# Woodloes Primary School

## Calculation Policy

A guide for teachers and parents: developing children's number sense in mental and written calculation

This policy has been largely adapted from the White Rose Maths Hub Calculation Policy with further material added. It is a working document and will be revised and amended as necessary. Progression within each area of calculation is in line with the programme of study in the 2014 National Curriculum. This calculation policy should be used to support children to develop a deep understanding of number and calculation. This policy has been designed to teach children through the use of concrete, pictorial and abstract representations.

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# Rationale

It is the intention of this document that the progression in strategies taught is understood alongside the central aim of developing 'number sense': nurturing children's ability to be flexible with using number. It is important then that the policy is not seen as a series of methods to be 'got through', but rather, guidance for strategies that may be used in service of this wider aim. As such, not every stepped approach will be necessary for every child. However, if a child is finding a particular strategy challenging, this may equally signify a conceptual misconception to be addressed. In effective maths learning, procedural fluency in a method must be accompanied by a conceptual understanding of its meaning. As such, standard formal written methods such as 'short division' or 'column method' can be problematic if not fully understood. It is for this reason that written methods must be based on solid foundations of mental strategies, which in turn are supported through the use of manipulatives, images, models and representations.

An established aim of the new mathematics curriculum is that children should learn to reason, explain and justify the types of maths they use by explaining not just what they are doing, but why and how the particular strategy works. Talk and reasoning should therefore be considered as a fundamental part of learning to calculate. The policy of Woodloes Primary is that manipulatives, images, models or representations should be available to children throughout primary school.

**Age stage expectations**

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

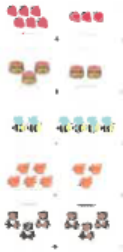
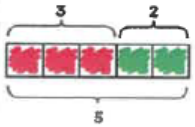
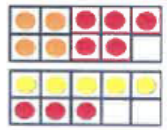
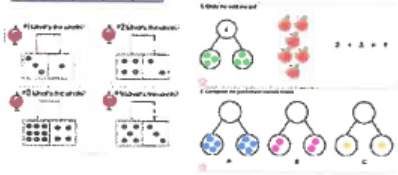
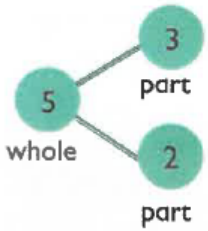
## Main Principles for EYFS

In the statutory framework for EYFS, an Early Learning Goal; is the standard children are expected to achieve by the end of their reception year. The ELG relevant t calculations is Number:

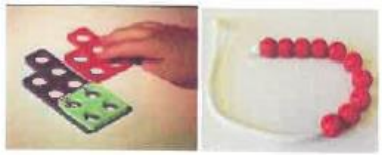
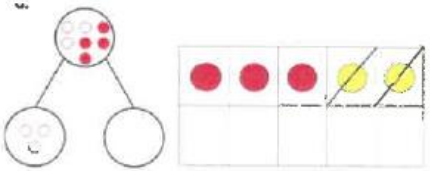
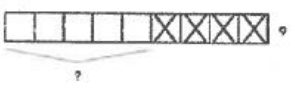
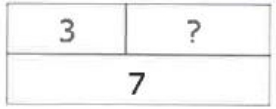
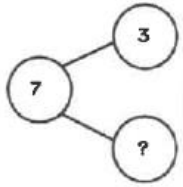
- Have a deep understanding of number to 10, including toe composition of each number.
- Subitise (recognise quantities without counting) up to 5.
- Automatically recall (without reference to rhymes, counting or other aids) number bonds up to 5 (including subtraction facts) and some up to 10.

Calculations will be taught in a purposeful, practical way and children will use play and exploration to acquire the relevant mathematical skills to solve them. A large majority of mathematical work is practical, and learning will happen in many different contexts around the indoor and outdoor provision. Some mathematical concepts relating to calculation will be adult/teacher led and children can also freely explore these concepts through a variety of different activities and resources set up each day. Learning is repeated using different resources and representations to embed understanding.

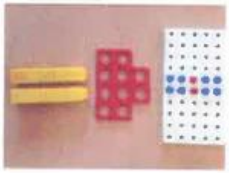
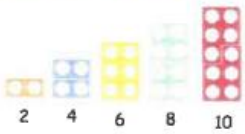
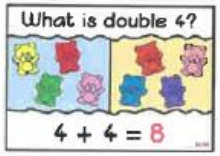
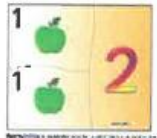
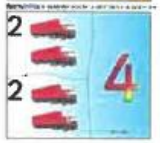
## Addition- EYFS

