


## Our Mission Statement

*As God's family we are STARs within a loving and thriving community, celebrating our diversity. We ignite lifelong learning where everyone becomes a positive influence on our world.*

# Calculation & Representation Policy

## Formulated in consultation with St Mary and St Peter Catholic Primary School

The Policy in Practice

- This policy outlines the key written methods and representations that are to be taught and used in maths throughout the school in conjunction with White Rose Maths Hub small step guidance. This is to ensure consistency in teaching and to promote the progression of children's learning in maths.
- Children need a secure understanding of the number system and each method of solving calculation problems (including varied fluency/representations) before they move on to formal written methods.
- Skills will be taught, practised and reviewed regularly.
- Practical resources and visual representations are regularly available for children to use e.g. multilink, counters, bead strings, number lines, hundred squares. The school follows a CPA approach where manipulatives and representations are available to all children to support them in their learning.

Mental Calculations

- Although the main focus of this policy is on written methods, it is important to recognise that the ability to solve calculations mentally lies at the heart of numeracy.

- Written methods of calculation are based on mental strategies. In every written method, there is an element of mental processing.
- Written recording helps children to clarify their thinking and supports and extends the development of more fluent and sophisticated mental strategies.
- Before carrying out a calculation, children will be encouraged to consider:
  Can I do it in my head?
  The size of an approximate answer (using rounding, estimation).
  Could I do jottings to keep track of the calculation?

'Maths is the study of patterns abstracted from the world around us – so anything we learn in maths has literally thousands of applications, in arts, sciences, finance, health and leisure!'
*Professor Ruth Lawrence, University of Michigan*

'Mathematics is not just a collection of skills, it is a way of thinking. It lies at the core of scientific understanding, and of rational and logical argument.'
*Dr Colin Sparrow, Lecturer in Mathematics, University of Cambridge*

## Calculation Policy Guidance

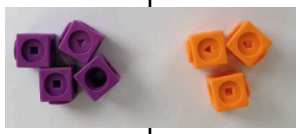
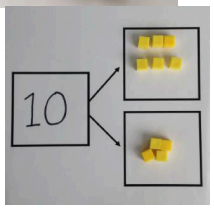
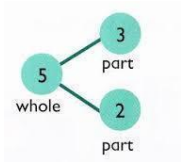
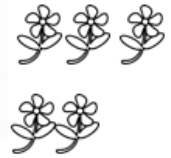
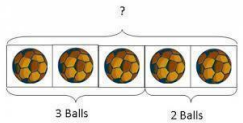
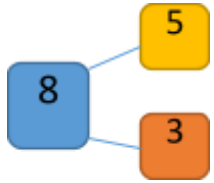
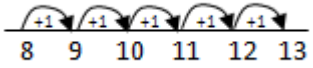
These are objectives taught in each phase, not a progression within each year group – see White Rose small steps guidance for sequencing

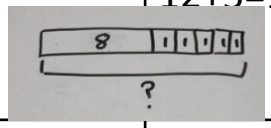
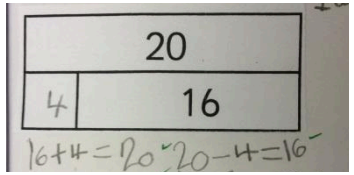
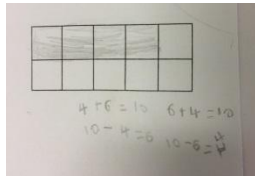
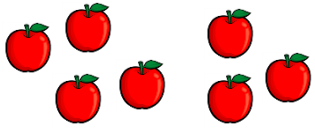
| | EYFS | Year 1 | Year 2 | Year 3 ,4,5 and 6 |
|---|---|---|---|---|
| **Addition** | Combine groups of objects<br>Find 1 more than a number<br>Start at bigger number and count on<br>Understanding = as equal groups or a balance<br>Recognise that addition is commutative<br><br>Representations include (but not limited to): concrete resources such as cubes, place value counters, Base 10 etc.<br>Pictorial resources such as: filled number lines, blank number lines. Bar models, part whole models etc. | Combine groups of objects<br>Find 1 more than a number<br>Start at bigger number and count on<br>Understanding = as equal groups or a balance<br>Recognise that addition is commutative<br>Regrouping to make 10<br>Adding 3 single digit numbers<br>Adding 10 to any number<br><br>Representations include (but not limited to): concrete resources such as cubes, place value counters, Base 10 etc.<br>Pictorial resources such as: filled number lines, blank number lines, Bar models, part whole models etc. | Regrouping to make 10<br>Adding 3 single digit numbers<br>Adding 10 to any number<br>Adding two 2-digit numbers by counting on from the larger, partitioning the smaller<br>Using expanded column addition method with no regrouping<br>Using expanded column addition method with regrouping<br>Using a formal column method with no regrouping<br><br>Representations include (but not limited to): concrete resources such as cubes, place value counters, Base 10 etc.<br>Pictorial resources such as: filled number lines, blank number lines, Bar models, part whole models etc. | Using expanded column addition method with no regrouping<br>Using expanded column addition method with regrouping<br><br>Using a formal column method with no regrouping<br>Using a formal column method with regrouping<br><br>Representations include (but not limited to): concrete resources such as cubes, place value counters, Base 10 etc.<br>Pictorial resources such as: filled number lines, blank number lines, Bar models, part whole models etc. |

