Calculation Policy

2017

This policy has been designed to teach children through the use of concrete, pictorial and abstract methods. This calculation policy should be used to support children to develop a deep understanding of number and calculation.

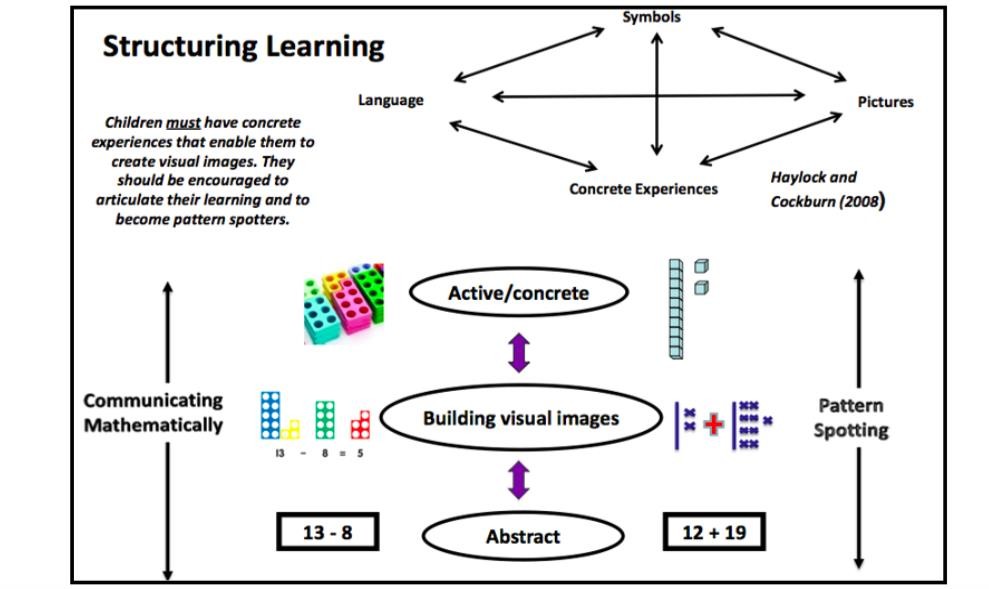
**Using the concrete-pictorial-abstract approach:**

Children develop an understanding of a mathematical concept through the three steps (or representation) of concrete-pictorial-abstract approach. Reinforcement is achieved by going back and forth between these representations.

**Concrete representation**  The enactive stage - a pupil is first introduced to an idea or a skill by acting it out with real objects. This is a 'hands on' component using real objects and it is the foundation for conceptual understanding.

**Pictorial representation**  The iconic stage - a pupil has sufficiently understood the hands-on experiences performed and can now relate them to representations, such as a diagram or picture of the problem.

**Abstract representation**  The symbolic stage - a pupil is now capable of representing problems by using mathematical notation, for example: 12 ÷ 2 = 6 .

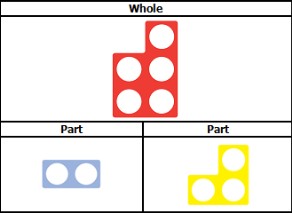
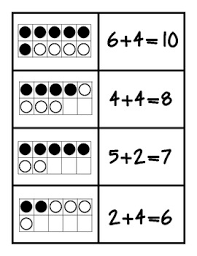
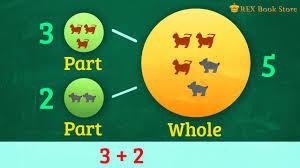
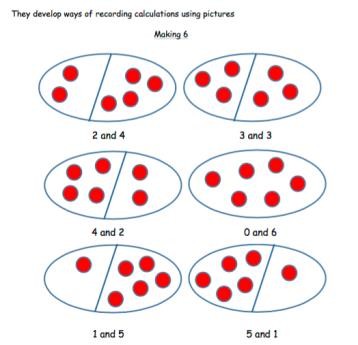


**Guidance**

This is document provides guidance and examples for key objectives for each year group but is not to be followed as a complete planning aid as not all objectives are exemplified.

Reception

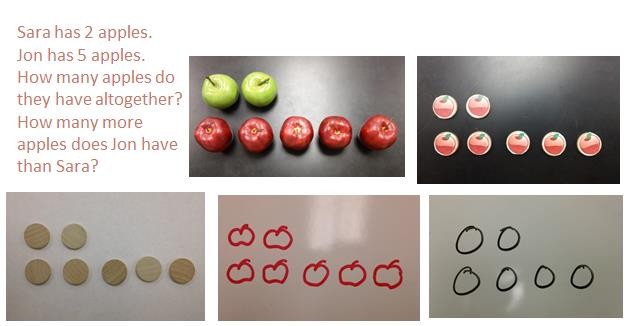
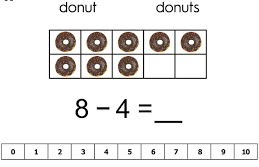
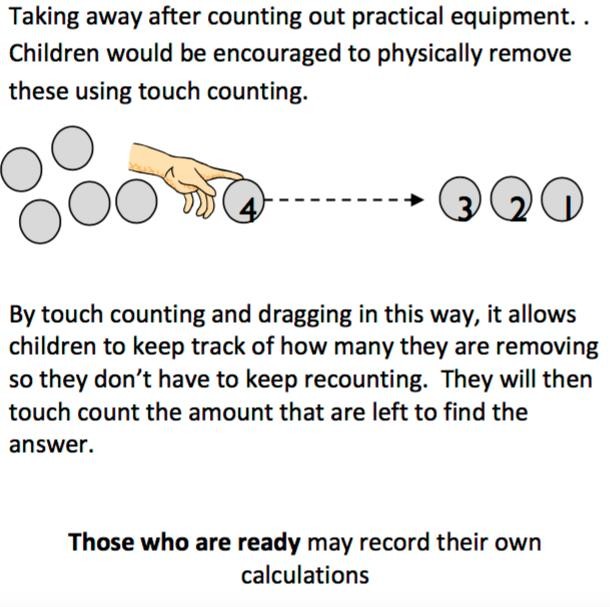
A**ddition**