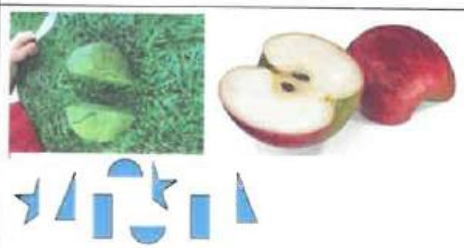
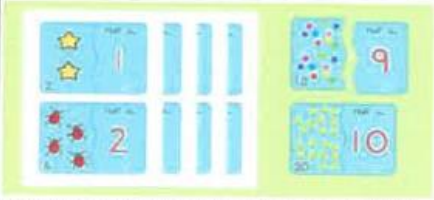
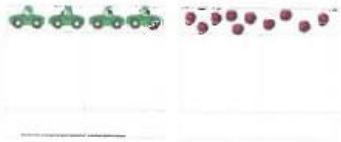
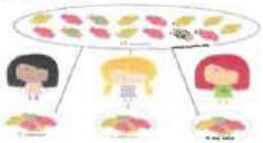
| Objectives | Concrete | Pictorial | Abstract |
|---|---|---|---|
| Knows that a group of things change in quantity when something is added.<br><br>Find the total number of items in two groups by counting all of them.<br><br>Says the number that is one more than a given number.<br><br>Finds one more from a group of up to five objects, then ten objects.<br><br>In practical activities and discussion, beginning to use the vocabulary involved in adding.<br><br>Using quantities and objects, they add two single digit numbers and count on to find the answer.<br><br>Solve problems including doubling. | <br>Use toys and general classroom resources for children to physically manipulate, group/regroup.<br><br> <br>Use specific maths resources such as counters, snap cubes, Numicon etc.<br><br> <br> <br>Use visual supports such as ten frames, part part whole and addition mats, with the physical objects and resources that can be manipulated. |  <br> <br>Two groups of pictures so children are able to count the total.<br><br>  <br>Bar model using visuals, pictures/icons or colours.<br><br> <br>  <br>Use visual supports such as ten frames, part part whole and addition mats with pictures/icons.<br><br>  | A focus on symbols and numbers to form a calculation.<br><br>5+2=7<br><br>  <br><br><br> |

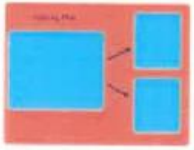
## Subtraction- EYFS

| Objectives | Concrete | Pictorial | Abstract |
|---|---|---|---|
| Knows that a group of things change in quantity when something is taken away<br><br>Find one less from a group of five objects, then ten objects.<br><br>In practical activities and discussion, beginning to use the vocabulary involved in subtracting.<br><br>Using quantities and objects, they subtract two single digit numbers and count back to find the answer. | <br>Use toys and general classroom resources for children to physically manipulate, group/regroup.<br> <br>  <br>Use specific maths resources such as snap cubes, Numicon, bead strings etc.<br> <br>Use visual supports such as ten frames, part part whole and subtraction mats, with the physical objects and resources that can be manipulated. | <br> <br>6 - 4 =<br> <br>3 - 1 =<br> <br>5 - 3 =<br> <br>7 - 2 =<br>A group of pictures for children to cross out or cover quantities to support subtraction.<br>  <br>  <br>Use visual supports such as ten frames, part part whole and bar model with pictures/icons. | A focus on symbols and numbers to form a calculation.<br> <br>10 - 6 = 4<br>  <br>7 - 3 = ?<br>  |

## Multiplication-EYFS

| Objectives | Concrete | Pictorial | Abstract |
|---|---|---|---|
| Solve problems including doubling |    Counting and other maths resources for children to make 2 equal groups. Physical and real life examples that encourage children to see concept of doubling as adding two equal groups. |      Pictures and icons that encourage children to see concept of doubling as adding two equal groups. | 1+1= 7+7=<br>2+2= 8+8=<br>3+3= 9+9=<br>4+4= 10+10=<br>5+5= 11+11=<br>6+6= 12+12=<br>Addition calculations to model adding two equal groups. |

| Division- EYFS | | | |
|---|---|---|---|
| **Objectives** | **Concrete** | **Pictorial** | **Abstract** |
| Solve problems including halving and sharing.<br><br>Halving a whole, halving a quantity of objects.<br><br>Sharing a quantity of objects. |  <br>Children have the opportunity to physically cut objects, food or shapes in half. |  <br>Pictures and icons that encourage children to see concept of halving in relation to subitising, addition and subtraction knowledge. i.e. Knowing 4 is made of 2 groups of 2, so half of 4 is 2.<br>  <br>Bar model with pictures or icons to support understanding of finding 2 equal parts of a number, to further understand how two halves make a whole.<br>  <br>Pictures for children to create and visualise 3 or more | |



Use visual supports such as halving mats and part part whole with the physical objects and resources that can be manipulated

Counting and other maths resources for children to explore sharing between 3 or more

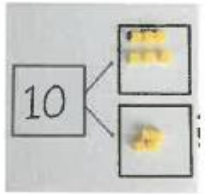
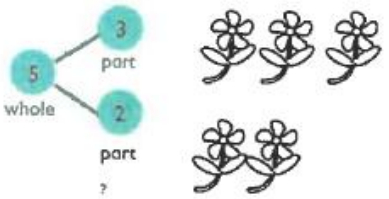
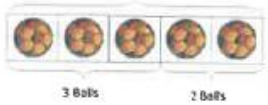
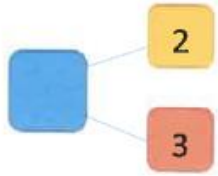
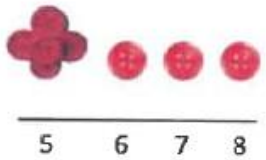
Counting and other maths resources for children to share into two equal groups.