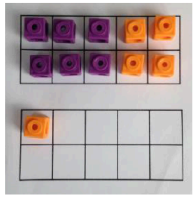
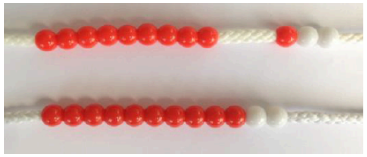
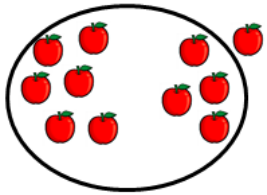
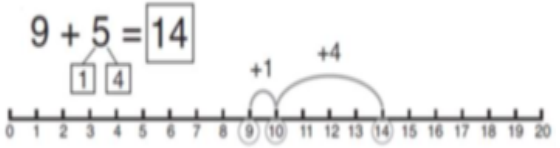
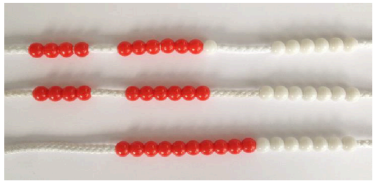
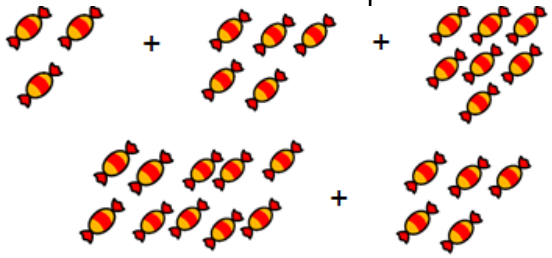
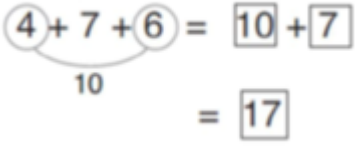
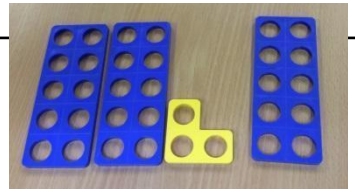
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| **Subtraction** | Taking away ones<br>Finding 1 less than a number<br>Counting back<br><br>Representations include (but not limited to): concrete resources such as cubes, Numicon, place value counters, Base 10 etc.<br>Pictorial resources such as: filled number lines, blank number lines.<br>Bar models, part whole models etc. | Taking away ones<br>Finding 1 less than a number<br>Counting back.<br>Find the difference<br>Bridging the 10<br><br>Representations include (but not limited to): concrete resources such as cubes, place value counters, Numicon, Base 10 etc.<br>Pictorial resources such as: filled number lines, blank number lines.<br>Bar models, part whole models etc. | Find the difference.<br>Bridging the 10.<br>Column method without regrouping.<br><br>Representations include (but not limited to): concrete resources such as cubes, place value counters, Numicon,Base 10 etc.<br>Pictorial resources such as: filled number lines, blank number lines.<br>Bar models, part whole models etc. | Using expanded column subtraction method with no regrouping<br>Using expanded column subtraction method with regrouping<br>Column method without regrouping<br>Column method with regrouping<br><br>Representations include (but not limited to): concrete resources such as cubes, place value counters, Numicon, Base 10 etc.<br>Pictorial resources such as: filled number lines, blank number lines.<br>Bar models, part whole models etc. |
| **Multiplication** | Doubling<br>Counting in multiples<br><br>Representations include (but not limited to): concrete resources such as bead strings, counters, multilink, Numicon. Counting Critters<br>Pictorial resources such as: | Doubling<br>Counting in multiples<br>Repeated addition<br>Arrays showing commutative multiplication<br><br>Representations include (but not limited to): concrete resources such as<br>Pictorial resources such as: | Counting in multiples<br>Repeated addition<br>Arrays showing commutative multiplication<br><br>Representations include (but not limited to): concrete resources such as<br>Pictorial resources such as: | Formal column short multiplication<br>Formal column long multiplication<br><br>Representations include (but not limited to): concrete resources such as<br>Pictorial resources such as: |