Explore part part whole relationship

Using the ten frame to support addition of single digits – counting all/combining two groups

Solving problems using concrete and pictorial images.



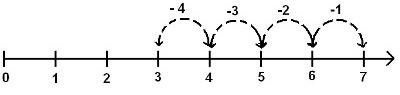
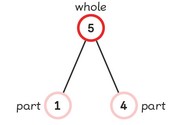
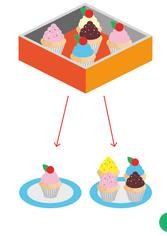
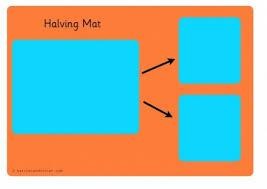
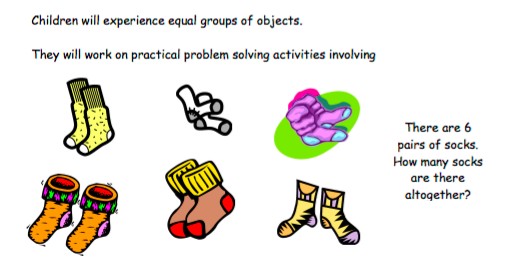
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| S**ubtraction** |
| Using the ten frame to support subtraction by taking away  • Peter has 5 pencils and 3 erasers. How  many more pencils than erasers does he have? Solving problems using concrete and pictorial images. |
| M**ultiplication** |

D**ivision**

Year 1

A**ddition**

Joining two groups and then recounting all objects using one-to-one Correspondence



(lots of practice making

10 and numbers to 10 e.g. 6 + 4 = 10 or 3 + 5 =

8)

3 + 4 = 7

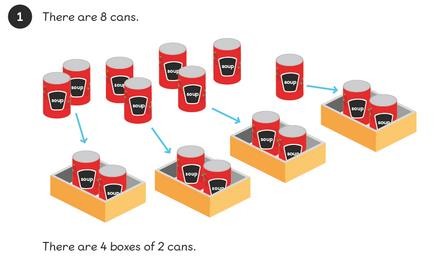
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| Learn number bonds to  20 and demonstrate related facts  *Teach addition and subtraction alongside each other as pupils need to see the*  *relationship between the facts.* |  |
| Add and subtract one  digit numbers and two digit numbers to 20, including zero | 8+1=9 |
| **Bridging 10**  Use ten frames, Singapore bars, egg boxes and number lines to practice.  *Chn should start with the larger number and add the smaller number seeing what makes ten and what is left over.* | 6 + 6 = 12 Make 9 in one and 3 in the other. Take one from  the 3 to make the 9 into a ten….10+2 = 12 |
| S**ubtraction** | |
| Taking away should  begin with **physical objects**: objects, cubes, Dienes etc |  |

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| Subtraction by counting  back |  |
| Subtracting a single digit  number from a single digit number and a single digit from a two digit by crossing out pictures |  |
| Subtracting using the  part part whole  (include problem solving with missing digits).  ? - 5 = 2 |  |
| Subtraction by  subtracting from 10  *Children subtract from*  *10 and not from ones* | 14 – 8 = ? |

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| When subtracting using  Dienes children should be taught to regroup a ten rod for 10 ones and then subtract from those ones | 20 – 4 = 16 |
| Subtracting multiples of  10  *Using the vocabulary of*  *1 ten, 2 tens etc alongside 10, 20, 30 Is very important here as pupils need to*  *understand that it is a 10 not a 1 that is being taken away* |  |
| M**ultiplication** | |
| Counting in multiples of  2, 5 and 10 from zero  *Children should count*  *the number of groups on their fingers as they are skip counting.* | *2 4 6 8*  4 groups of 2 = 8 |

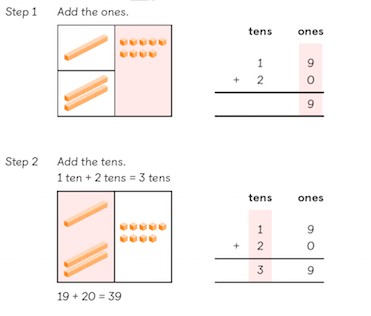
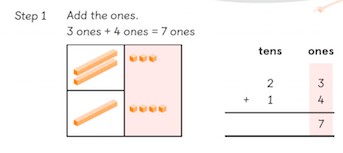
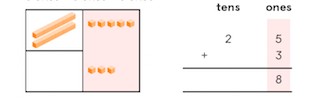
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| When moving to  pictorial/written calculations the vocabulary is important | This image represents two groups of 4 or 4 twice |
| Solving multiplication problems using repeated addition |  |
| D**ivision** | |
| Pupils should be taught  to divide through working practically and the sharing should be shown below the whole to familiarize children with the concept of the whole.  *The language of whole and part part should be used.* | 10 ÷ 2 = 5  8 ÷ 4 = 2 |