| Key Stage One | | |
|---|---|---|
| Children in Years 1 and 2 will be given a really solid foundation in the basic building blocks of mental and written arithmetic. Through being taught place value, children will develop an understanding of how numbers work, so that they are confident with 2-digit numbers and beginning to read and say numbers above 100. | | |
| **Addition and Subtraction:** A focus on number bonds, first via practical hands-on experiences and subsequently using memorisation techniques, enables a good grounding in these crucial facts, and ensures that all children leave Year 2 knowing the pairs of numbers which make all the numbers up to 10 at least. Children will also have experienced and been taught pairs to 20. Children's knowledge of number facts enables them to add several 1-digit numbers, and to add/subtract a 1-digit number to/from a 2-digit number. Another important conceptual tool is the ability to add/subtract 1 or 10, and to understand which digit changes and why. This understanding is extended to enable children to add and subtract multiples of 10 to and from any 2-digit number. The most important application of this knowledge is the ability to add or subtract any pair of 2-digit numbers by counting on or back in 10s and 1s. Children may extend this to adding by partitioning numbers into 10s and 1s. | **Multiplication and Division:** Children will be taught to count in 2s, 3s, 5s and 10s, and will relate this skill to repeated addition. Children will meet and begin to learn the associated ×2, ×3, ×5 and ×10 tables. Engaging in a practical way with the concept of repeated addition and the use of arrays enables children to develop a preliminary understanding of multiplication, and asking them to consider how many groups of a given number make a total will introduce them to the idea of division. Children will also be taught to double and halve numbers, and will thus experience scaling up or down as a further aspect of multiplication and division. | **Fractions:** Fractions will be introduced as numbers and as operators, specifically in relation to halves, quarters and thirds. |

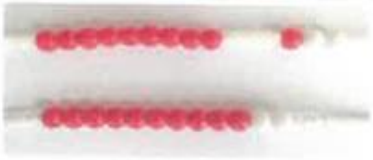
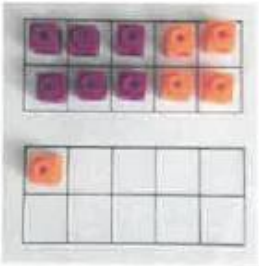
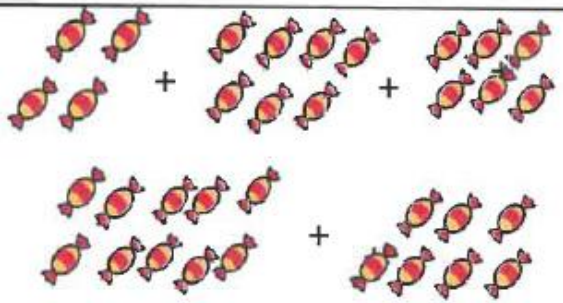
| LOWER KEY STAGE 2 | | |
|---|---|---|
| In Lower Key Stage 2, children build on the concrete and conceptual understandings they have gained in Key Stage 1 to develop a real mathematical understanding of the four operations, in particular developing arithmetical competence in relation to larger numbers. | | |
| **Addition and subtraction:** Children are taught to use place value and number facts to add and subtract numbers mentally and they will develop a range of strategies to enable them to discard the 'counting in 1s' or fingers-based methods of Key Stage 1. In particular, children will learn to add and subtract multiples and near multiples of 10, 100 and 1000, and will become fluent in complementary addition as an accurate means of achieving fast and accurate answers to 3-digit subtractions. Standard written methods for adding larger numbers are taught, learned and consolidated, and written column subtraction is also introduced. | **Multiplication and division:** This key stage is also the period during which all the multiplication and division facts are thoroughly memorised, including all facts up to 12 × 12. Efficient written methods for multiplying or dividing a 2-digit or 3-digit number by a 1-digit number are taught, as are mental strategies for multiplication or division with large but 'friendly' numbers, e.g. when dividing by 5 or multiplying by 20. | **Fractions and decimals:** Children will develop their understanding of fractions, learning to reduce a fraction to its simplest form, as well as finding non-unit fractions of amounts and quantities. The concept of a decimal number is introduced and children consolidate a firm understanding of 1-place decimals, multiplying and dividing whole numbers by 10 and 100. |

| UPPER KEY STAGE 2 | | |
|---|---|---|
| Children move on from dealing mainly with whole numbers to performing arithmetic operations with both decimals and fractions. | | |
| **Addition and subtraction:** Children will consolidate their use of written procedures in adding and subtracting whole numbers with up to 6 digits and also decimal numbers with up to 2 decimal places. Mental strategies for adding and subtracting increasingly large numbers will also be taught. These will draw upon children's robust understanding of place value and knowledge of number facts. Negative numbers will be added and subtracted. | **Multiplication and division:** Efficient and flexible strategies for mental multiplication and division are taught and practised, so that children can perform appropriate calculations even when the numbers are large, such as *40 000 × 6* or *40 000 ÷ 8*. In addition, it is in Years 5 and 6 that children extend their knowledge and confidence in using written algorithms for multiplication and division. | **Fractions, decimals, percentages and ratio:** Fractions and decimals are also added, subtracted, divided and multiplied, within the bounds of children's understanding of these more complicated numbers. Children will also calculate simple percentages and ratios. |

