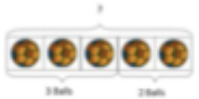
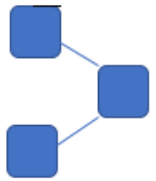
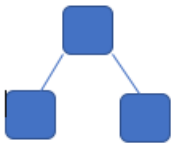
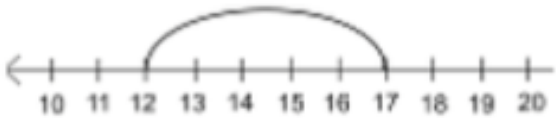
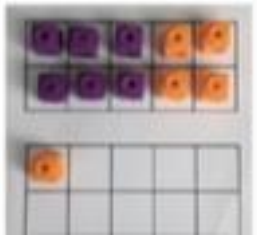
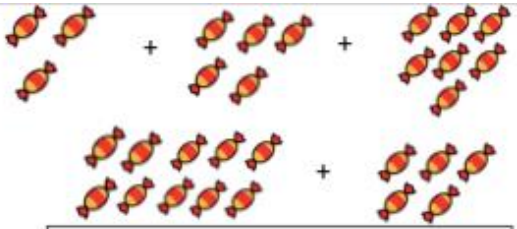
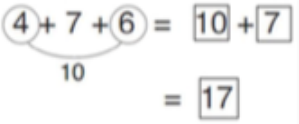
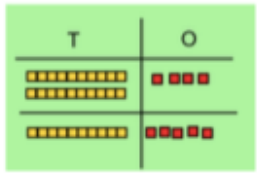
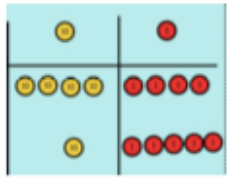
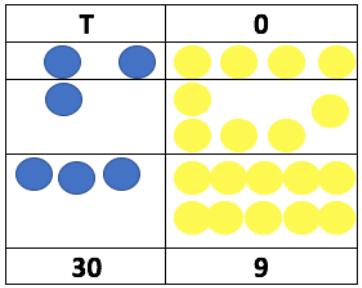
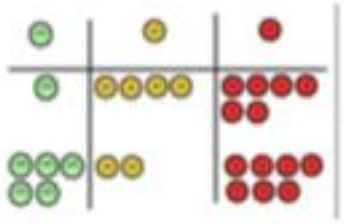
**Wentworth Primary School – Calculation Policy**

## Addition

| Objective | Concrete | Pictorial | Abstract |
|---|---|---|---|
| Combining two parts to make a whole: part-whole model |     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>10 = 8 + 2<br>The orientation of the part-whole models should vary to support deeper understanding.<br>Use the part whole model to move the parts into an abstract model.   |
| Starting at the bigger number and counting on |  Using a bead string to add on one each time starting at the bigger number, reinforcing 1:1 correspondence and cardinality. | 12 + 5 = 17   Using a number line to add on one each time starting at the bigger number. Alternatively, complete one jump to find the answer using known facts to support this. Visual and efficient jumps. | 5 + 12 = 17<br>Reorder the calculation to place the bigger number in your head and count one. Reinforcing the rule of commutativity. |

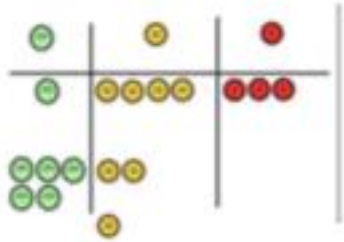
| | | | |
|---|---|---|---|
| Regrouping to make 10 | **6 + 5 = 11**<br>  <br>Start with the bigger number and visually partition the smaller addend to make 10, with the remaining beginning another tens frame. |  <br>Use pictures or a number line. Regroup or partition the smaller number to make 10.<br>**3 + 9 =**<br>Showing the bond of 10 in a part whole model.<br>9 + 5 = 14<br>1 4<br>+1 +4<br>0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 | 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?<br>I know that 7 + 4 = 7 + 3 + 1 so the sum is 11. |
| Adding three single digits | **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.<br>Group the items into the formation of a tens frame. |  <br>Combine the two numbers that make 10 and then add on the remainder. |
| Column method – no regrouping | **24 + 15=**<br>Add together the ones first then add the tens. Use the Base 10 blocks first before moving onto place value counters.<br>  <br><br>  | **24 + 15 = 5 + 4 and 20 + 10**<br>  <br> | **Expanded form**<br>20 + 1<br>40 + 2 +<br>60 + 3 = 63<br>Calculations<br>21 + 42 =<br>21<br>+ 42<br>Moving from the expanded form to a more formal written method to create greater efficiency. |

Column method - regrouping



146
+ 527

Start with the ones column exchanging 10 ones for 1 ten.