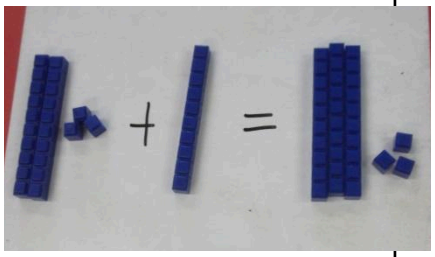
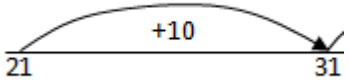
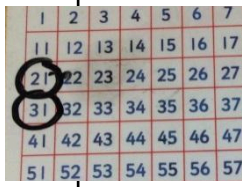
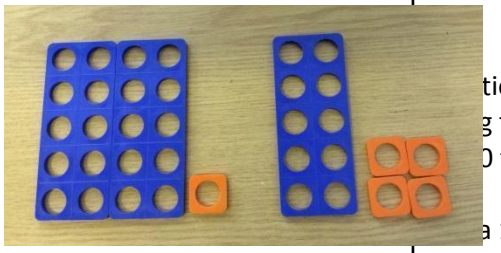
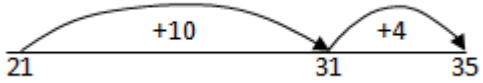
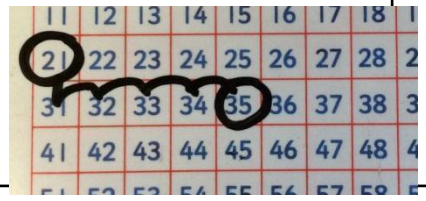
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| **Division** | Sharing objects into groups<br>Division as grouping<br><br>Representations include (but not limited to): concrete resources such as<br>Pictorial resources such as: | Sharing objects into groups<br>Division as grouping<br>Division within arrays<br><br>Representations include (but not limited to): concrete resources such as<br>Pictorial resources such as: | Division within arrays<br>Division with a remainder<br><br>Representations include (but not limited to): concrete resources such as<br>Pictorial resources such as: | Division with a remainder (including to 2 decimal places: Y5/6)<br>Formal Short division<br>Formal Long division<br><br>Representations include (but not limited to): concrete resources such as<br>Pictorial resources such as: |

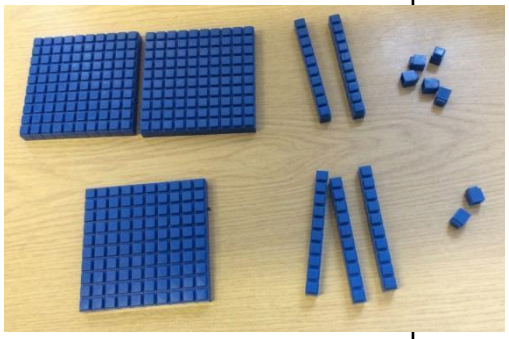
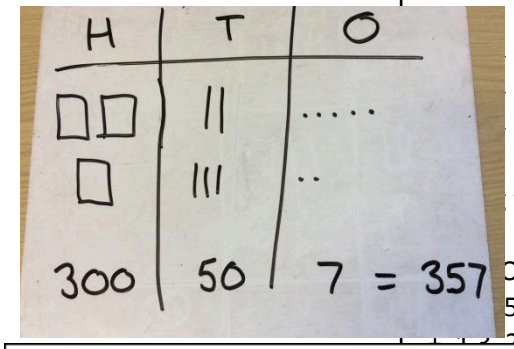
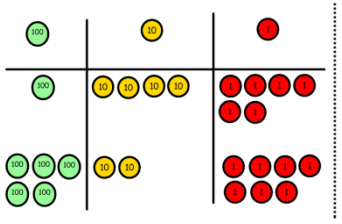
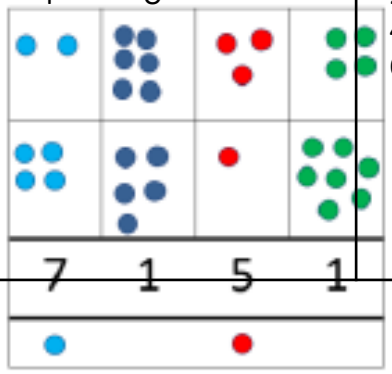
# ADDITION

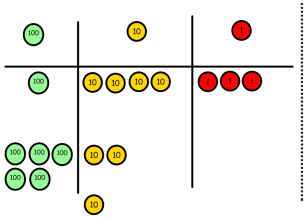
| CONCEPT | CONCRETE | PICTORIAL | ABSTRACT |
|---|---|---|---|
| Combine groups of objects and count to find out how many 'altogether'. |      Use cubes to add two numbers together as a group or in a bar. |        Use pictures to add two numbers together as a group or in a bar. | 4 + 3 = 7<br><br>10= 6 + 4   Use the part-part whole diagram a shown above to into the abstract recording as num sentences using = signs. |
| Find 1 more than a number. |  Use cubes to find 1 more than an amount. | 3 4 5  | 3 is 4. <br> and numbers to make number <br> te this to number sentences with + <br> Use a numberline to count on 1. |
| Start at the bigger number and count on. |  Start with the larger number on the bead string and then count on to the smaller number 1 by 1 to find the answer. | 13 <br> ith the biggest number on the numberline <br> unt on in ones to find the answer.   | 5+12=17 <br><br> Place the larger number in your head and count on the smaller number to find your answer. |

