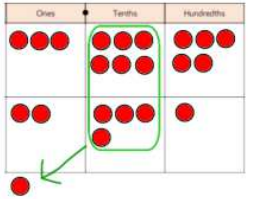
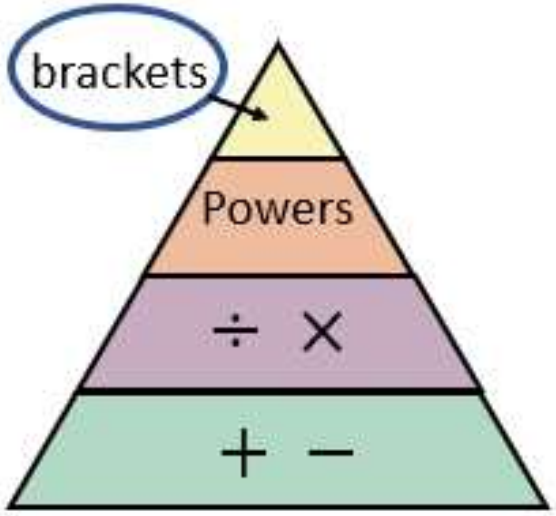
| | out the question to avoid mistakes.<br><br>EOY Expectations<br>Children in Year 5 should use a formal written method as their primary way of solving larger addition questions. They should be efficient and effective in their use of mental strategies based upon number bonds and representations, such as part-whole. |  <br>  <br>3.65<br>+ 2.41<br>6.06<br>1 |
| **6** | Progression Statements<br>-use their knowledge of the order of operations to carry out calculations involving the four operations<br>*Children in Year 6 should continue to use the methods used in Year 5, including concrete resources and pictorial representations.<br><br>Use of Methods<br>If children have been taught acronyms for the order of operations, such as BIDMAS, BODMAS, PEMDAS etc, then there should be a conversation with those children about why this may be misleading.<br><br>The triangle is more helpful in understanding the order of operations as it allows for the interchanging of multiply and divide, or addition and subtraction, depending on their placement in the equation.<br><br>EOY Expectations<br>Children in Year 6 should be able to use the order of operations in questions that involve multiple operations. They should also be able to identify why a solved equation might be incorrect or where brackets may need to be added to make an equation correct. |  |

# Subtraction

| Year Group | Information | Methods |
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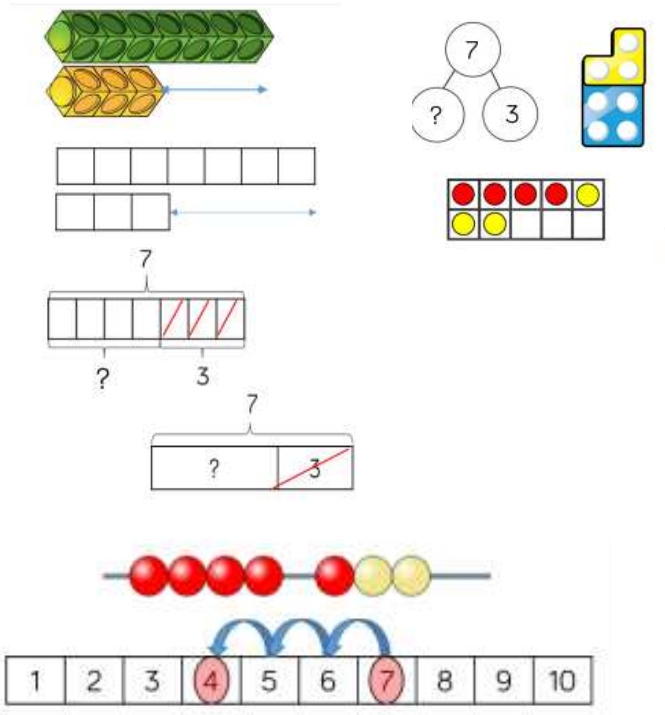
| **1** | Progression Statement<br>-Subtract one-digit numbers within 10<br>-Subtract one-digit and two-digit numbers to 20<br><br>Use of Methods<br>These methods support children in 3 areas of subtraction:<br>-partitioning a number<br>-the reduction of a number<br>-finding the difference<br><br>EOY Expectations<br>By the end of the year, children should be able to answer a range of addition and subtraction questions that use these representations as well as abstract (digits and symbols) representation.<br><br>They should also be able to solve missing number problems such as 9 = _ + 5 when using resources, counting out the total amount, finding the known number and then counting what is left. It is important to verbalise processes like this in a STEM sentence. |  |