146
+ 527

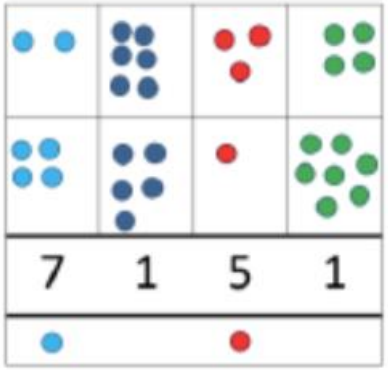
Add up the rest of the columns, exchanging the 10 counters from one column for the next place value column until every column has been added.

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.

Children can draw a pictorial representation to show the exchanging from the PV column with the smallest value.

| Th | H | T | O |
|---|---|---|---|




**Annotations can be made to support and mathematical discussions/thinking.**

Start by partitioning the numbers before moving on to clearly show the exchange below the addition.

20 + 5
40 + 8
60 + 13 = 73

**A**

536
+ 85
621
1 1

As the children move on, introduce decimals with the same number of decimal places and different. Money can be used here.

72.8
+ 54.6
127.4
1 1

£ 2 3 . 5 9
+ £ 7 . 5 5
£ 3 1 . 1 4
1 1 1

2 3 . 3 6 1
9 . 0 8 0
5 9 . 7 7 0
+ 1 . 3 0 0
9 3 . 5 1 1
2 1 2

The use of rounding/ near doubles/same difference (subtraction) can support mental efficiency and automaticity with calculating. EG: Encourage to add 50 and subtract 2 for example **A**

## Additive structures:

First… then… now is identified as **Augmentation**

***First*** Tom had two sweets
***Then*** Tom got one more sweet
***Now*** Tom has 3 sweets

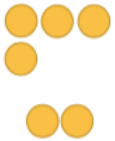
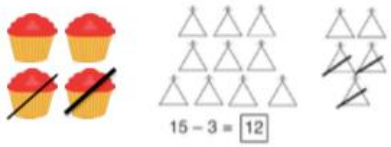
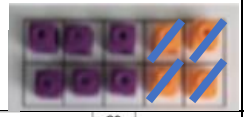
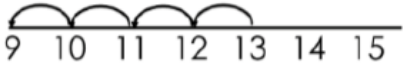
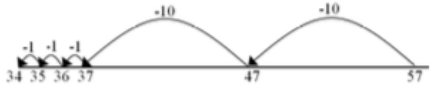
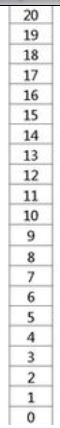
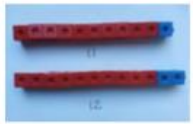
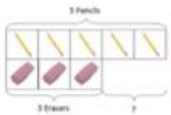
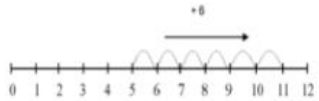
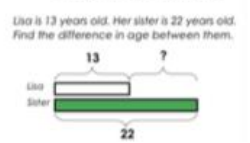
2 + 1 = 3

Augend Addend

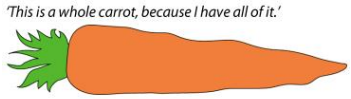
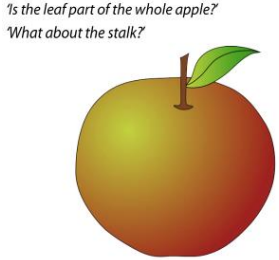
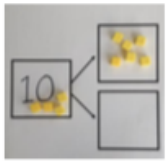
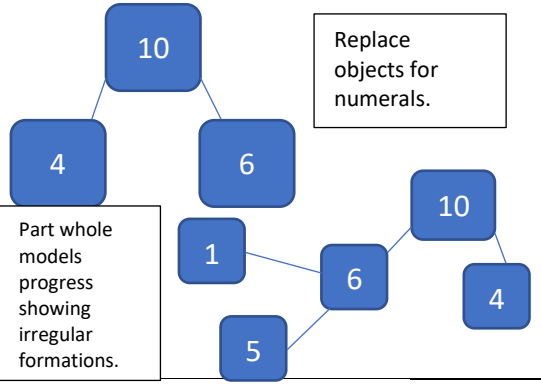
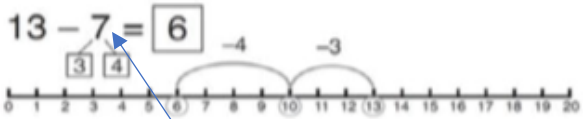
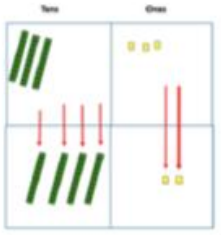
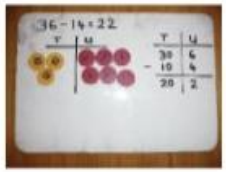
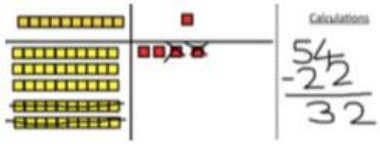
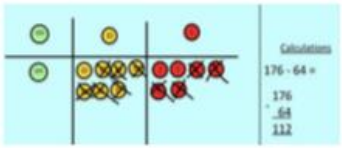
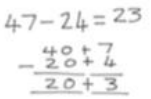
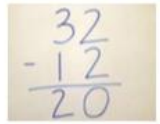
The initial value, known as the augend is increased by the addend (the new amount).