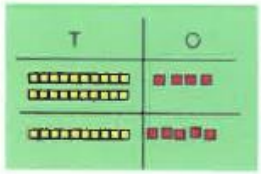
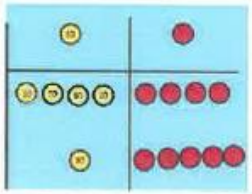
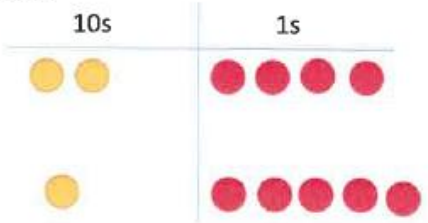
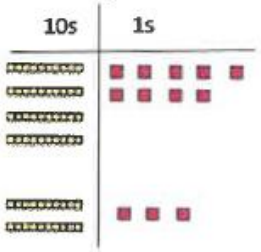
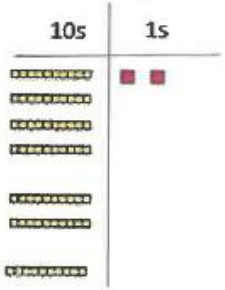
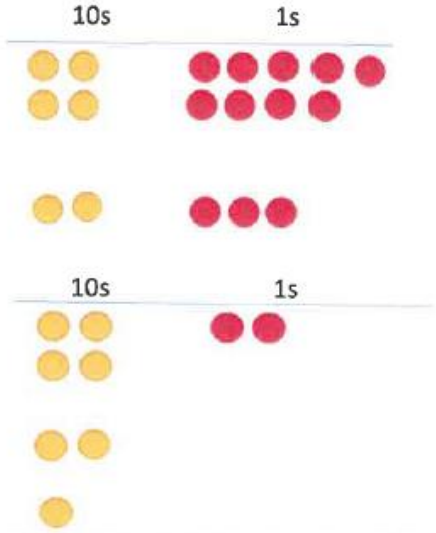
# Calculation Guidance: Addition

| | Objective | Concrete | Pictorial | Abstract |
|---|---|---|---|---|
| Year 1 | Number bonds of 5, 6, 7, 8, 9 and 10 |  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. | 2 + 3 = 5<br>3 + 2 = 5<br>5 = 3 + 2<br>5 = 2 + 3   Use the part-part-whole diagram as shown above to move into the abstract. |
| | Counting | Start with the larger number on the bead string and then count on to the smaller number 1 by 1 to find the answer.   | Use a number line to count on in ones. | 5 + 3 = 8 |

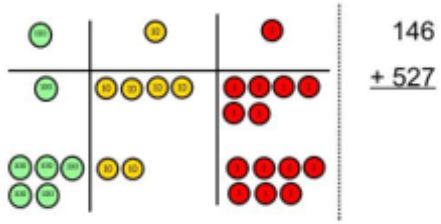
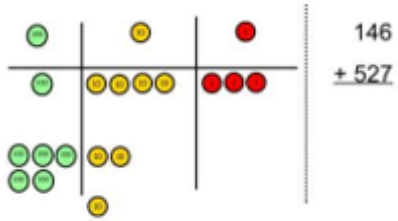
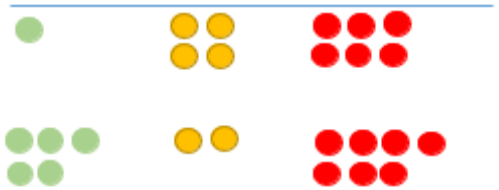
# Calculation Guidance: Addition

| | Objective | Concrete | Pictorial | Abstract |
|---|---|---|---|---|
| Year 1 | Regrouping to make 10 |  <br>  <br>6 + 5 = 11<br>Start with the bigger number and use the smaller number to make 10. | <br>6 + 5 = 11<br>4 1<br>6 + 4 =10<br>10 + 1 = 11 | 6 + 5 = 11 |
| Year 2 | Adding 3 single digit numbers | 4 + 7 + 6= 17<br>Put 4 and 6 together to make 10. Add on 7.<br> <br>Following on from making 10, make 10 with 2 of the digits (if possible) then add on the third digit. |  <br>Add together three groups of objects. Draw a picture to recombine the groups to make 10. | 4 + 7 + 6 = 10 + 7<br>10<br>= 17<br>Combine the two numbers that make 10 and then add on the remainder. |

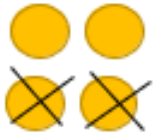
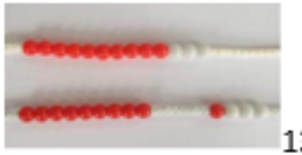
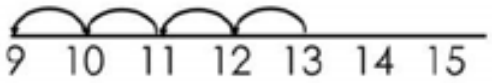
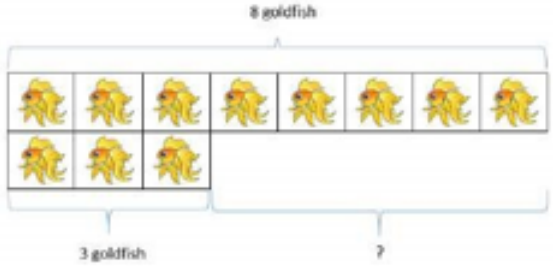
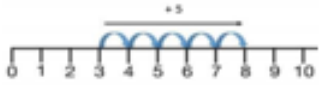
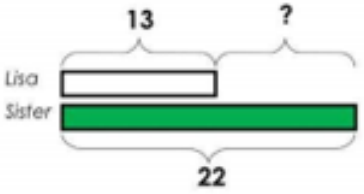
# Calculation Guidance: Addition

| | Objective | Concrete | Pictorial | Abstract |
|---|---|---|---|---|
| Year 2 | Column method without regrouping | Add together the ones first, then add the tens. Use the Base 10 blocks first before moving onto place value counters.<br>24 + 15 =<br>  <br><br>44 + 15 =<br>  | After physically using the base 10 blocks and place value counters, children can draw the counters to help them to solve additions.<br>  <br> | 24 + 15 = 39<br><br>24<br>+ 15<br>39 |
| | Column method with regrouping | Make both numbers on a place value grid.<br>  <br><br>Add up the units and exchange 10 ones for 1 ten.<br>  <br> | Using place value counters, children can draw the counters to help them to solve additions.<br>  <br> | 40 + 9<br>20 + 3<br>60 + 12 = 72 |