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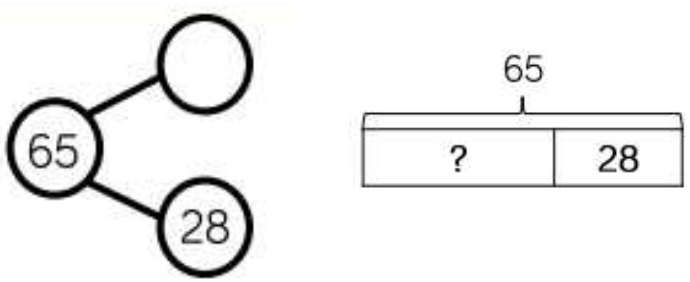
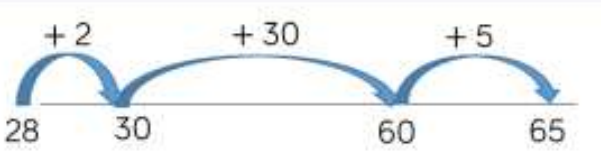
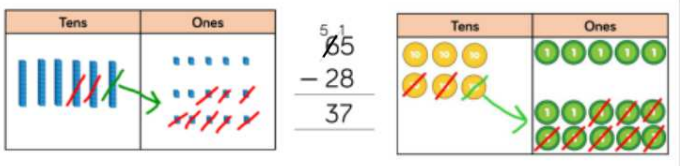
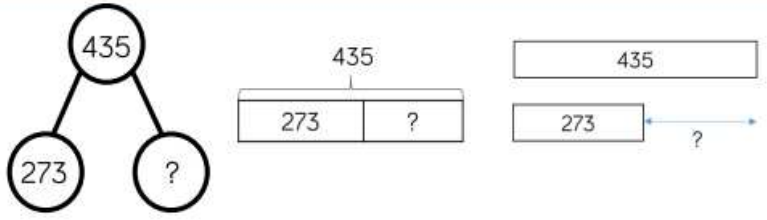
| **2** | <u>Progression Statement</u><br>-recall and use subtraction facts to 20 fluently, and derive and use related facts up to 100<br>-Subtract 2 digit number and ones<br>-Subtract 2 digit number and tens<br>-Subtract two 2 digit numbers<br>-Subtract numbers within 100<br>-Subtract across 10<br><br><u>Use of Methods</u><br>Children should become more confident using a blank number line to find the difference, as well as make jumps related to number bonds and multiples of 10. It is also important that children see use of a formal written method alongside other concrete and visual methods. Ensure that exchanges are clearly written above the numbers so that their new value is clear. There should also be a diagonal line through the exchanged number which shows it is no longer that value.<br><br><u>EOY Expectations</u><br>By the end of Year 2 children will be more familiar with abstract addition questions and more confident using abstract methods, such as number lines, blank number lines and place value grids.They should be able to identify that, unlike addition which is commutative, subtraction is not and changing the order will result in a different answer. |  <br>  <br>  |
| **3** | <u>Progression Statement</u><br>-subtract a 3 digit number and ones<br>-subtract a 3 digit number and tens<br>-subtract a 3 digit number and hundreds<br>-subtract and subtract up to 3 digit numbers using a formal method<br>-understand commutativity between addition and subtraction and how they can relate to a part-part-whole method.<br><br><u>Use of Methods</u><br>Place value counters and base 10 are the most effective methods now that numbers are getting larger. |  |