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| | | Draw a bar model to represent the addition, counting on in ones.<br> | 12+5=17 |
| Understand the meaning of the = sign as an indication of 2 equal groups or a balance. |  | <br><br>Use of bar model or tens frame to show equivalence. | Number sentences involving missing numbers and equations on each side of the equals sign:<br>3 + = 12 ☐<br>14 = + 6 ☐<br>3 + 9 = 5 + ☐ |
| Recognise that addition is commutative (can be done in any order). | Using objects to demonstrate that<br>4+3 = 7 can also show 3+4 = 7<br> | <br>Use pictures to represent that 4+3 is the same as 3+4 by grouping both ways. | If I know 7+5 = 12, I also know that 5+7 = 12 |

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| Regrouping to make 10 (using number bonds to 10). | 6 + 5 = 11<br><br>Start with the bigger number and use the smaller number to make 10.<br>9 + 3 = 12<br> | 6 + 5 = 11<br><br>…s or a number line. Regroup or partition the smaller number to make 10.<br> | 7 + 4= 11<br>If I am at seven, how many more do I need to make 10. How many more do I add on now? |
| Adding 3 single digit numbers. | 4 + 7 + 6= 17<br><br>Following on from making 10, make 10 with 2 of the digits (if possible) then add on the third digit. | 3 + 5 + 7 = 15<br>Regrouped as (3+7) + 5<br><br>Add together three groups of objects. Draw a picture to recombine the groups to make 10. | <br>Combine the two numbers that make and then add on the remainder. |
| Adding 10 to any number. | 23 + 10 = 33<br>Using numicon or base 10:<br> | Use a numberline to jump on 10 and write the answer. | 34 + 10 = 44 |

| | | | |
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| |  | <br>Use a 100 square to add 10 to a number and explore the effects it has.<br> | Understand that adding 10 increases the 'tens' number and calculate this mentally. |
| Add two 2-digit numbers by counting on from the larger number, partitioning the smaller number in tens and ones. | 21 + 14 using numicon – count on 10 from 21 and then on 4 in ones.<br><br>Base 10 can also be used to demonstrate this. | 21 + 14 = 35<br><br>tion the 14 into 10+4<br>g the numberline to start at 21 then jump<br>0 then 4.<br><br>a 100 square to add 10 then 4 more.<br> | 21 + 14<br>21 + 10 + 4<br>31 + 4 = 35 |

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| Using a formal column method with no regrouping. | 225 + 132 = 357<br><br>Add together the ones first then add the tens. Use the Base 10 blocks first before moving onto place value counters. | 225 + 132 = 357<br><br><br>After practically using the base 10 blocks and place value counters, children can use a visual representation by drawing to help them to solve addition equations. | 225 +132 =<br>20 + 5<br>30 + 2<br>50 + 7 = 357<br>to:<br>O<br>5<br>2<br>l write the headings over the til secure with place value eds, T – tens, O – ones). |
| Using a formal column method with regrouping. | Make both numbers on a place value grid.<br><br>Add up the units and exchange 10 ones for one 10. | Children can draw a pictorial representation of the columns and place value counters to further support their learning and understanding.<br>Th H T O<br><br> | Start by partitioning the numbers before moving on to clearly show the exchange below the addition.<br>T O<br>20 + 5<br>40 + 8<br>60 + 13 = 73 |



146
+ 527

Add up the rest of the columns, exchanging the 10 counters from one column for the next place value column until every column has been added.

This can also be done with Base 10 to help children clearly see that 10 ones equal 1 ten and 10 tens equal 100.

As children move on to decimals, money and decimal place value counters can be used to support learning.

| H | T | O |
|---|---|---|
| 300 | + 20 | + 5 |
| 100 | + 40 | + 8 |
| 400 | + 60 | + 13 = 473 |

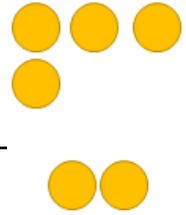
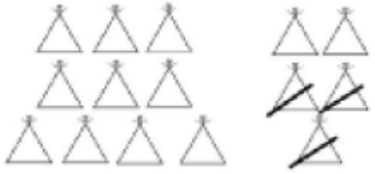
Moving on to compact formal addition

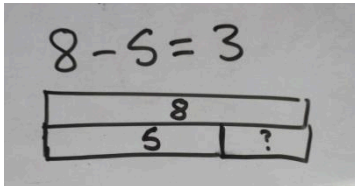
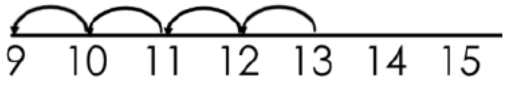
789 + 642 becomes