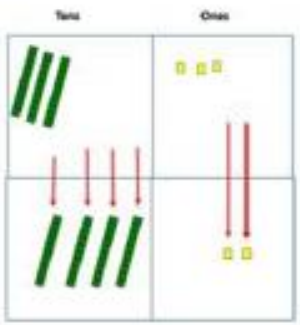
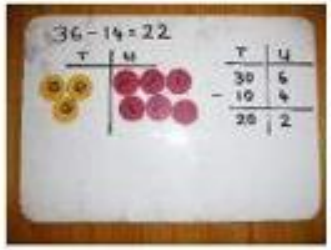
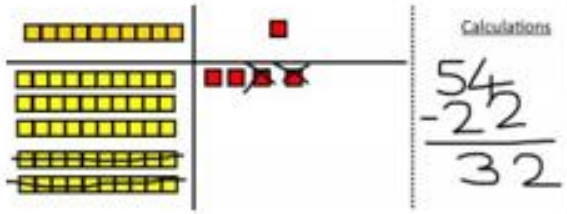
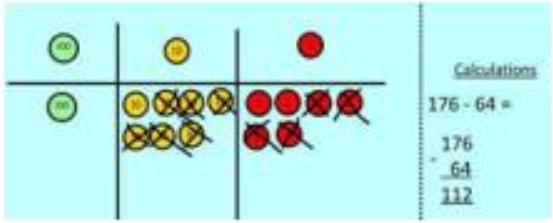
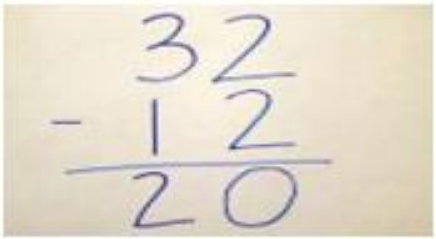
# Calculation Guidance: Addition

| | Objective | Concrete | Pictorial | Abstract |
|---|---|---|---|---|
| Year 3/4 | Column method with regrouping | Make both numbers on a place value grid.<br>  <br>146<br>+ 527<br><br>Add up the units and exchange 10 ones for 1 ten.<br>  <br>146<br>+ 527<br><br>As children move on to decimals, money and decimal place value counters can be used to support learning.<br>**NB** By Year 4 children will progress on to adding four-digit numbers. | 100s 10s 1s<br>  <br> <br>100s 10s 1s<br><br>Children can draw a pictorial representation of the columns and place value counters to further support their learning and understanding.<br>**NB** Addition of money needs to have £ and p added separately | 100 + 40 + 6<br>500 + 20 + 7<br>600 + 70 + 3 = 673<br><br>As the children progress, they will move from the expanded to the compacted method.<br><br>146<br>+ 527<br>673<br>**1 (Exchange under the calculation)**<br><br>As the children move on, introduce decimals with the same number of decimal places and different. Money can be used here. |
| Year 5/6 | Column method with regrouping | Consolidate understanding using numbers with more than 4 digits and extend by adding numbers with up to 3 decimal places. | | |

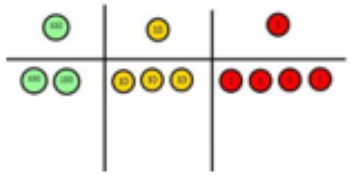
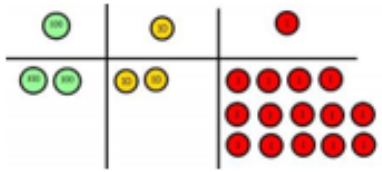
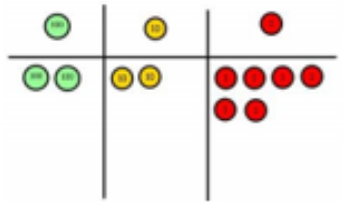
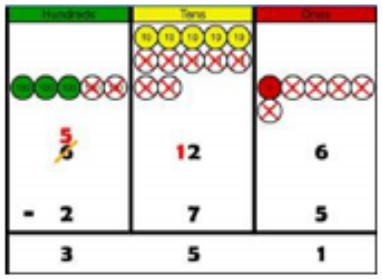
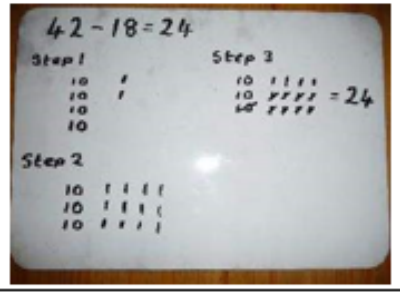
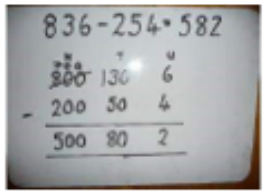
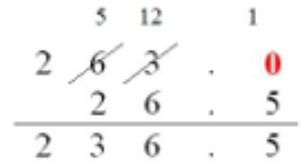
# Calculation Guidance: Subtraction

| | Objective | Concrete | Pictorial | Abstract |
|---|---|---|---|---|
| Year 1 | Taking away ones | Use physical objects, counters, cubes etc. to show how objects can be taken away.<br> <br>4 – 2 = 2 | Cross out drawn objects to show what has been taken away.<br>  <br>4 – 2 = 2 | 4 – 2 = 2 |
| | 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 = 9 | Count back on a number line or number track<br>  <br>Start at the bigger number and count back the smaller number, showing the jumps on the number line. | Put 13 in your head, count back 4. What number are you at?<br>Use your fingers to help. |
| | Find the difference | Compare amounts and objects to find the difference.<br>  <br>Use cubes to build towers or make bars to find the difference. Use basic bar models with items to find the difference. |  <br>Count on to find the difference.<br>*Lisa is 13 years old. Her sister is 22 years old. Find the difference in age between them.*<br>  <br>Draw bars to find the difference between 2 numbers. | Hannah has 8 goldfish.<br>Helen has 3 goldfish.<br>Find the difference between the number of goldfish the girls have. |