Year 2

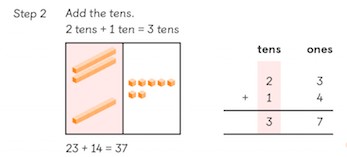
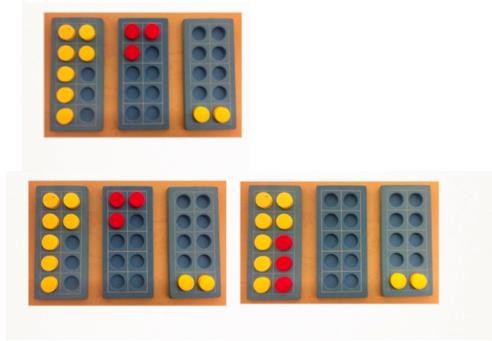
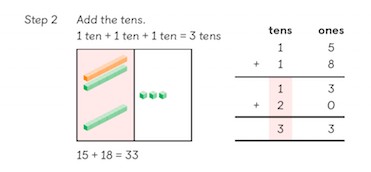
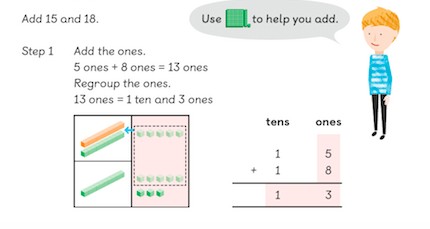
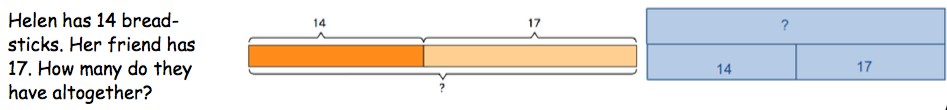


**Addition**

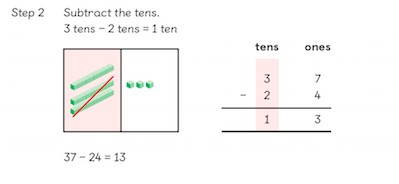
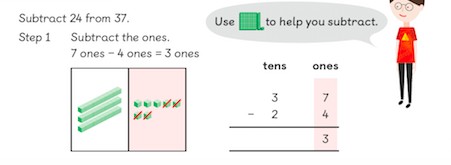
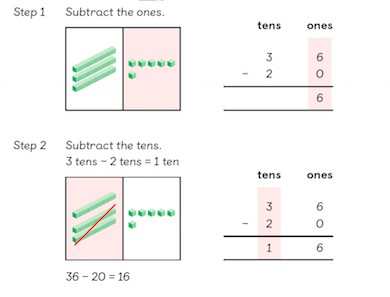
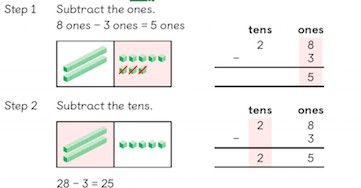
Using concrete objects and pictorial



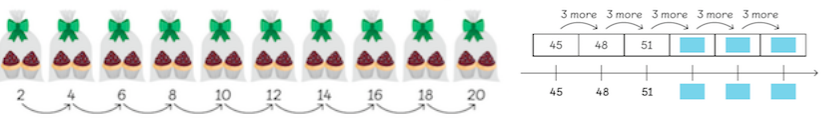
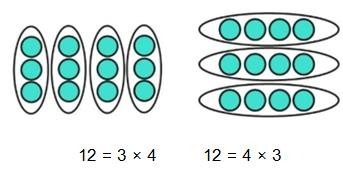
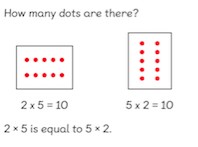
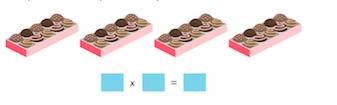
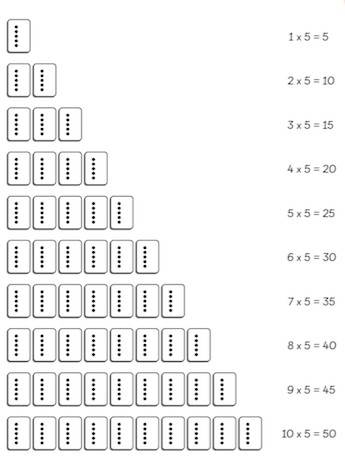
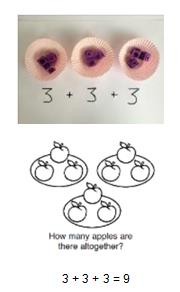
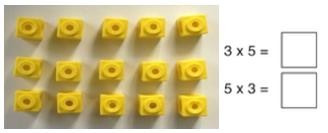
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| representations to  add a 2 digit number with a 1 digit number. |  |
| Using concrete objects and pictorial representations to add a 2 digit number and 10s number. |  |



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| Using concrete  objects and pictorial representations to add a 2 2 digit numbers. | Adding with renaming |
| Using concrete  objects and pictorial representations to add a 3 single digit numbers. | 7+3+2 = leads to 10 + 2 = |
| Using the bar to find  missing digits.  *It is important for children to use the bar in this way to encourage the use of it to aid with*  *problem solving.* |  |