| | |
|---|---|
| The combining of two or more quantities is identified as **Aggregation** | Tom had two sweets and John had three sweets: how many do they have altogether?<br><br>***Key vocabulary: How many? How much? What is the total? Altogether there are…*** |

## Subtraction

| Objective | Concrete | Pictorial | Abstract |
|---|---|---|---|
| Subtracting ones | Use physical objects, counters, cubes etc to show how objects can be taken away.<br>  <br>**6 – 2 = 4** | Cross out drawn objects to show what has been taken away.<br>  <br>15 – 3 = 12<br>**10 – 4 = 6**<br>  | **8 – 3 = 5**<br><br>**15 – 2 = 13**<br><br>Counting back in ones remembering the starting point. |
| Counting back | Make the larger number in your subtraction. Move the beads along your bead string as you count backwards in ones.<br>**13 – 4**<br>  <br>Use counters and move them away from the group as you take them away counting backwards as you go.<br>  | 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.<br>  <br>This can progress all the way to counting back using two 2 digit numbers.<br>  | Put 13 in your head and count back 4. What number are you at?<br>I know that if I subtract 3 it will be 0 and then if I subtract 1 more, I will be at number 9.<br><br>Making relationships and connections between known facts to support efficiency. |
| Finding the difference | Compare amounts and objects to find the difference.<br>  <br>Use cubes to build towers or make bars to find the difference<br>  <br>Use basic bar models with items to find the difference. |  <br>Count on to find the difference.<br>Draw bars to find the difference between 2 numbers.<br>  | Hannah has 23 sandwiches, Helen has 15 sandwiches. Find the difference between the number of sandwiches. |

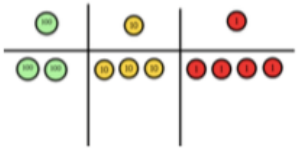
**Wentworth Primary School – Calculation Policy**

| | | | |
|---|---|---|---|
| Part whole models |  <br>'This is a whole carrot, because I have all of it.'<br>  <br>'Is the leaf part of the whole apple?'<br>'What about the stalk?'<br>Use concrete resources to identify what a part is and what a whole is, in relation to its parts. |  <br>Link to addition- use the part whole model to help explain the inverse between addition and subtraction.<br>If 10 is the whole and 6 is one of the parts. What is the other part?<br>**10 - 6 =**<br>Bar models can also be used to show parts and hole, ensure that models offer variation and are not always presented with the whole at the top.<br>6 \| 4<br>10 |  <br><br>Replace objects for numerals.<br>Part whole models progress showing irregular formations. |
| Making ten | **14 – 9 =**<br>  <br>Make 14 on the ten 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. |  <br>Partition the subtrahend into parts that form a bond with ten, subtracting 3 to reach 10 then a further 4 to reach 6. | **16 – 8=**<br>Create efficiency with calculating to mentally partition and solve. |
| Column method – no regrouping |  <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. | Draw the Base 10 or place value counters alongside the written calculation to help to show working.<br>  <br>  |  <br>Expanded form<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.

Make the larger number with the place value counters

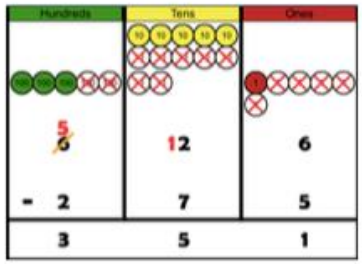


Calculations

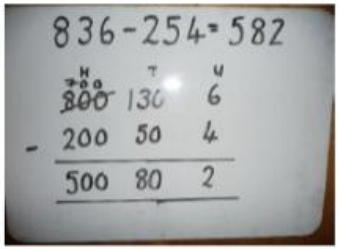
234
- 88

Start with the ones column. 4 ones subtract 8 ones… There are not enough ones. I will exchange one ten for 10 ones etc…

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.



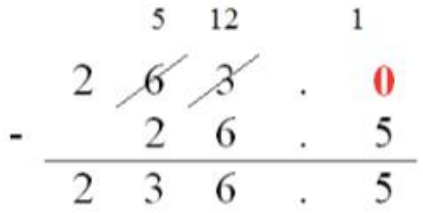

**Annotations can be made to support and mathematical discussions/thinking.**

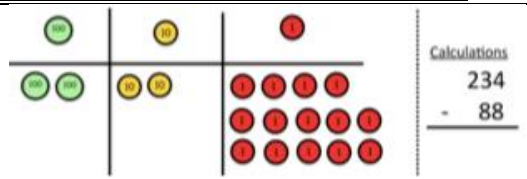



Children can start their formal written method by partitioning the number into clear place value columns.