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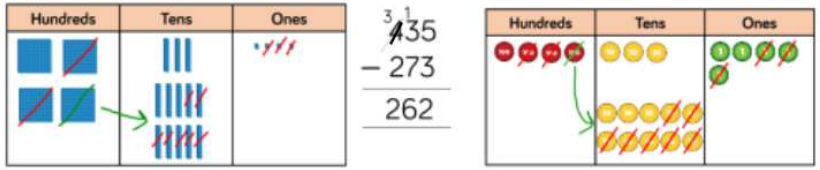
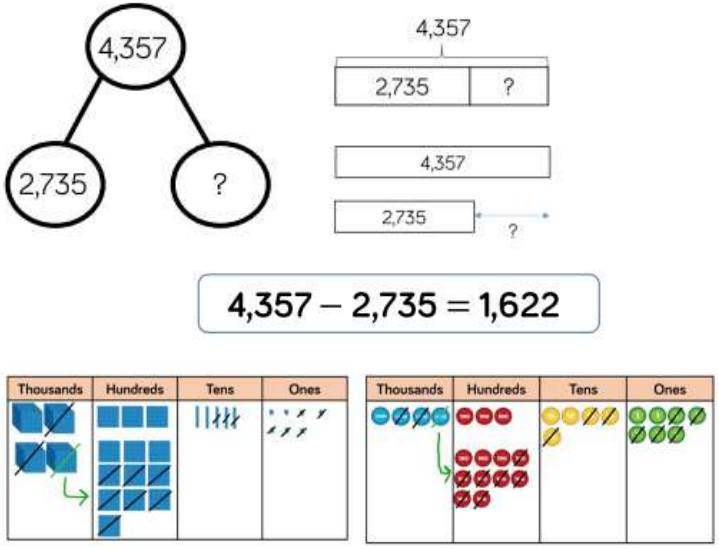
| | Formal written methods should always be written out alongside any other methods to reinforce the link between them.<br><br>EOY Expectations<br>Solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction. |  |
| **4** | Progression Statement<br>-subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate<br><br>Use of Methods<br>At this point children could use plain counters on a PV grid to represent the different values as their understanding of the concept becomes more secure.<br>With contextual problems and missing number problems, children might start by representing the problem using a bar model before using a formal written method to complete the calculation.<br>If using other methods, the formal method should be used alongside to continue strengthening the link between them.<br><br>EOY Expectations<br>Children in Year 4 should be using a formal written method for addition and should be able to explain how the method works using concrete resources or pictorial representations. They should also be able to solve two-step problems in context, choosing the correct operation to use at each stage. |  |

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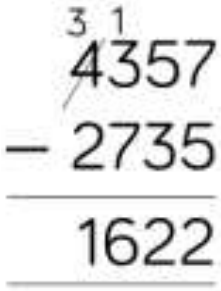
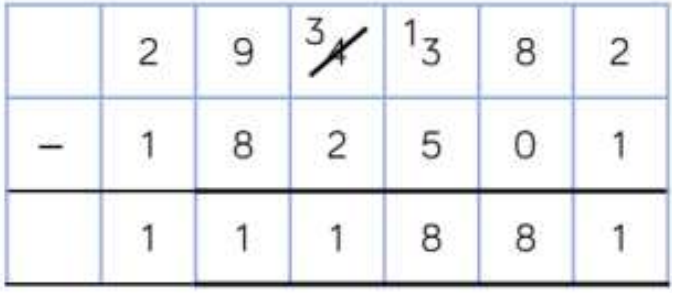
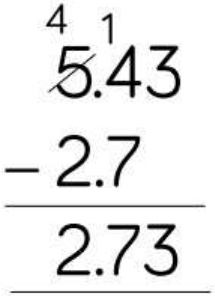
| **5/6** | Progression Statement<br>-subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)<br>-solve problems involving numbers up to three decimal places<br><br>Use of Methods<br>Abstract, formal written methods are now the main method that children will regularly be using, however it is important that concrete resources and/or pictorial representations are used regularly and are available to children. They should also now be expected to 'Create it, Draw it or Explain it' often to deepen their understanding.<br><br>EOY Expectations<br>Children in Year 5 and 6 should use a formal written method as their primary way of solving larger subtraction questions. They should be efficient and effective in their use of mental strategies based upon number bonds and representations, such as part-whole. |  <br><br>  <br><br>  <br> |