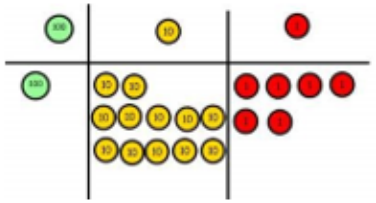
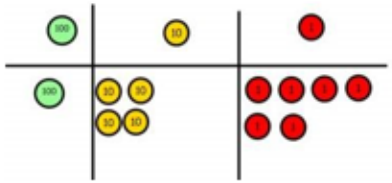
# Calculation Guidance: Subtraction

| | Objective | Concrete | Pictorial | Abstract |
|---|---|---|---|---|
| Year 2 | Column method without regrouping | 75 – 42 = 33<br>  <br>Use Base 10 to make the bigger number then take the smaller number away.<br><br>Show how you partition numbers to subtract.<br><br>Again make the larger number first.<br>  |  <br>Draw the Base 10 or place value counters alongside the written calculation to help to show working.<br>  | 47 – 24 = 23<br>40 + 7<br>– 20 + 4<br>20 + 3<br><br>This will lead to a clear written column subtraction.<br>  |

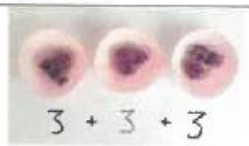
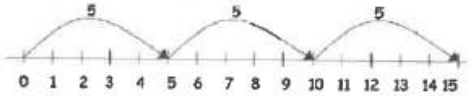
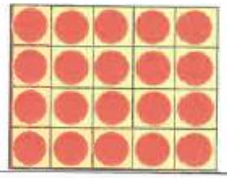
# Calculation Guidance: Subtraction

| | Objective | Concrete | Pictorial | Abstract |
|---|---|---|---|---|
| Year 3 onwards | 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<br>  <br>Calculations<br>234<br>- 88<br><br>Start with the ones, can I take away 8 from 4 easily? I need to exchange 1 of my tens for 10 ones.<br>  <br>Calculations<br>234<br>- 88<br><br>Now I can subtract my ones.<br>  <br>Calculations<br>234<br>- 88 |  <br>Draw the counters onto a place value grid and show what you have taken away by crossing the counters out as well as clearly showing the exchanges you make.<br><br>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>  |  <br>Children can start their formal written method by partitioning the number into clear place value columns.<br> <br>Moving forward the children use a more compact method.<br><br>This will lead to an understanding of subtracting any number including decimals.<br>  |

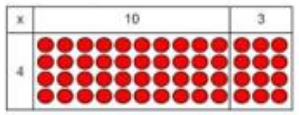
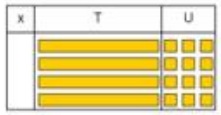
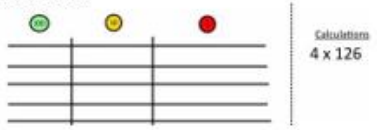
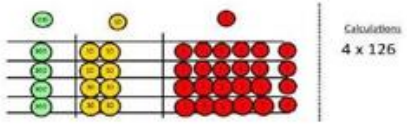
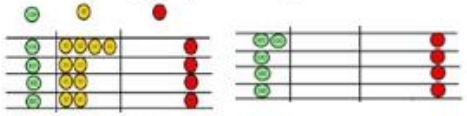
# Calculation Guidance: Subtraction

| | Objective | Concrete | Pictorial | Abstract |
|---|---|---|---|---|
| Year 3 onwards | Column method with regrouping | Now look at the tens, can I take away 8 tens easily? I need to exchange 1 hundred for 10 tens.<br>  <br>Calculations<br>234<br>- 88<br><br>Now I can take away 8 tens and complete my subtraction.<br>  <br>Calculations<br>~~234~~<br>- 88<br>146<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. | | |

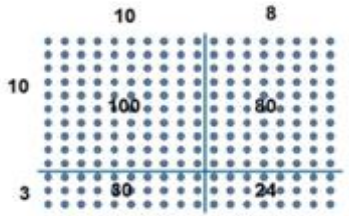
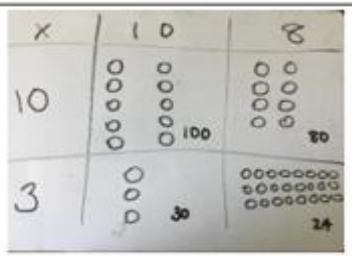
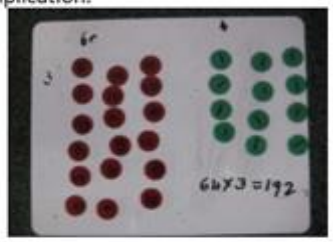
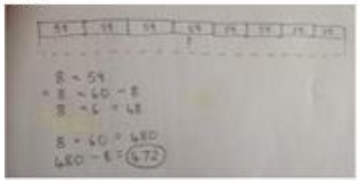
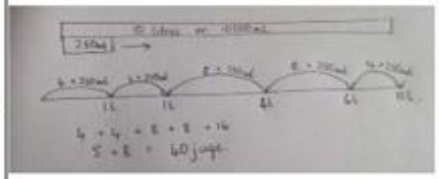
# Calculation Guidance: Multiplication