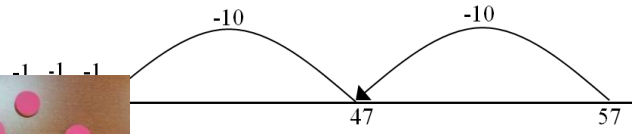
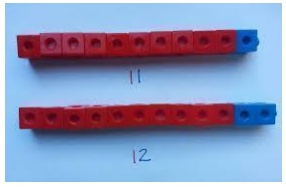
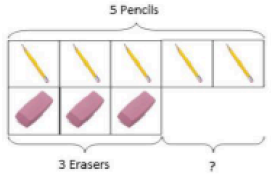
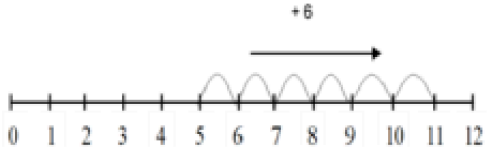
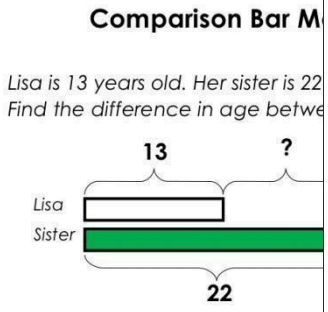
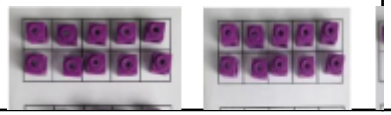
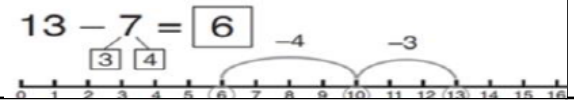
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|---|---|---|---|
| | **7** | **8** | **9** |
| **+** | **6** | **4** | **2** |
| **1** | **4** | **3** | **1** |
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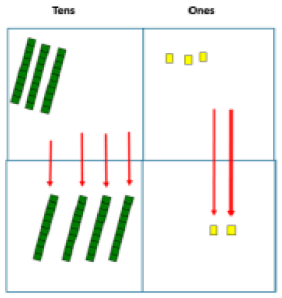
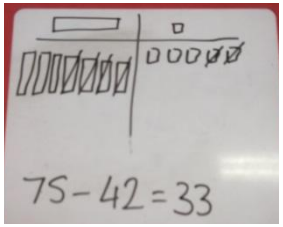
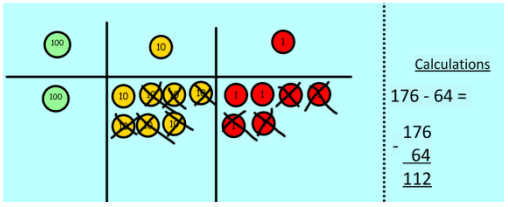
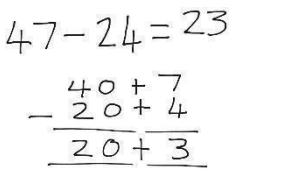
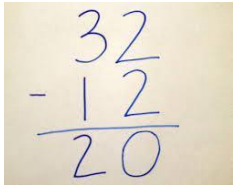
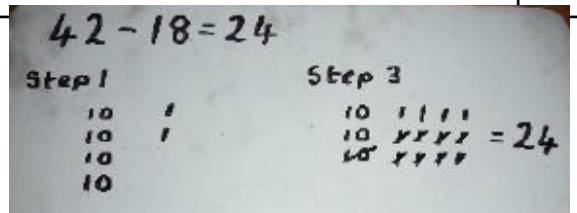
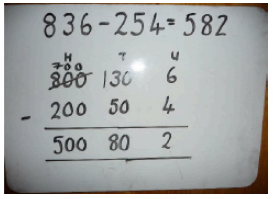
Answer: 1431

## SUBTRACTION

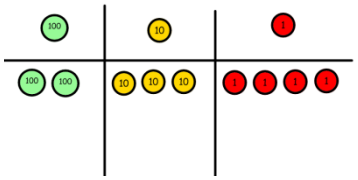
| CONCEPT | CONCRETE | PICTORIAL | ABSTRACT |
|---|---|---|---|
| Taking away ones | Use objects to count out an amount and take an amount of objects away.  | Draw an amount of objects and cross out the ones to be taken away.  15 – 3 = 12 | Written number sentences:<br>8 – 5 = 3<br>8 – 3 = 5   Use the part-pa whole diagram shown above t into the abstra recording as nu sentences usin signs and linkin addition. |

| | | | |
|---|---|---|---|
| | | Drawing a bar model:<br><br> | |
| Finding 1 less than a number. | <br>Use cubes to find 1 less than an amount. | 3 4 5<br>Use a numberline to count back 1. | 1 less than 9 is 8.<br>1 less than 3 is 2.<br>Use word cards and numbers to m number sentences. Relate this to number sentences with - and = |
| Counting back | Make the larger number in your subtraction. Move the beads along your bead string as you count backwards in ones.<br><br>13 – 4 | Count back on a number line<br><br> | Put 13 in your head, count back 4. What number are you at? Use your fingers to help. |