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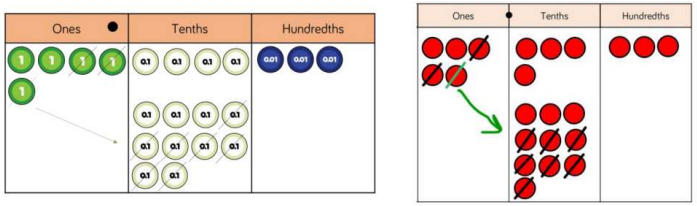
| | |  |

## Multiplication

| Year Group | Information | Methods |
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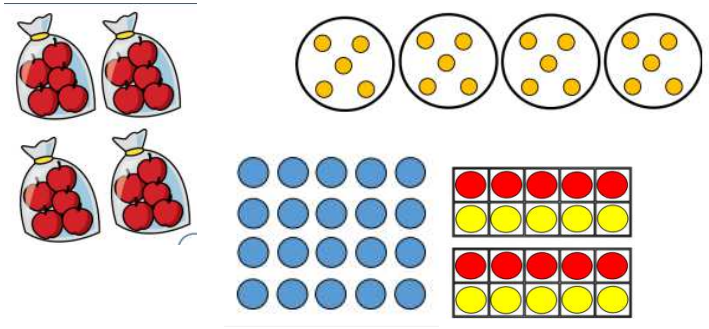
| 1 | Progression Statement<br>-solve one-step problems involving multiplication by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher<br><br>Use of Methods<br>Concrete resources should be used to introduce children to the concept of multiplication through repeated addition. Any resource of the same type is appropriate, e.g. counters, compare bears, pebbles etc.<br><br>Pictorial representations should show groups of items moving on to arrays.<br><br>Children do not need to use the multiplication sign at this point or record the multiplications, but the use of language is essential to embed the concept of lots or groups of.<br><br>EOY Expectations<br>Children should be able solve a multiplication question and use a concrete or pictorial method with support. It is important that they can also tell you what they did and why. |  |

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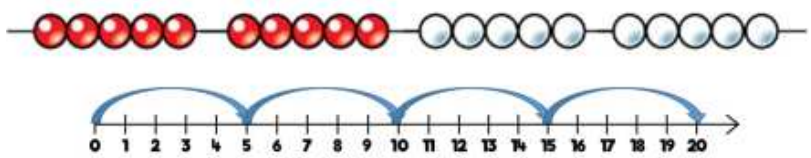
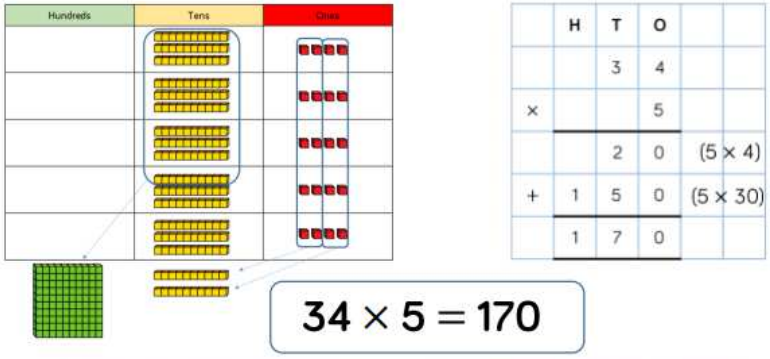
| **2** | Progression Statement<br>-calculate mathematical statements for multiplication within the multiplication tables and write them using the multiplication (×), and equals/the same as (=) signs.<br>-solve problems involving multiplication using materials, arrays, repeated addition, mental methods, and multiplication facts, including problems in contexts.<br><br>Use of Methods<br>Children should continue to use a range of concrete and pictorial representations but can also now be introduced to the multiplication symbol so they can begin to record what they have solved.<br><br>EOY Expectations<br>Children can record multiplications they solve using concrete, pictorial or mental methods as number statements e.g. 4 x 5 = 20. |  <br><br>One bag holds 5 apples.<br>How many apples do 4 bags hold?<br>$5 + 5 + 5 + 5 = 20$<br>$4 \times 5 = 20$<br>$5 \times 4 = 20$ |
| **3** | Progression Statement<br>-write and calculate mathematical statements for multiplication using the multiplication tables that they know (2, 3, 4, 6 and 8 times tables), including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods.<br><br>Use of Methods<br>Concrete and pictorial representations of multiplication must still be used at this stage, however children should be encouraged to use their knowledge of times tables to calculate answers and the resources should be used to learn about the formal method.<br><br>Initially children will be taught to partition the multiplicand and then multiply separately e.g. 24 x 5 = 20 x 5 + 4 x 5.<br><br>Formal written methods can be demonstrated alongside these methods. When demonstrating, clearly circle the picture or resources when a group of 10 has been made and it needs to be exchanged. *Children should only begin to use a formal method (expanded multiplication) themselves once they have mastered the previous methods and are secure in their knowledge of multiplication.* |  <br><br>$34 \times 5 = 170$<br><br>H T O<br>3 4<br>× 5<br>2 0 (5 × 4)<br>+ 1 5 0 (5 × 30)<br>1 7 0 |