| | Objective | Concrete | Pictorial | Abstract |
|---|---|---|---|---|
| Year 1/2 | Repeated addition |  Use different objects to add equal groups. | There are 3 plates. Each plate has 2 star biscuits on. How many biscuits are there?  2 + 2 + 2 = 6  5 + 5 + 5 = 15 | Write addition sentences to describe objects and pictures. 2 + 2 + 2 = 6 |
| | Arrays- showing commutative multiplication | Create arrays using counters/cubes to show multiplication sentences. | Draw arrays in different rotations to find **commutative** multiplication sentences. 4 × 2 = 8 2 × 4 = 8 2 × 4 = 8 4 × 2 = 8 Link arrays to area of rectangles.  | Use an array to write multiplication sentences and reinforce repeated addition. 5 + 5 + 5 = 15 3 + 3 + 3 + 3 + 3 = 15 5 x 3 = 15 3 x 5 = 15 |

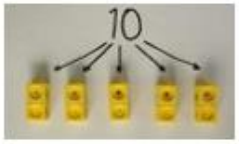
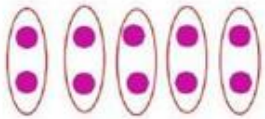
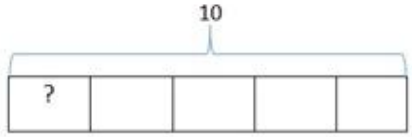
# Calculation Guidance: Multiplication

| | Objective | Concrete | Pictorial | Abstract |
|---|---|---|---|---|
| Year 3/4 | Multiplication Method |  4 rows of 10<br>4 rows of 3<br>Move on to using Base 10 to move towards a more compact method.<br>  4 rows of 13<br>Move on to place value counters to show how we are finding groups of a number. We are multiplying by 4 so we need 4 rows.<br>  <br>Fill each row with 126.<br>  <br>Add up each column, starting with the ones making any exchanges needed.<br>  <br>4 × 126 = 504 | Children can represent the work they have done with place value counters in a way that they understand.<br>They can draw the counters, using colours to show different amounts or just use circles in the different columns to show their thinking as shown below.<br>24x3=<br> | 5 × 28 =<br>20 8<br>x5 x5<br>100 + 40<br>140<br>5 × 28 = 140<br>20 8 |

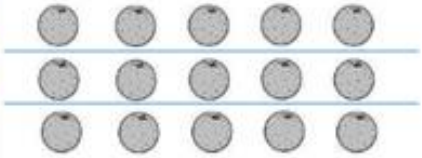
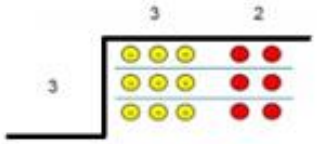
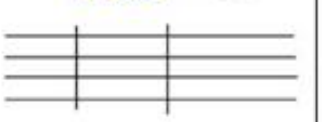
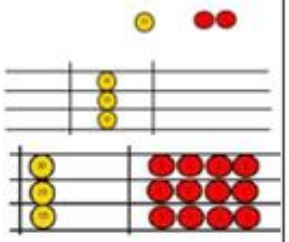
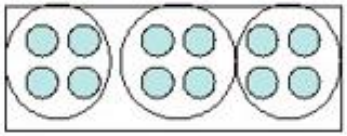
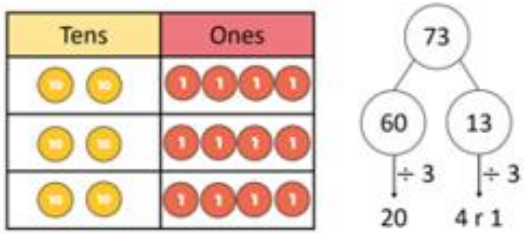
# Calculation Guidance: Multiplication

| | Objective | Concrete | Pictorial | Abstract |
|---|---|---|---|---|
| | Expanded method | Show the link with arrays to first<br>  <br><br>introduce the expanded method. |  <br> | Start with multiplying by one-digit numbers and showing the clear addition alongside the grid.<br>x \| 30 \| 5<br>7 \| 210 \| 35<br>210 + 35 = 245<br>Moving forward, multiply by a 2-digit number showing the different rows within the grid method.<br>10 \| 8<br>10 \| 100 \| 80<br>3 \| 30 \| 24<br>100+80+30+24=234 |
| Year 5/6 | Compact method | Children can continue to be supported by place value counters at the stage of multiplication.<br>  <br><br>It is important at this stage that they always multiply the ones first and note down their answer followed by the tens which they note below. | Bar modelling and number lines can support learners when solving problems with multiplication alongside the formal written methods.<br>  <br>  | Start with long multiplication, reminding the children about lining up their numbers clearly in columns.<br>If it helps, children can write out what they are solving next to their answer.<br>74 x 63<br>12<br>210<br>240<br>+ 4200<br>4662<br>This moves to the more compact method.<br>1342 x 18<br>13420<br>10736<br>24156 |