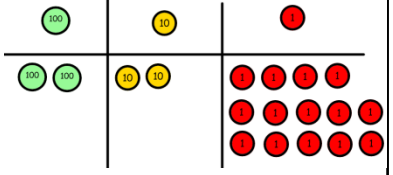
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|---|---|---|---|
| | Use counters and move them away from the group as you take them away counting backwards as you go.<br> | Start at the bigger number and count back the smaller number showing the jumps on the number line.<br><br>…ress all the way to counting back using two 2 digit numbers. | |
| Find the difference | Compare amounts and objects to find the difference.<br><br>Use cubes to build towers make bars to find the difference<br><br>or<br><br>Use basic bar models with items to find the difference<br> | Count on to find the difference.<br><br><br>Draw bars to find the difference between 2 numbers.<br> | Understand subtraction as ‘finding the difference’ and by ‘how many more to make…?’ questions.<br>I need 12 apples but I only have 8. How many more do I need? |
| Bridging the 10 (using number bonds) | 14 – 5 =<br>Make 14 on the ten<br> | Start at 13.<br>Take away 3<br> | 16 – 8= |

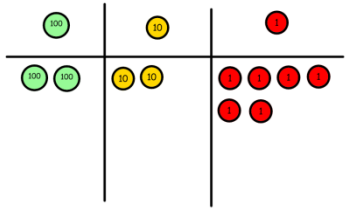
| | | | |
|---|---|---|---|
| | frame. Take away the four first to make 10 and then takeaway one more so you have taken away 5. You are left with the answer of 9. | to reach 10. Then take away the remaining 4 so you have taken away 7 altogether. You have reached your answer. | How many do we take off to reach the next 10?<br><br>How many do we have left to take off? |
| Column method without regrouping | 75-42 =<br>Use Base 10 to make the bigger number then take the smaller number away.<br><br>Show how you partition numbers to subtract. Again make the larger number first.<br> | Draw the Base 10 or place value counters alongside the written calculation to help to show working.<br><br> | <br>This will lead to a clear written column subtraction.<br> |
| Column method with regrouping | Use Base 10 to start with before moving on to place value counters. Start with one exchange before moving onto subtractions with 2 exchanges.<br><br>Make the larger number with the place value counters | When confident, children can find their own way to record the exchange/regrouping.<br><br>Just writing the numbers as shown here shows that the child understands the method and knows when to exchange/regroup.<br> |  |

Start with the ones, can I take away 8 from 4 easily? I need to exchange one of my tens for ten ones.



Now I can subtract my ones.



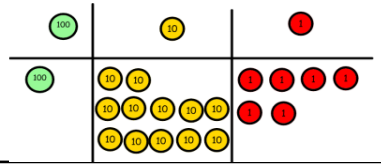


Calculations

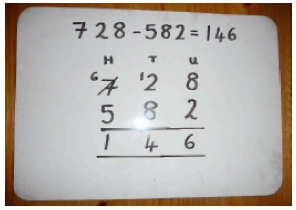
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- 88

Now look at the tens, can I take away 8 tens easily? I need to exchange one hundred for ten tens.

Now I can take away



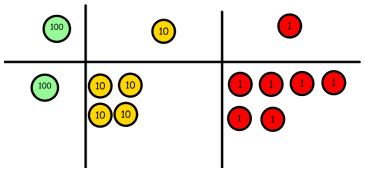
Children can start their formal written method by partitioning the number into clear place value columns.



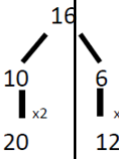
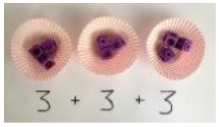
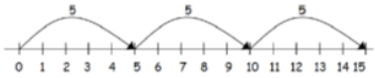

Moving forward the children use a more compact method.

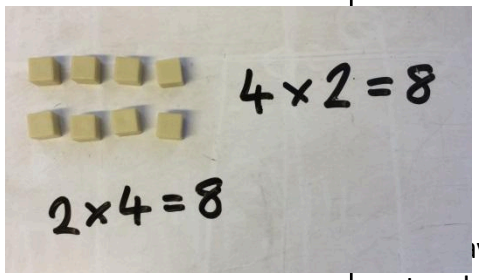
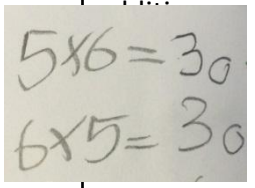
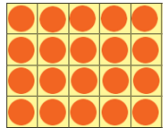
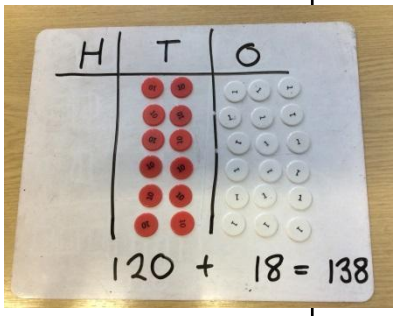
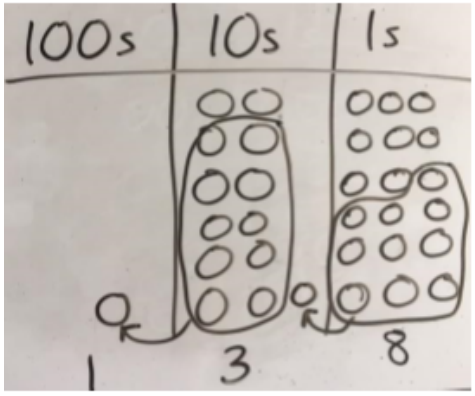
This will lead to an understanding of subtracting any number including decimals.