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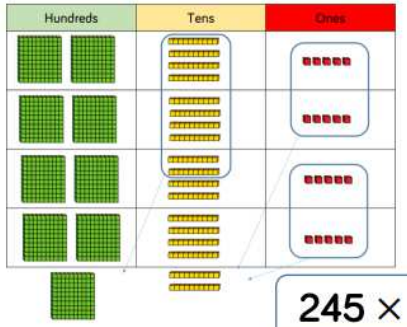
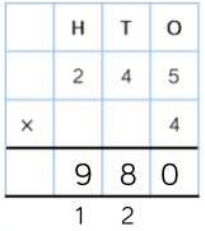
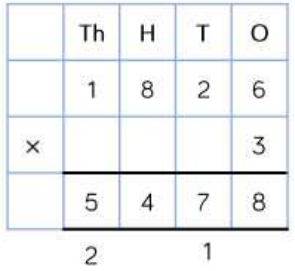
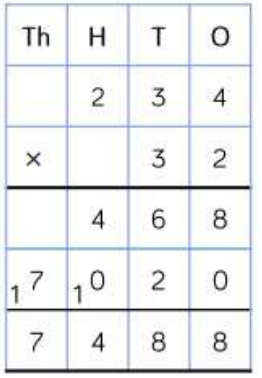
| | <u>EOY Expectations</u><br>Children should be able to solve 2 digit multiplied by 1 digit questions using their knowledge of times tables and partitioning. They should also be able to explain using concrete and pictorial resources how an expanded/short multiplication method works. | |
| **4** | <u>Progression Statement</u><br>-multiply two-digit and three-digit numbers by a one-digit number using formal written layout<br><br><u>Use of Methods</u><br>Children progress to a compact method of multiplication once they are multiplying 3 instead of 2-digit numbers. The expanded method taught in Y3 should be shown side by side so children can make the link between the two methods. Resources should still be used to help explain a method.<br><br><u>EOY Expectations</u><br>Children should be fluent in their use of a compact written method solving multiplications up to 3-digit multiplied by a 1-digit number. |  <br>$245 \times 4 = 980$<br>  |
| **5** | <u>Progression Statement</u><br>-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<br><br><u>Use of Methods</u><br>When multiplying by larger numbers, if children are struggling with times tables then they should, for a short time, make use of multiplication grids so that their working memory can focus on learning a long method.<br>Place value counters are most efficient when demonstrating the process with larger numbers.<br>It is essential that there is consistency with where exchanged digits are placed to avoid any ambiguity or confusion.<br>*Avoid saying 'add' when needing to use a placeholder, instead saying 'put' or 'place' to avoid introducing the misconception of 'adding 0s' when multiplying by multiples or powers of 10.*<br><br><u>EOY Expectations</u><br>Children should be fluent in multiplying 4-digit by 1-digit number or 3-digit by a 2-digit number. | $1{,}826 \times 3 = 5{,}478$<br>  <br>  |