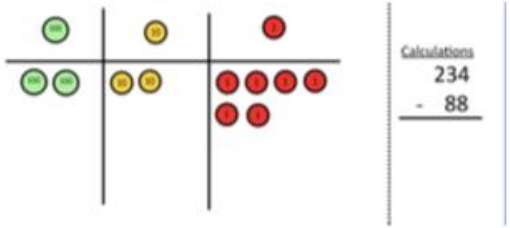

Moving forward the children use a more compact method.

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

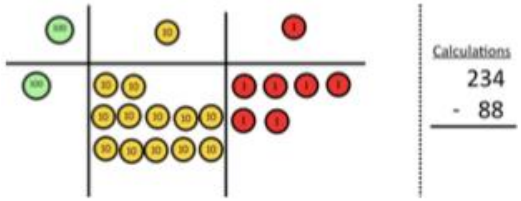




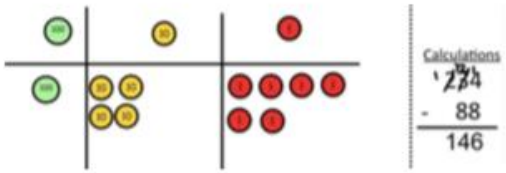

Now I can subtract my ones.




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

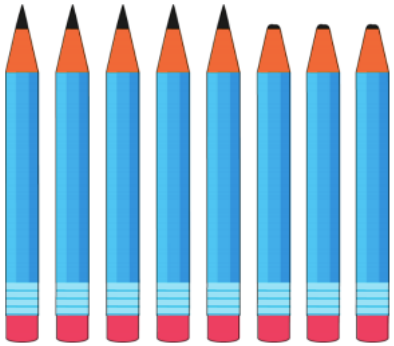


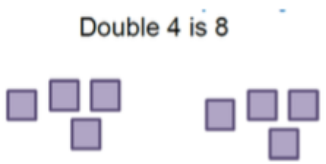
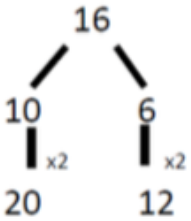
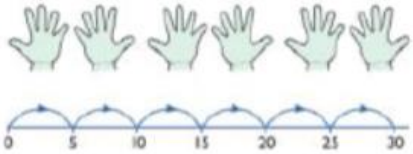

Now I can take away eight tens and complete my subtraction

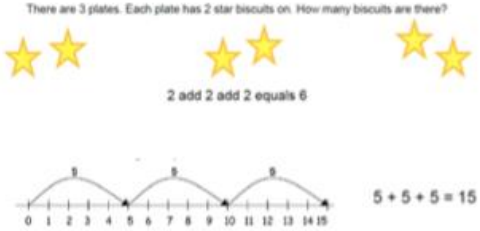
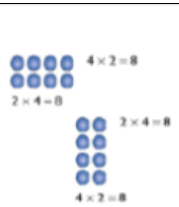



Show children how the concrete method links to the written method alongside your working. Cross out the numbers when exchanging and show where we write our new amount.

Subtraction structures

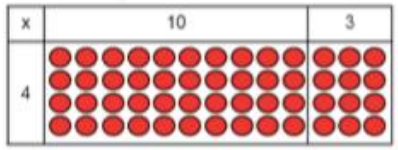
| | |
|---|---|
| First… then… now is identified as **Reduction** | ***First*** Tom had two sweets<br>***Then*** Tom gave one sweet away 2 - 1 = 1<br>***Now*** Tom has 1 sweet left<br>Minuend Subtrahend<br><br>The initial value, known as the Minuend is decreased by the subtrahend. |
| Breaking a whole down into two or more equal parts is identified as **Partitioning.** | *There are eight pencils. Five have been sharpened. How many have not been sharpened?*<br>  <br>There are two distinct parts, one of which is unknown. |

| Multiplication | | | |
|---|---|---|---|
| Doubling | Use practical activities to show how to double a number.<br>  <br><br>  <br><br>Using 'Numberblocks' series to explore and reinforce the conceptual idea of doubling.<br>***Double Dungeon of Doom*** | Draw pictures to show how to double a number.<br>  <br> | Partition a number and then double each part before recombining it back together.<br>  <br> |
| Counting in multiples |  <br>  <br>Count in multiples supported by concrete objects in equal groups. |  <br><br>Use a number line or pictures to continue support in counting in multiples.<br>'Rolling numbers' (using fingers, left to right) reinforces cardinality and ordinality. | Count in multiples of a number aloud.<br>Write sequences with multiples of numbers.<br>**2, 4, 6, 8, 10**<br>**5, 10, 15, 20, 25, 30**<br>Patterns of number should be forward, backwards related to doubles and halving. EG 3 x 2 = 6 so 6 x 2 is double 6 or 9 x 2 = 10 x 2 - 2<br>Missing number examples and balancing number sentences could also be given to deepen; embedding mathematical concepts.<br>? x 3 = 12<br>12 = 3 x ?<br>? x 3 = 1 x 12 |

| | | | |
|---|---|---|---|
| Repeated addition |  Use different objects to add equal groups. Ensure the rotation of concrete objects to embed the understanding that 5 is 5 or 4 is 4 irrespective of its presentation. |   |   |
| Arrays – showing commutative multiplication |   |   | Use an array to write multiplication sentences and reinforce repeated addition.<br>Develop the use of language making the relationship between 4 groups of 2 = 8 4 2's are 8, 2 + 2 + 2 + 2 = 8 and 8 = 4 x 2 |

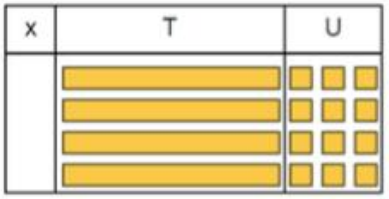
## Grid method

Show the link with arrays to first introduce the grid method.