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| **Subtraction** | |
| Using concrete  objects and pictorial representations to subtract a 1 digit number from 2 digit number. |  |
| Using concrete  objects and pictorial representations to subtract a 10s number from 2 digit number. |  |
| Using concrete objects and pictorial representations to subtract a 2 digit number from 2 digit number. |  |
| Recognise and use  the inverse relationship between addition and subtraction | Use this to check calculations and  ? 76 solve missing number problems.  23 53 23 ? |
| **Multiplication** | |

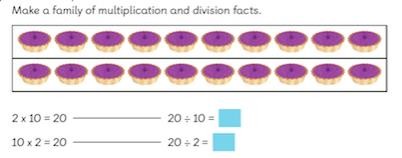
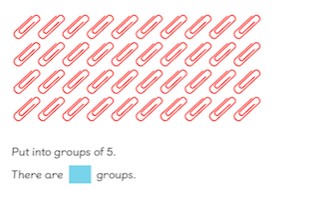


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| **Skip counting in**  **multiples**  **of 2, 3, 5, 10 from**  **0** |  |
| Recall and use  multiplication facts for the multiplication tables 2, 5 and 10. |  |
| I can use  multiplication (x) and  equal (=) sign when writing out my times tables. |  |
| **Multiplication is**  **commutative**  *Pupils should understand that an array can represent different equations and that, as multiplication is*  *commutative, the order of the multiplication does not affect the answer.* |  |
| Solve multiplication  problems in context using arrays and repeated addition |  |
| D**ivision** | |

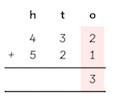
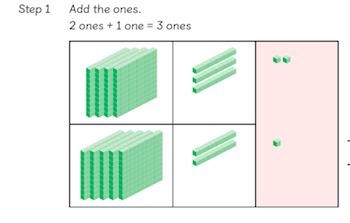
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| Recall and use division facts for the multiplication tables  2, 5 and 10. |  |
| Solve division  problems in context  using concrete objects by sharing |  |
| Solve division  problems in context using arrays |  |
| I can solve  division as grouping. |  |

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| I can use the inverse.  This should be taught alongside both multiplication and division. |  |