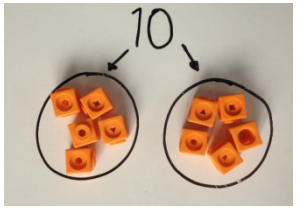
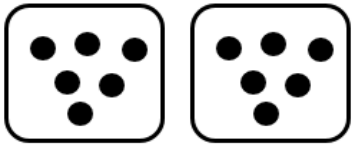
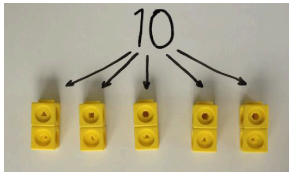
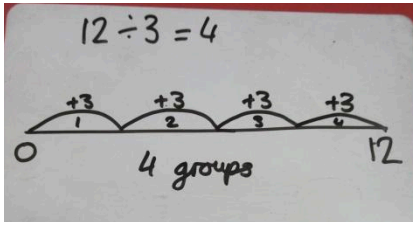
$$\begin{array}{r} \phantom{-}\ 5\ \ 12 \\ 2\ \not{6}\ \not{3} \\ -\ \ 2\ \ 6 \\ \hline 2\ \ 3\ \ 6 \end{array}$$

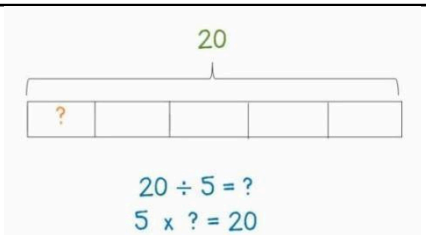
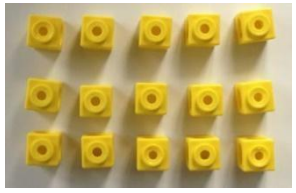
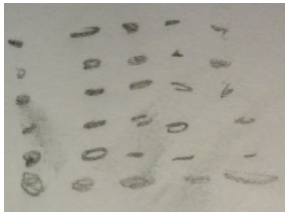
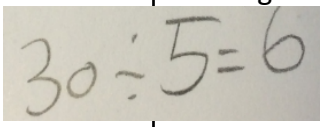
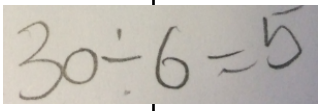
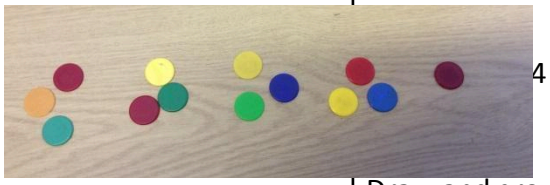
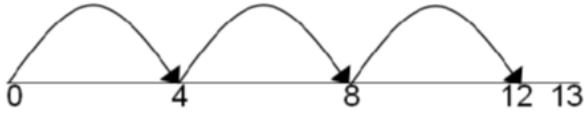
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| | eight tens and complete my subtraction<br><br><br>Show children how the concrete method links to the written method alongside your working. Cross out the numbers when exchanging and show where we write our new amount. | | |

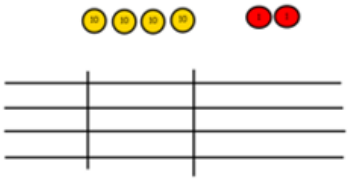
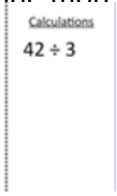
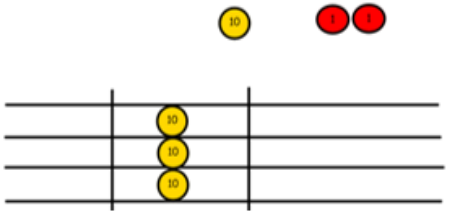
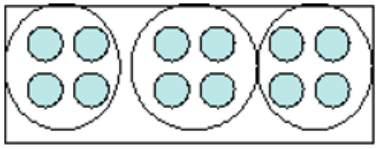
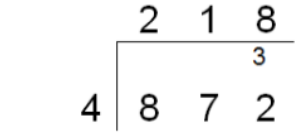
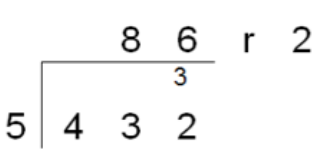
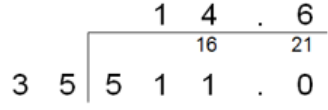
| MULTIPLICATION | | | |
|---|---|---|---|
| CONCEPT | CONCRETE | PICTORIAL | ABSTRACT |