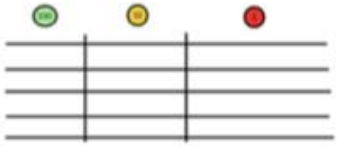

4 rows of 10
4 rows of 3

Move on to using Base 10 to move towards a more compact method.



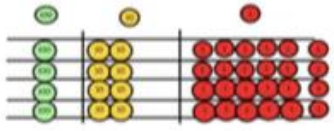

4 rows of 13

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.



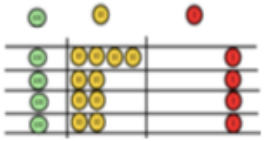
Calculations
4 x 126

Fill each row with 126.



Calculations
4 x 126

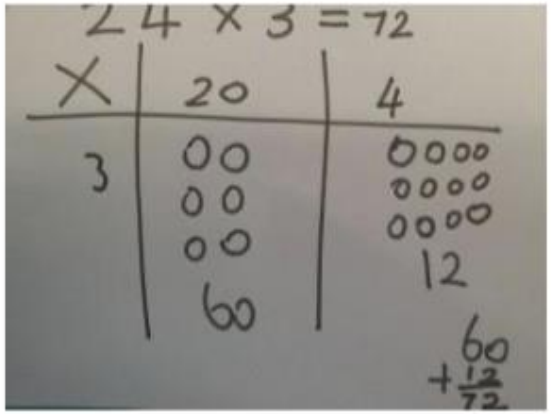
Add up each column, starting with the ones making any exchanges needed.



Then you have your answer.

Children can represent the work they have done with place value counters in a way that they understand.

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.




Further progression and efficiency can be developed through unitising (placing a value on each counter).

| X | 20 | 4 |
|---|---|---|
| 3 | 20 20 20 | 4 4 4 |
| | 60 | 12 |

Start with multiplying by one digit numbers and showing the clear addition alongside the grid.

| × | 30 | 5 |
|---|---|---|
| 7 | 210 | 35 |

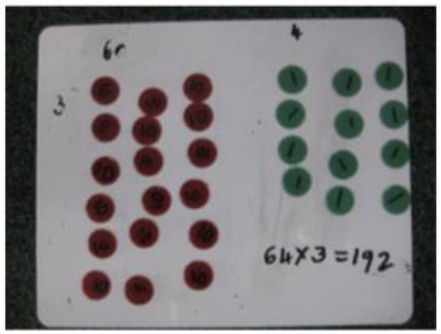
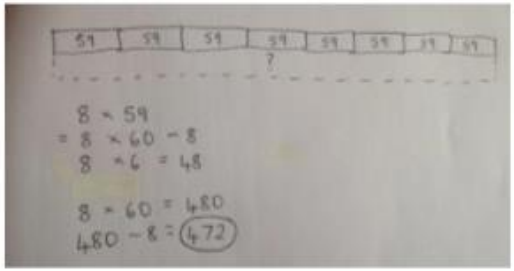
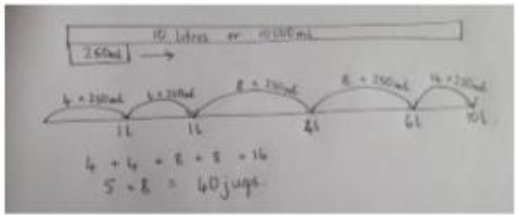
**210 + 35 = 245**

Moving forward, multiply by a 2 digit number showing the different rows within the grid method.

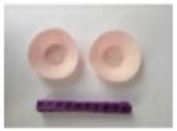
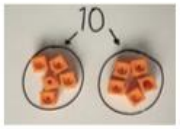
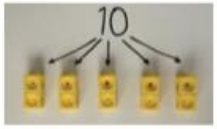
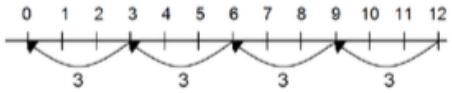
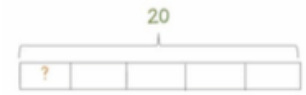
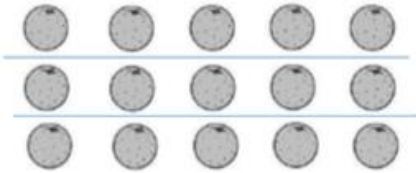
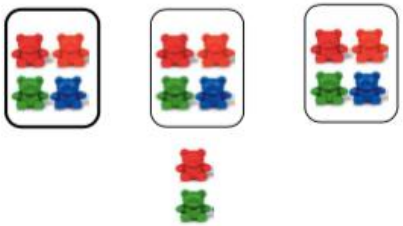
| | 10 | 8 |
|---|---|---|
| 10 | 100 | 80 |
| 3 | 30 | 24 |