Year 3



Addition

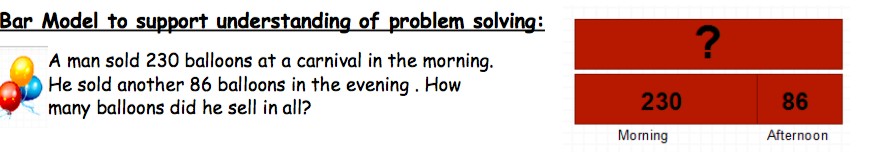
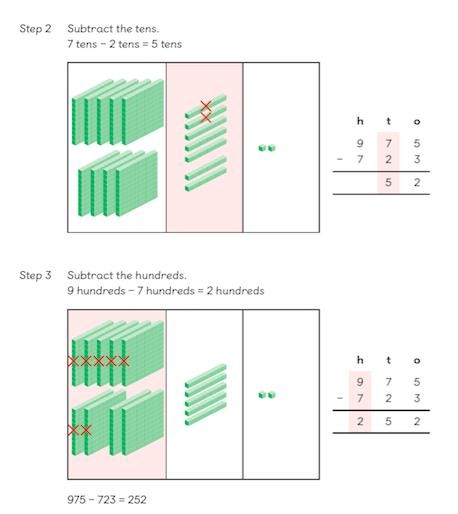
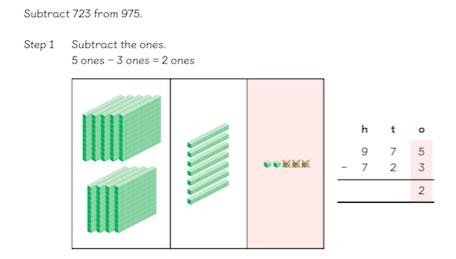
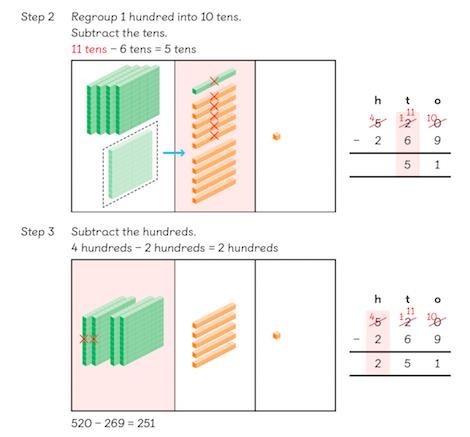
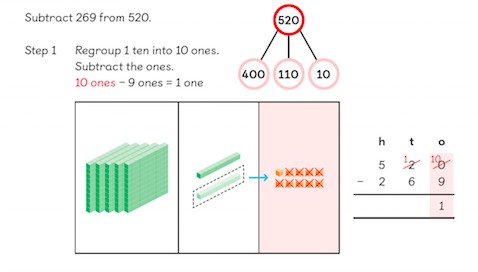
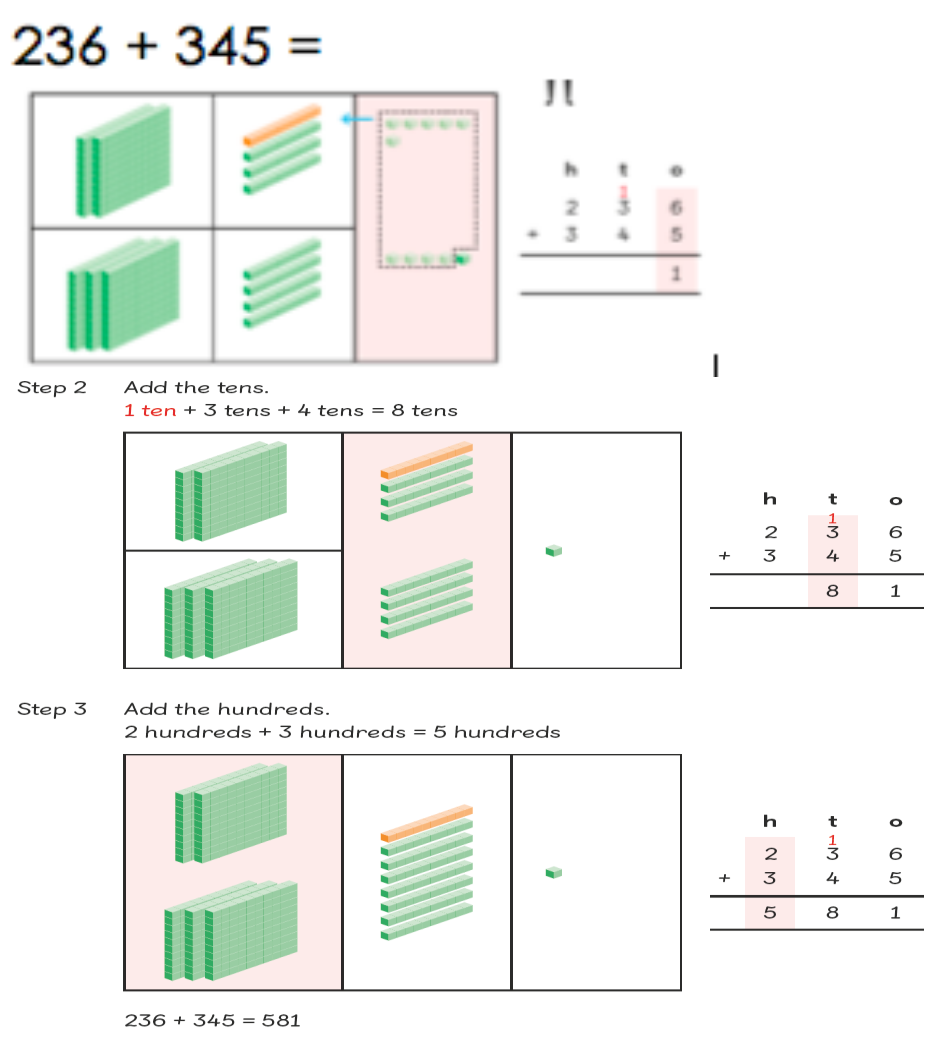
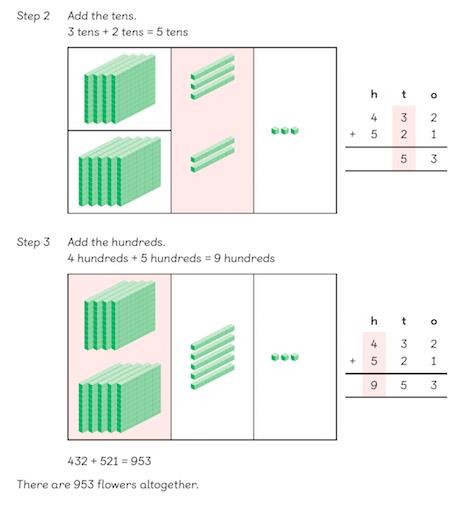


Add two three digit numbers.

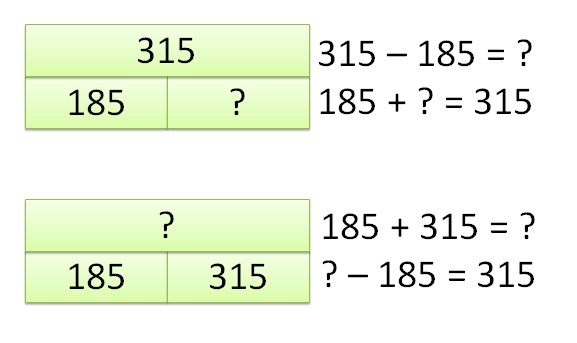
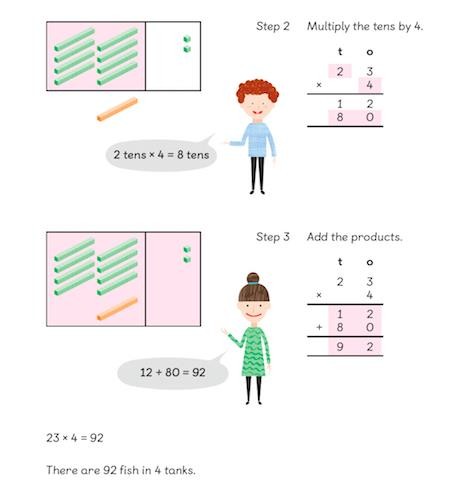
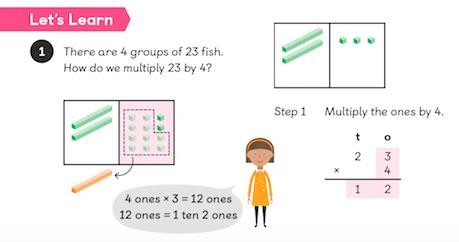
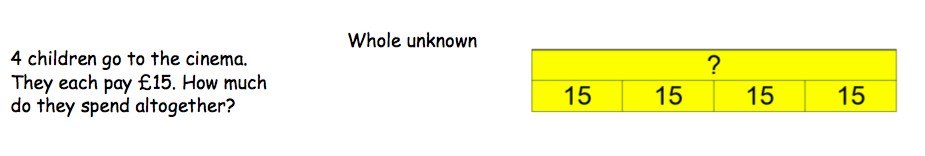
*Children need to use equipment first to support their understanding of place value.*