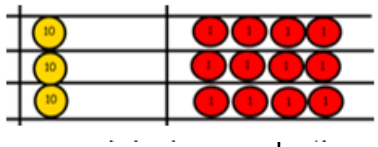
| | | | |
|---|---|---|---|
| Doubling |  s 10 | Draw pictures to represent doubles:<br> is 10 | Double 16 is 32<br><br>Partition a 2 digit number, double each part then re-combine. |
| Counting in multiples | <br><br>Counting in multiples using concrete objects to support. | <br>Counting in multiples using a numberline or pictures to support. | Count in multiples of a number aloud.<br>Write sequences with multiples of numbers.<br>, 6, 8, 10<br>0, 10, 15, 20, 25 , 30 |
| Repeated addition | <br><br><br>Use objects to show addition of equal groups. | There are 3 plates and each has 2 biscuits on – how many biscuits are there altogether?<br><br><br>15<br>Repeated addition linked to multiplication by drawing pictures or a numberline. | Write repeated addition sentences and link to multiplication sentences:<br>3 + 3 + 3 + 3 = 12<br>3 x 4 = 12 |

| | | | |
|---|---|---|---|
| Arrays- showing commutative multiplication | Create arrays using objects to show multiplication.<br> | Draw arrays in different rotations to represent multiplication sentences<br><br><br>ys to finding the area of rectangles.<br> | Use an array to write multiplication sentences and link to repeated<br><br>3 + 3 + 3 + 3 = 15<br>5 = 15 |
| Column multiplication | Children can continue to be supported by place value counters at the stage of multiplication.<br>23 x 6:<br><br>It is important at this stage that they always multiply the ones first and note | Children can draw to represent the place value counters:<br>23 x 6:<br> | Start with long multiplication, remind the children about lining up their numbers clearly in columns<br>ildren can write out what they are to their answer:<br>32<br>x 24<br>8 (4 x 2)<br>120 (4 x 30)<br>40 (20 x 2)<br>600 (20 x 30)<br>768<br>to the more compact method:<br>2 3 1<br>1342<br>x 18<br>13420<br>10736<br>24156<br>1 |

| | | | |
|---|---|---|---|
| | down their answer followed by the tens which they note below. | | |
| **DIVISION** | | | |
| CONCEPT | CONCRETE | PICTORIAL | ABSTRACT |
| Sharing objects into groups |  Use objects to share into equal groups. | Children draw pictures, sharing them into equal amounts.  10 ÷ 2 = 5 | Move into the abstract, solving number sentences and division problems: 10 ÷ 2 = 5 |
| Division as grouping | Divide objects into equal groups.  10 ÷ 5 = 2  | Use a number line to show jumps in groups. The number of jumps equals the number of groups. 12 ÷ 3 = 4  Think of the bar as a whole. Split it into the number of groups you are dividing by and work out how many would be within each group. | Move into the abstract, solving problems such as: Divide 28 into 7 groups. How many are in each group? 28 ÷ 7 = 4 |

| | | | |
|---|---|---|---|
| | 96 ÷ 3 = 32 |  | |
| Division within arrays | Link division to multiplication by using an array and thinking about the division sentences that can be created:<br> | Draw an array and use this to create division sentences:<br><br><br> | Find the inverse of multiplication by creating 4 linking number sentences: |
| Division with a remainder | Use objects to divide into groups and see how many are left over:<br>13 ÷ 4 = 3r1<br> | Use a numberline to jump and see how many left over:<br><br>4 = 3r1<br>Draw and group pictures / spots and see how many left over:<br> | Solve written number sentences and problems:<br>÷ 8 = 3r5 |

| | | | |
|---|---|---|---|
| | | 14 ÷ 4 = 3r2 | |
| Short division | The adult can demonstrate short division using place value counters:<br><br>42 ÷ 3<br><br><br><br><br><br>Starting with the largest place value we are putting 40 into 3 groups. We can put 1 ten in each group and we have 1 ten left over:<br><br> | Children continue to draw pictures or dots to help them divide numbers into equal groups.<br><br>Encourage them to move to counting in multiples to divide more efficiently.<br><br> | Begin with divisions that divide equally with no remainder:<br><br><br><br><br>Move on to divisions with a remainder:<br><br><br><br><br>Finally move into decimal places:<br><br><br> |

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|---|---|---|---|
| | We exchange this ten for ones and share the ones into the 3 groups:<br><br>We can see there is 14 in each group so<br>42 ÷ 3 = 14 | | |