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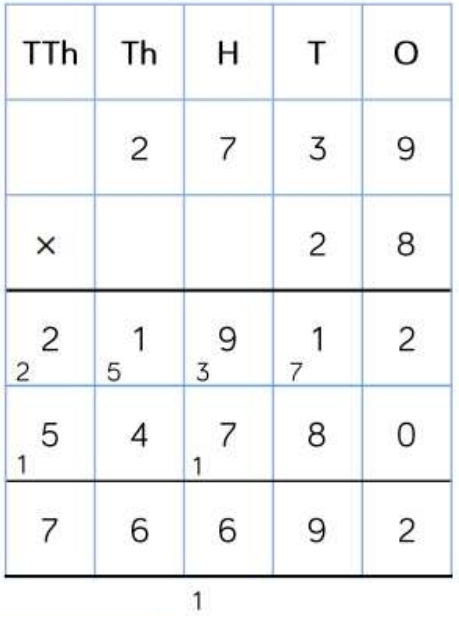
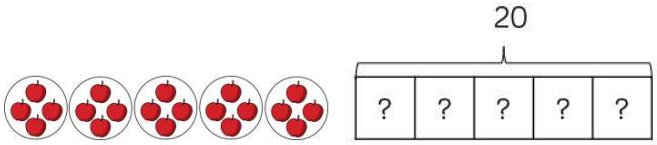
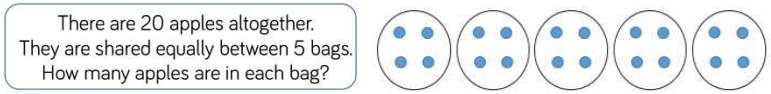
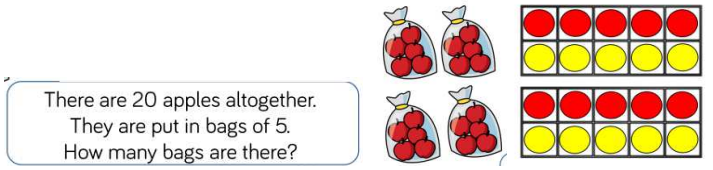
| **6** | Progression Statement<br>-multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication<br><br>Use of Methods<br>When multiplying by larger numbers, if children are struggling with times tables then they should, for a short time, make use of multiplication grids so that their working memory can focus on learning a long method.<br>Place value counters are most efficient when demonstrating the process with larger numbers.<br>It is essential that there is consistency with where exchanged digits are placed to avoid any ambiguity or confusion.<br>*Avoid saying 'add' when needing to use a placeholder, instead saying 'put' or 'place' to avoid introducing the misconception of 'adding 0s' when multiplying by multiples or powers of 10.*<br><br>EOY Expectations<br>Children should be fluent in the use of long multiplication when multiplying numbers up to 4-digit by 2-digit numbers. |  |

# Division

| Year Group | Information | Methods |
|---|---|---|
| 1 | Progression Statement<br>-solve one-step problems involving division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.<br><br>Use of Methods<br>Children will learn about sharing (partitive division) and grouping (quotative division) initially through use of concrete resources, moving on to pictorial representations alongside them. There is no expectation for children to record division formally.<br><br>Counting in 'groups of' secures the link between multiplication and can also be shown through repeated subtraction on a number line.<br><br>EOY Expectations<br>Children should be able to select concrete resources to help them solve a problem, moving on to showing how this works using pictorial representations and then numbers. They do not need to use the division sign at this point. | ***Sharing***<br>  <br>  <br>***Grouping***<br>  |