*Children to word gradually to three digit + three digit starting without carrying and gradually moving towards carrying.*

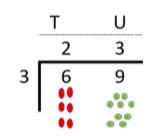
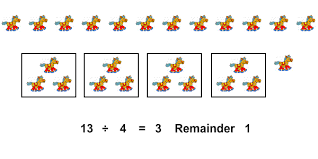
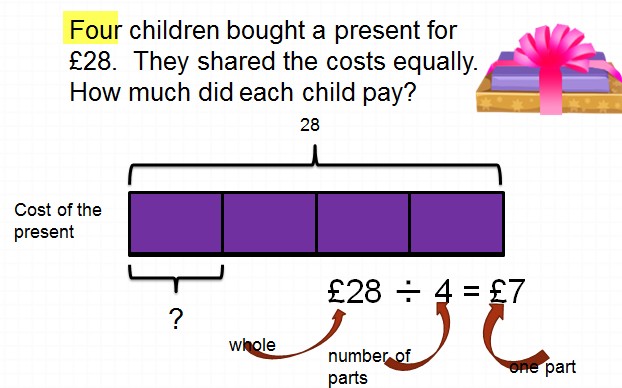
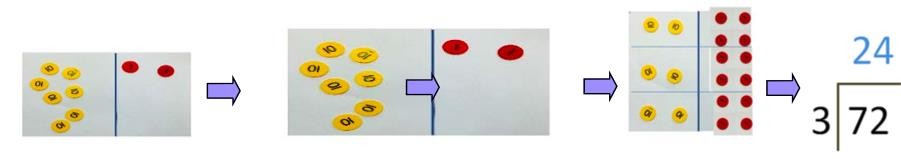
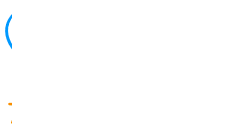
432 + 521 =



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| Using the bar to  find missing digits. *It is important for children to use the bar in this way to encourage the use of it to aid with problem solving.* |  |
| **Subtraction** | |
| Subtract up to 3  digits from 3 digits.  *Very important for children to use dienes equipment along with a place value chart to support.* | Only when secure with the method should exchanging be introduced. |

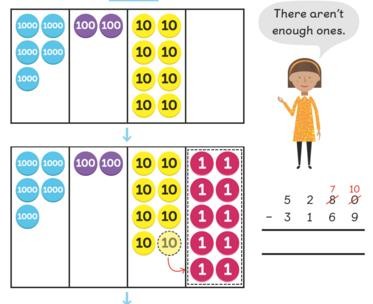
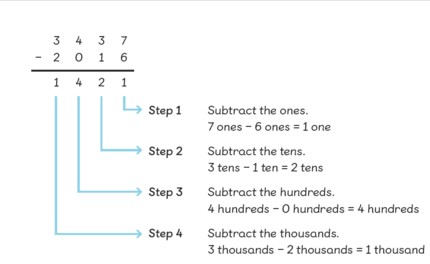
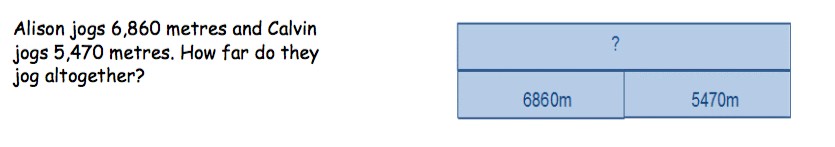
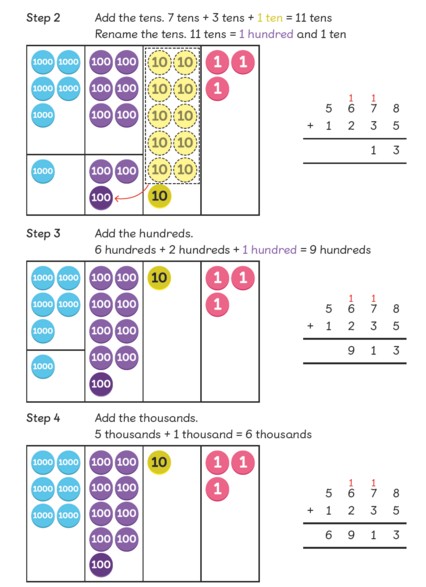
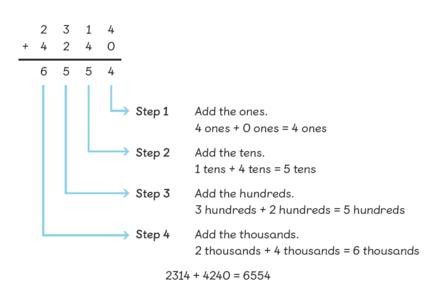