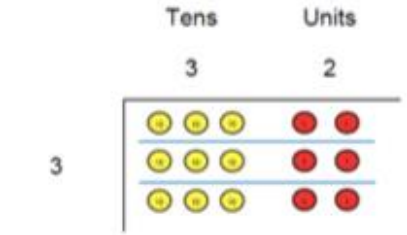
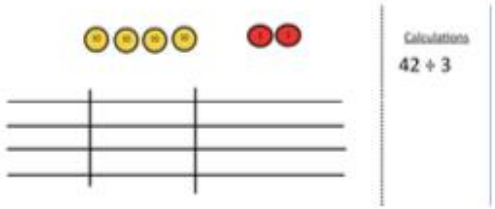
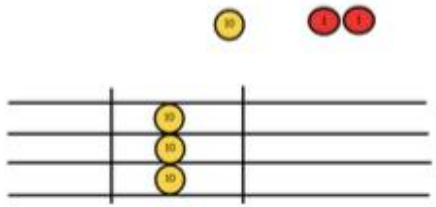
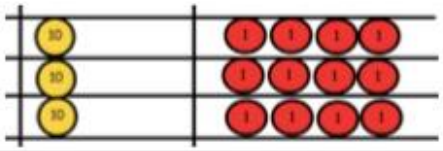
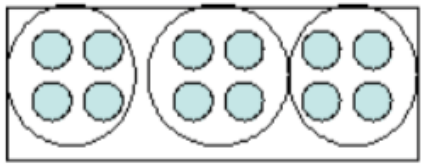
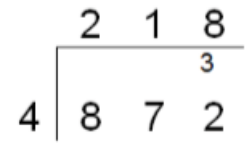
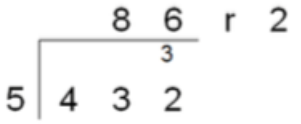
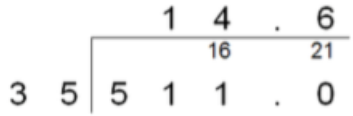
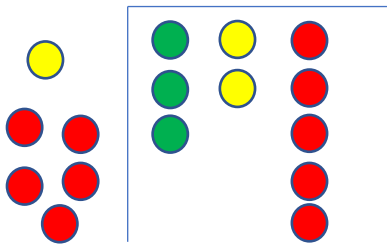
| X | 1000 | 300 | 40 | 2 |
|---|---|---|---|---|
| 10 | 10000 | 3000 | 400 | 20 |
| 8 | 8000 | 2400 | 320 | 16 |

Calculating efficiently by making the numbers smaller, using powers of 10:
30 x 7 = 3 x 7 … 21 x 10 = 210

| | | | |
|---|---|---|---|
| Column multiplication | 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><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>32 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>74 × 63<br>12<br>210<br>240<br>+ 4200<br>4662<br>This moves to the more compact method.<br>1342 × 18<br>13420<br>10736<br>24156 |

## Division

| | | | |
|---|---|---|---|
| Sharing objects into groups |     I have 10 cubes, can you share them equally in 2 groups? | Children use pictures or shapes to share quantities.  8 ÷ 2 = 4 | **Share 9 buns between three people.** **9 ÷ 3 = 3** |
| Division as grouping | Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.   96 ÷ 3 = 32     | Use a number line to show jumps in groups. The number of jumps equals the number of groups.   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.   20 ÷ 5 = ? 5 x ? = 20 | 28 ÷ 4 = 7 ? ÷ 4 = 7 7 = 28 ÷ ? Using the inverse operation to solve a statement. |
| Division using arrays |  Link division to multiplication by creating an array and thinking about the number sentences that can be created. E.g. 15 ÷ 3 = 5 5 x 3 = 15 15 ÷ 5 = 3 3 x 5 = 15 |  Draw an array 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. **7 x 4 = 28** **4 x 7 = 28** **28 ÷ 7 = 4** **28 ÷ 4 = 7** |
| Division with remainders | **14 ÷ 3 =** Divide objects between groups and see how much is left over  | Jump forward in equal jumps on a number line then see how many more you need to jump to find a remainder.   Draw dots and group them to divide an amount and clearly show a remainder.   | Complete written divisions and show the remainder using r.   |