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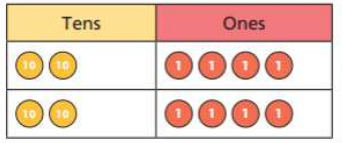
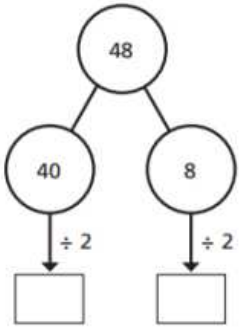
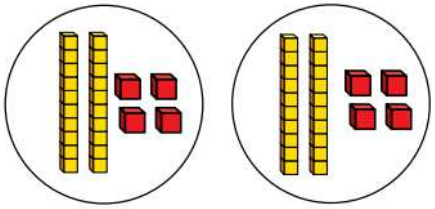
| **2** | <u>Progression Statement</u><br>-calculate mathematical statements for division, using knowledge of the multiplication tables and write them using the division (÷) and equals (=) signs.<br>-solve problems involving division, using materials, arrays, repeated subtraction, mental methods, and division facts, including problems in contexts.<br><br><u>Use of Methods</u><br>In Year 2 children are shown the division sign and abstract methods are shown alongside concrete and pictorial representations.<br>When calculating 2-digit numbers divided by 1-digit numbers, children are taught to partition the dividend into tens and ones.<br><br><u>EOY Expectations</u><br>Children should be able to select and use concrete resources and pictorial representations to help solve a problem, as well as being able to record this in numerals and using symbols. |  <br>$48 \div 2 = 24$<br>  <br>  |

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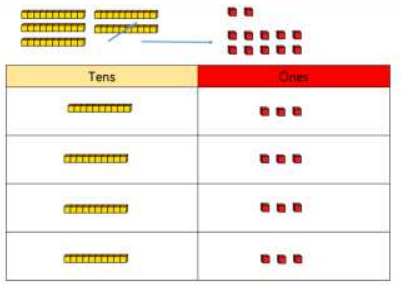
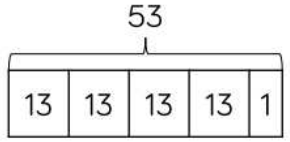
| **3** | <u>Progression Statement</u><br>-write and calculate mathematical statements for division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods.<br><br><u>Use of Methods</u><br>Children use base 10 and place value counters to solve division problems through sharing. Concrete resources should start outside of the place value grids, then children should share them equally into the correct columns.<br>It is important concrete resources and visual representations are used when there are remainders or exchanging needs to take place.<br>*The formal written method of short division can be introduced alongside these representations and children should only begin to use formal methods once they have mastered previous methods and have a secure understanding of division.*<br><br><u>EOY Expectations</u><br>Children should be able to use resources and pictorial representations to solve division questions that use exchanging and have remainders. They should be able to verbally explain what they are doing and why. They may begin using a formal written method of short division. |  <br><br>$52 \div 4 = 13$<br><br>$53 \div 4 = 13$ r1<br><br>  <br><br>  <br> |

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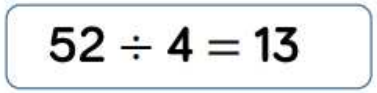
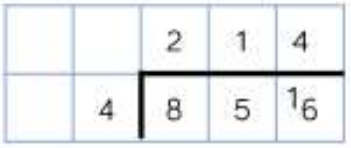
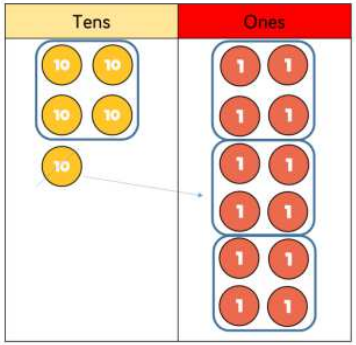
| **4** | <u>Progression Statement</u><br>-Divide numbers up to 3 digits by 1 digit using a formal written method.<br><br><u>Use of Methods</u><br>When using a short division method children are now grouping instead of sharing. They will need to ask, 'How many groups of _ can we make from _?'<br>Concrete and pictorial methods should be used alongside use of a formal method so children can see what happens when a number is exchanged.<br>It is important that, unlike with the other operations, we start with the largest place value.<br><br><u>EOY Expectations</u><br>Children should be able to use a formal written method for solving division questions, but can also demonstrate what happens using concrete resources or pictorial representations. By the end of the year children should no longer need concrete or pictorial representations to solve a problem. |  <br>  <br>  <br>  |