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| Using the bar to  find missing digits.  *It is important for children to use the bar in this way to encourage the use of it to aid with problem solving.* |  |
| **Multiplication** | |
| Children should be  able to recall the 2,  5, 10, 3, 4 and 8 times tables.  Multiple a two digit number by a one digit. |  |
| Using the bar to  solve multiplication problems. |  |



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| D**ivision** | |
| Dividing by  grouping undrestanding the concept of remainders. | Start with using the real objects-or objects that represent the calculation. |
| Dividing using short division.  *Once children are secure with division as grouping and demonstrate this using number lines, arrays etc.,* ***short division*** *for larger*  *2-digit numbers should be introduced, initially with carefully selected examples requiring no calculating of remainders at all. Start by*  *introducing the*  *layout of short division by comparing it to an array.* | **Remind children of correct place value, that 69 is equal to 60 and 9, but in short division, pose:**  · *How many 3’s in 6? = 2, and record it above the* ***6 tens****.*  · *How many 3’s in 9? = 3, and record it above the* ***9 ones***.  Once children demonstrate a full understanding of remainders, and also the short division method taught, they can be taught how to use the method when remainders occur within the calculation (e.g. 72÷3), and be taught to ‘carry’ the remainder onto the next digit. |
| Using the bar to  aid the solving of division problems. |  |

Year 4

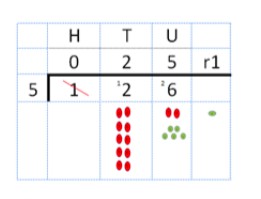
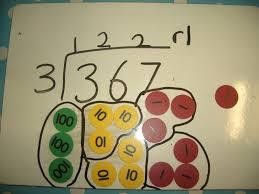


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| **Addition** | |
| Adding numbers  with up to 4 digits.  *Again this should start with the children using dienes to support them with lots of*  *discussion about the value of each digit.* |  |
| Using the bar to find  missing digits.  *It is important for children to use the bar in this way to encourage the use of it to aid with problem solving.* | This is not a form of getting the correct answer but helping to guide children to the  correct operation. |
| **Subtraction** | |
| To subtract with  numbers up to four digits including exchanging when children are secure.  *Again children need to use dienes to support their learning.* |  |

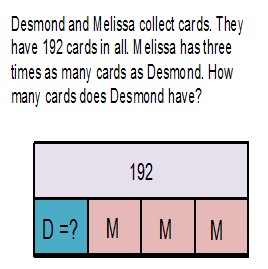
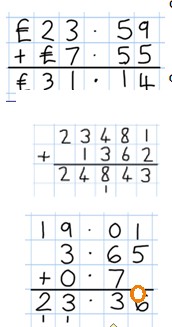
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|  |  |
| Using the bar to find  missing digits.  *It is important for children to use the bar in this way to encourage the use of it to aid with problem solving.* |  |
| **Multiplication** | |
| Children to know all  times tables to 12 x  12.  Ladder method to be used with children multiplying both two and three digits by a one digit number. |  |
| Multiplying using  the bar. |  |

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| D**ivision** | |
| Dividing up to three digit numbers by a one digit number using short division.  Only when the children are secure with dividing a two digit number should they move onto a 3 digit number. |  |
| Dividing using the  bar. |  |

Year 5

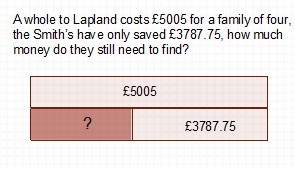
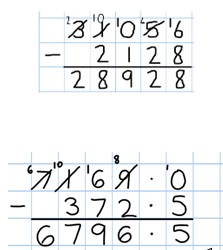
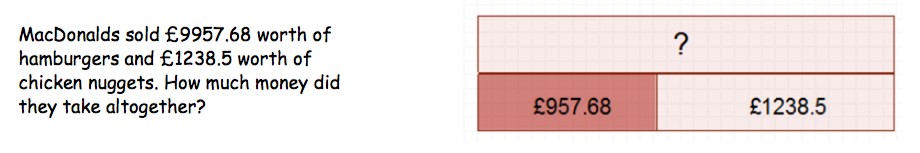


**Addition**

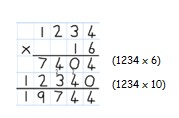
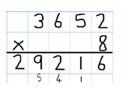
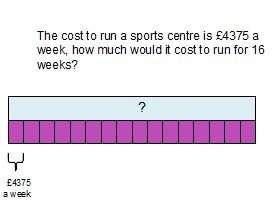
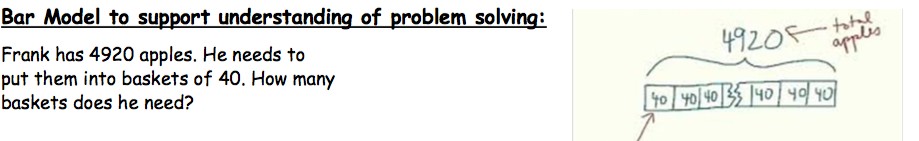


Adding numbers with more than 4 digits including decimals

*Using place value charts are key to this as well as place value counters to help with the decimals.*