| | | | |
|---|---|---|---|
| Short division |  <br>Use place value counters to divide using the bus stop method alongside<br>  <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.<br>  <br>We exchange this ten for ten ones and then share the ones equally among the groups.<br>  <br>We look how much in 1 group so the answer is 14. | 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.<br>Use known multiplicative facts to help support an estimation where the numbers are larger. | Begin with divisions that divide equally with no remainder.<br>  <br>Move onto divisions with a remainder.<br>  <br>Finally move into decimal places to divide the total accurately.<br>  |
| Long division | 325 divided by 15<br>  | Formal method<br>1. List the multiples of 15 by repeated addition<br>15<br>30<br>45 etc<br>2. How many 15's in 3 hundreds? Three hundreds need to be exchanged for 30 tens<br>3. How many groups of 15 can you make out of 32 tens? | Formal method in context<br>1. List the multiples of 15 by repeated addition<br>15<br>30<br>45 etc<br>2. How many 15's in 3 hundreds? Three hundreds need to be exchanged for 30 tens<br>3. How many groups of 15 can you make out of 32 tens? |

| | | | |
|---|---|---|---|
| | Divisor (15). 3H. 2T 5ones<br><br>1. List the multiples of 15 by repeated addition<br>15<br>30<br>45 etc<br>2. How many 15's in 3 hundreds? Three hundreds need to be exchanged for 30 tens<br>3. How many groups of 15 can you make out of 32 tens?<br>4. Look down your multiple list… I can make 2 groups of 15 to equal 30 tens.<br>5. I had 32 tens and I used 30 tens which leaves 2 tens left.<br>6. I have 2 tens left. We exchange the 2 tens for 20 ones and add to the 5 ones in the ones column. I now have 25 ones.<br>7. How many 15 ones are there is 25 ones? I ca make 1 group of 15 ones. I had 25 ones, I used 15 ones so I have 10 ones left.<br>8. We record the remainders as r. 10 | 4. Look down your multiple list… I can make 2 groups of 15 to equal 30 tens.<br>5. I had 32 tens and I used 30 tens which leaves 2 tens left.<br>6. I have 2 tens left. We exchange the 2 tens for 20 ones and add to the 5 ones in the ones column. I now have 25 ones.<br>7. How many 15 ones are there is 25 ones? I ca make 1 group of 15 ones. I had 25 ones, I used 15 ones so I have 10 ones left.<br>We record the remainders as r. 10 | 4. Look down your multiple list… I can make 2 groups of 15 to equal 30 tens.<br>5. I had 32 tens and I used 30 tens which leaves 2 tens left.<br>6. I have 2 tens left. We exchange the 2 tens for 20 ones and add to the 5 ones in the ones column. I now have 25 ones.<br>7. How many 15 ones are there is 25 ones? I ca make 1 group of 15 ones. I had 25 ones, I used 15 ones so I have 10 ones left.<br>We record the remainders as r. 10<br><br>8. In context (money and measure), the remainders need to be shown as a decimal. |

| **Division structures** | Quotitive division contexts | Partitive division contexts |
|---|---|---|
| Example problem | *'There are fifteen biscuits. If I put them into bags of five, how many bags will I need?'* | *' I have twenty conkers and I share them equally between five children. How many conkers does each child get?'* |
| Key language | ***'… divided into groups of…'***<br><br>*Fifteen divided into groups of five is eual to three.* | ***'… divided between…'***<br><br>*Twenty divided between five is equal to four each.* |

## Key Mathematical language glossary

| Concept Definition | Definition |
|---|---|
| Acute | Describes angles between 0 and 90 degrees. |
| Adjacent | Adjoining (as used to describe lines and angles). |
| Alternate | Every other one in a sequence. |
| Angle | The number of degrees rotated around a point |
| Area | The amount of space within a perimeter (expressed in square units) |
| Ascending order | The arrangement of numbers from smallest to largest |
| Average | A number representing a set of numbers (obtained by dividing the total of the numbers by the numbers itself). |
| Axis of symmetry | A line dividing a shape into two symmetrical parts |
| Base | The line or face on which a shape is standing |
| Baker's dozen | The colloquial name given to the number 13 |
| Base angles | Those angles adjacent to the base of a shape |
| Bisect | To divide into two equal parts. |
| Breadth | Breadth is another name for width. It is the distance across from side to side. |
| Capacity | The amount of space in an object (the amount of liquid or air it contains) |
| Cardinal number | A number that shows quantity but not order. |
| Carroll Diagram | A problem-solving diagram used in classification activities. |
| Circumference | The distance around a circle (its perimeter). |
| Composite number | A number with more than two factors. |

| | |
|---|---|
| Congruent | Congruent shapes are the same shape and size (equal). |
| Consecutive numbers | Consecutive numbers are numbers follow in order without interruption. EG 2, 3, 4, 5 |
| Coordinates | Numbers used to locate a point on a grid. |
| Denominator The number below the line in a fraction. | |
| Descending order | The arrangement of numbers from the largest to smallest. |
| Diagonal | A straight line connecting two non-adjacent vertices (corners) of a polygon. |
| Difference | By how much a number is bigger or smaller than another. |
| Digit | Any number from 0 to 9 (inclusive). |
| Digital root | The digital root of 58 is 4 because 5 + 8 =13 and 1 + 3 = 4 |
| Dimensions | The measurements of a shape (i.e.length, width, height). |
| Dodecagon | A twelve sided polygon. |
| Edge | The intersection of two faces of a three-dimensional object. |
| Equation | A statement of equality between two expressions (e.g. 3 x 4 = 6 + 6). |
| Equilateral triangle | A triangle with congruent (equal)sides and angles. |
| Even number | A positive or negative number exactly divisible by 2. |
| Exterior | Outside. |
| Face | A plane surface of a three-dimensional object. |