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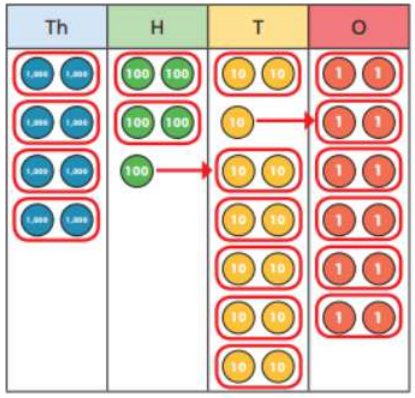
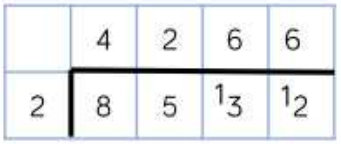
| **5** | Progression Statement<br>-divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context.<br><br>Use of Methods<br>Children should begin by using a short division method to solve 3-digit by 1-digit questions. Grouping using resources can be used to support parts of solving the problem but should be removed as soon as possible.<br>When solving 4-digit divided by 1-digit questions, it is important that children are shown how to carefully and clearly place exchanges to avoid confusion, especially when there are multiple exchanges.<br>To support them in solving, children may be encouraged to write out multiplication jottings before attempting the problem.<br><br>EOY Expectations<br>Children should be masters at using a short division method when solving a division problem. They use resources occasionally to support their work but can also use them to demonstrate what is happening. |  <br>  <br>8,532 ÷ 2 = 4,266 |

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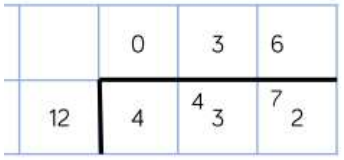
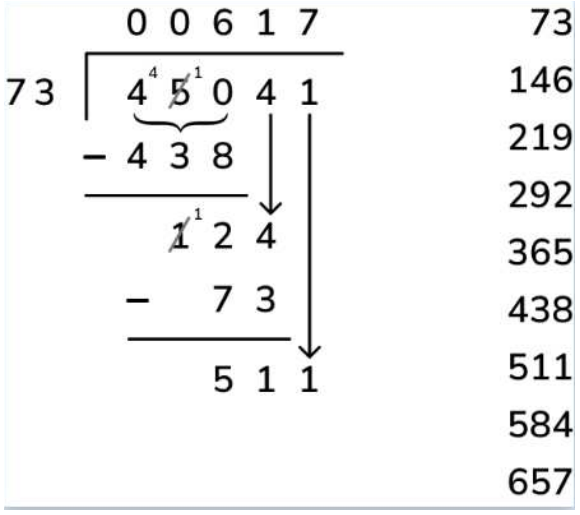
| **6** | Progression Statement<br>-divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context<br><br>-divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context<br><br>Use of Methods<br>Children should be taught that different questions may require different methods to help be as efficient as possible.<br><br>When dividing a 4-digit number by a 2-digit number in the teens then a short division method may work. However, as the divisor increases in value, children should use a long division method.<br><br>For divisors greater than 12, children must write out multiplication jottings to support them in solving the problem.<br><br>Children should be taught that the context of a question may require them to do something with the quotient or the remainder. At times the quotient may need to be rounded, or it might be appropriate for the remainder to be represented as a fraction over the divisor, then simplified where possible.<br><br>EOY Expectations<br>Children should have mastered the use of both short and long division methods to solve division problems. Concrete and pictorial resources should be used to explain or demonstrate learning. To support them in solving division questions, their knowledge of multiplication and times tables will be used. |  <br>$432 \div 12 = 36$<br><br>  |