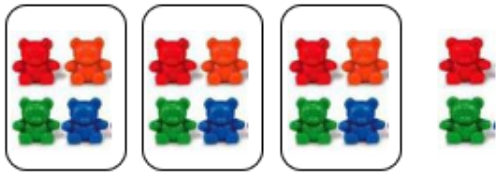
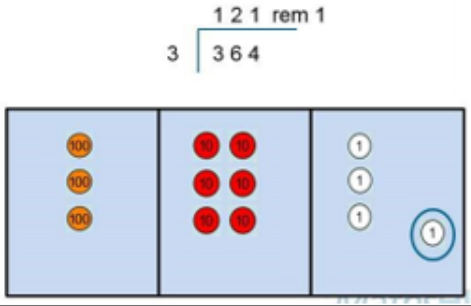
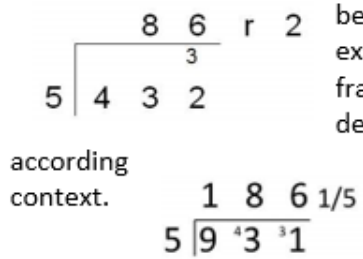
# Calculation Guidance: Division

| | Objective | Concrete | Pictorial | Abstract |
|---|---|---|---|---|
| Year 1/2 | Sharing | I have 8 cubes, can you share them equally between two people? | Children use pictures or shapes to share quantities.<br> <br>8 ÷ 2 = 4 | Share 8 buns between two people.<br>8 ÷ 2 = 4<br> |
| | Grouping | Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.<br>  <br>  | Use a number line to show jumps in groups. The number of jumps equals the number of groups.<br> <br>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.<br>  <br>10 ÷ 5 = ?<br>5 x ? = 10 | 10 ÷ 5 = 2<br><br>Divide 10 into 5 groups. How many are in each group? |

# Calculation Guidance: Division

| | Objective | Concrete | Pictorial | Abstract |
|---|---|---|---|---|
| Year 3/4 | Division with arrays | Link division to multiplication by creating an array and thinking about the number sentences that can be created.<br> <br>E.g. 15 ÷ 3 = 5 5 x 3 = 15<br>15 ÷ 5 = 3 3 x 5 = 15 | Draw an array<br>  <br>and use lines to split the array into groups to make multiplication and division sentences. | Find the inverse of multiplication and division sentences by creating four linking number sentences.<br><br>5 x 3 = 15<br>3 x 5 = 15<br>15 ÷ 5 = 3<br>15 ÷ 3 = 5 |
| | Short division | Use place value counters to divide using the short division method alongside.<br>96 ÷ 3<br>  <br>42 ÷ 3<br>Start with the biggest place value. We are sharing 40 into three groups. We can put 1 ten in each group and we have 1 ten left over. We exchange this ten for 10 ones and then share the ones equally among the groups. We look at how many are in each group.<br>  <br>  | Students can continue to use drawn diagrams with dots or circles to help them divide numbers into equal groups.<br>  <br>Encourage them to move towards counting in multiples to divide more efficiently. | Begin with divisions that divide equally with no remainder then with reminder.<br>73 ÷ 3 = 24 remainder 1<br>  <br> |

# Calculation Guidance: Division

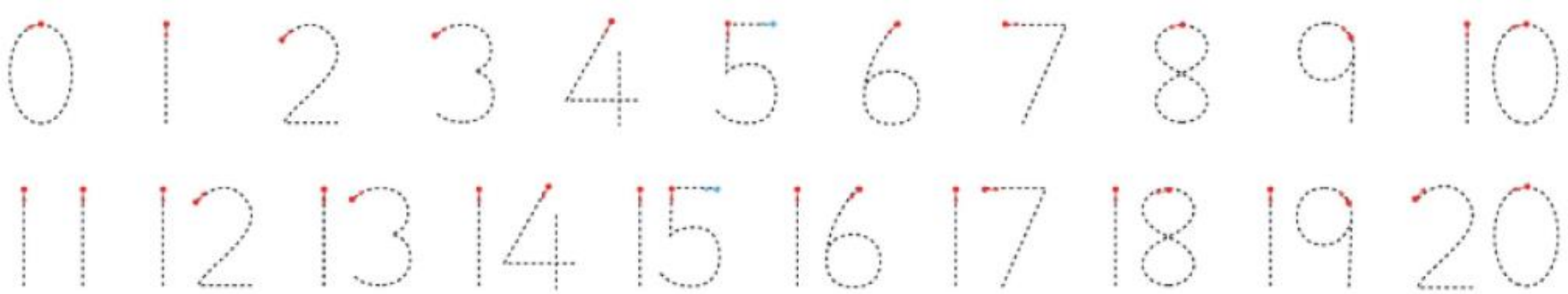
| | Objective | Concrete | Pictorial | Abstract |
|---|---|---|---|---|
| Year 5/6 | Division with remainders | 14 ÷ 3 =<br>Divide objects between groups and see how much is left over<br>  | Jump forward in equal jumps on a number line then see how many more you need to jump to find a remainder.<br> <br><br>Draw dots and group them to divide an amount and clearly show a remainder.<br> <br> | Complete written divisions and show the remainder using r.<br> <br> |
| | Short division with remainders | 364 ÷ 3 =<br>  <br> | | Move onto divisions with a remainder. Once children understand remainders, begin to express as a fraction or decimal according to the context.<br>  <br> |

# Calculation Guidance: Division

| | Objective | Concrete | Pictorial | Abstract |
|---|---|---|---|---|
| Year 6 | Long division | | | Children will use long division to divide numbers with up to 4 digits by 2-digit numbers.<br><br>015<br>32 ⟌ 487<br>-0<br>48<br>-32<br>167<br>-160<br>7<br><br>17 r 19<br>31 ⟌ 546<br>31↓<br>236<br>217<br>19 |

## Number formation at Woodloes Primary School

This policy is to ensure consistency of number presentation throughout the school and avoid ambiguity between which number is which.




**Please Note:**

We use the above number formation but due to type face and font it is difficult to follow on paper.

When practising number formation with your child/ren, to use the above number formation.