| | |
|---|---|
| Face value | The numeral itself despite its position in a number (e.g. the face value of 8 in 38,250 is 8). |
| Factor | A number which will divide exactly into another number. |
| Greater than | An inequality between numbers. The symbol used to represent greater than is an arrow pointing towards the smallest number. |
| Gross | The name given to the number 144. |
| Hendecagon | A two dimensional shape with eleven sides and eleven angles. It is also called an undecagon. |
| Heptagon | A two dimensional shape withseven sides and seven angles. It is also called a septagon. |
| Hexagon | A polygon with six sides. |
| Horizontal | Describes a line or plane parallel to the earth's surface. |
| Improper fraction | A fraction whose numerator is equal to or greater than it denominator. |
| Integer | A negative or positive whole number. |
| Interior | Inside. |
| Intersection | The point or line where two lines or two faces meet. |
| Irregular shapes | Shapes which do not have all congruent sides and all congruent angles. |
| Isosceles triangle | A triangle which has two equal sides of equal length. |
| Kite | A quadrilateral that has two adjacent pairs of sides that are equal in length, and at least one pair of opposite angles are equal. |
| Less than | An inequality between numbers. The symbol used to represent less than |

| | |
|---|---|
| | is an arrow pointing towards the smallest number. |
| Line of symmetry | (See axis of symmetry). |
| Lozenge | Another name for a rhombus. |
| Mean | The average of a set of numbers. The sum of the values in a set of data divided by the total number of items in that set. |
| Median | The middle value of a set of ordered data. |
| Mode | The value that occurs the most often in a set of data. |
| Multiple | The product of a given number with another factor. |
| Numerator | The number above the line in a fraction. |
| Oblique | Oblique means sloping or slanting. |
| Oblong | A shape with two pairs of straight,unequal sides and four right angles. Also known as a rectangle. |
| Obtuse angle | An angle between 90 and 180 degrees. |
| Octagon | A polygon with eight sides and eight angles. |
| Odd number | A number that when divided by two leaves a remainder of one. |
| Ordinal number | Describes a position in a number sequence. |
| Parallel lines | Lines with no common points and always the same distance apart. |
| Parallelogram | A four-sided polygon with opposite sides equal and parallel and the opposite angles are equal in size. |

| | |
|---|---|
| Perimeter | The length of the distance around the boundary of a shape. |
| Perpendicular line | A line at right angles to another line or plane. |
| Polyhedron | A three dimensional shape with plane faces. |
| Place value | Indicates the position of a numeral (e.g. the place value of the 3 in 738 is 30) |
| Prime number | A number with only two factors, 1 and itself (e.g. 2,3,5,7,11, 13, 17, 19, 23...) |
| Product | The result when two or more numbers are multiplied. |
| Quadrant | A quarter of the area of a circle which also contains a right angle. |
| Quotient | The result when one number is divided by another number. |
| Quindecagon | A polygon with fifteen sides and fifteen angles. |
| Rectangle | A quadrilateral with opposite sides equal and parallel and containing four right angles. |
| Reflex angle | An angle greater than 180 degrees. |
| Rhombus | A parallelogram with congruent sides. Opposite sides are parallel and opposite sides are equal in size. |
| Roman numerals | Seven letters are used in combination to write numbers:<br>I = 1 V = 5<br>X = 10 L = 50<br>C = 100 D = 500<br>M = 1000 |

| | |
|---|---|
| Rotational symmetry | A shape is said to have rotational symmetry if it looks the same in different positions when rotated about it's centre. |
| Rounding | An approximation used to express a number in a more convenient way. |
| Scalene triangle | A triangle that has three sides of different length and no equal angles. |
| Score | The name given to the number 20. |
| Squared | A number squared is a number multiplied by itself. |
| Square number | A number whose units can be arranged into a square (e.g. 1,4,9,16,25,36,49,64...) |
| Sum | The result when two or more numbers are added together. |
| Symmetrical | A shape is symmetrical if it is identical on either side of a line dividing it into two parts. |
| Tally | A record of items using vertical and oblique lines to represent each item. |
| Tetragon | A four sided shape. |
| Tessellation | Shapes fitted together with a number of exact copies and with no overlaps or gaps. |
| Translation | This takes place when a shape is moved from one place to another just by sliding it (without rotating, reflecting or enlarging). |

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| Trapezium | A quadrilateral with two parallel sides. |
| Triangular number | A number whose units can be arranged into a triangle (e.g. 1, 3, 6, 10, 15, 21...) |
| Trigon | A three sided shape. |
| Vertex | The point at which two or more line segments or two or more edges of a polyhedron meet. |
| Vertical line | A line which is at right angles to a horizontal line. |