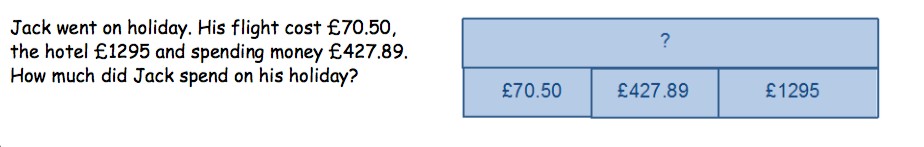
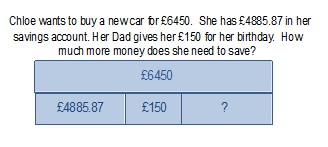
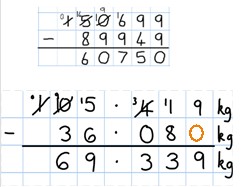
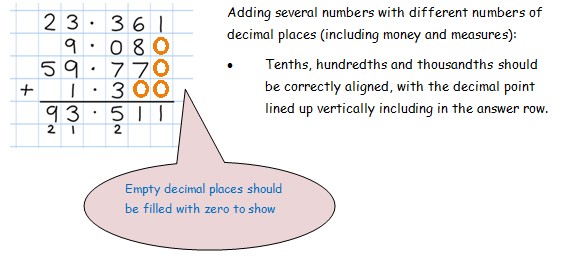


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| Using the bar to find missing digits.  *It is important for children to use the bar in this way to encourage the use of it to aid with problem solving.* | This is not a form of getting the correct answer but helping to guide children to the correct operation. |
| **Subtraction** | |
| Subtract with at least four digit numbers including two decimal places.  Include money, measures and decimals ensuring that children do this practically before the abstract. | Subtract with decimal values, including mixtures of integers and decimals, aligning the decimal point.  Approxima te, Calculate, Check . |
| Using the bar to find  missing digits.  *It is important for children to use the bar in this way to encourage the use of it to aid with problem solving.* |  |
| **Multiplication** | |
| Multiplying up to four  digit numbers by two digits using long multiplication.  *Children need to be taught to approximate first, e.g. for* ***72 x 38, they will use rounding:***  ***72 x 38*** *is approximately*  *70 x 40 =* ***2800****, and use the approximation to check the* | 56  X 27 Approximate, Calculate,  Check .  392 (56x7)  1120 (56x20)    1512  · Explain that first we are multiplying the top number by 7 starting with the units. (any carrying needs to be done underneath the numbers). |

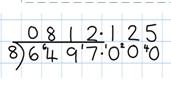
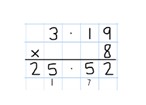
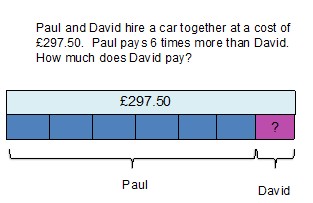
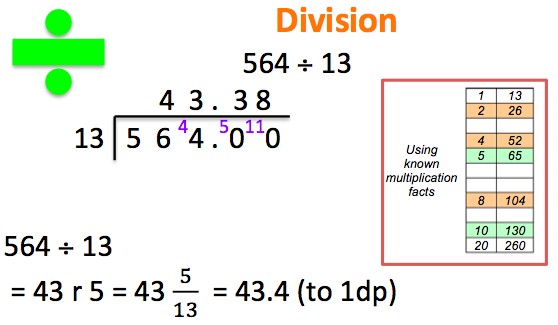
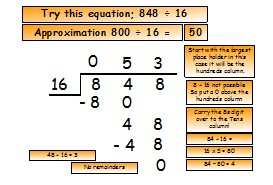


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| *reasonableness of their*  *answer.* | · Now explain that we need to put a 0 underneath—explain that this is because  we are multiplying the number by 20.. (2 tens) which is the same as multiplying  10 and 2.  · Now add the 2 numbers together to give you the answer.  · This will need lots of modeling to show the children. |
| Using the bar to support  multiplication. |  |
| D**ivision** | |
| Diving with up to four  digit numbers by one digit including numbers where remainders are left. | **Short division with remainders:** Now that pupils are introduced to examples that give rise to remainder answers, division needs to have a real life problem solving context, where **pupils consider the meaning of the remainder and how to express it,** ie. as a fraction, a decimal, or as a rounded number or value , depending upon the context of the problem. |
| Using the bar to support  division problems. |  |

Year 6



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| **Addition** | |
| Adding several  numbers with up to three decimal places. |  |
| Adding using the  bar. |  |
| **Subtraction** | |
| Subtracting with  increasingly large and more complex numbers and decimal values. | Very important to use in a range of contexts-  measures and money. |
| Using the bar for  subtraction. |  |



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| **Multiplication** | |
| Short and long  multiplication with up to two decimal places. | Approximate, Calculate, Check . |
| Using the bar to  help with multiplication. |  |
| D**ivision** | |
| Divide at least 4  digits by both single-digit and  2-digit numbers  (including decimal numbers and quantities) | **Short division with remainders:** Pupils should continue to use this method, but with numbers to at least 4 digits, and understand how to express remainders as fractions, decimals, whole number remainders, or  rounded numbers. Real life problem solving contexts need to be the starting point, where pupils have to consider the most appropriate way to express the remainder. |
| Long division this  is for when  dividing by two digit numbers. |  |
| Using the bar to  help divide. |  |