[](http://www.google.co.uk/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0CAcQjRxqFQoTCNeGrNnviMgCFTFa2wodr0MLnw&url=http://www.raiseonlinetraining.co.uk/testimonials.html&psig=AFQjCNHbDFhH-Fsrt6M083Ai77ZWz_6UOw&ust=1442950505118877)

Calculation Policy to Mathematics Curriculum: September 2019

*(Adapted from White Rose Maths Hub)*

**Rationale:** Our aim is to provide our learners with the mathematical skills and knowledge to be able to reason and problem solve effectively. Across the school crossover of strategies across year groups will occur as skills develop and understanding deepens. Some arithmetic strategies are year group specific whilst this policy also allows for increase in pace of learning where appropriate. The most early arithmetic strategies seen earlier in the school still hold weight as the children move through the national curriculum; developing understanding of number requires children to move between concrete, pictorial and abstract representations.

**Addition**

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| **Objective and Strategies** | **Concrete** | **Pictorial** | | **Abstract** |
| Combining two parts to make a whole: part- whole model/bar model  ***Vocab:***  Part, Whole, plus, add, and, bigger, larger, join, combine greatest, least, biggest, smallest. | Combining objects to show how the can be joined to make a larger number. Part+Part=Whole. | C:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\2GUHBRQ0\Simple-Flower-Outline-12183-large[1].pngImage result for part whole model  C:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\2GUHBRQ0\Simple-Flower-Outline-12183-large[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\2GUHBRQ0\Simple-Flower-Outline-12183-large[1].png  C:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\2GUHBRQ0\Simple-Flower-Outline-12183-large[1].png  C:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\2GUHBRQ0\Simple-Flower-Outline-12183-large[1].png  Image result for part whole model addition  8  Combining images to show how they can be joined to make a larger number. | | 4 + 3 = 7  10= 6 + 4  5  3  Number sentences to represent the combination, including starting with the whole.  Part+Part=Whole  Whole=Part+Part |
| Starting at the bigger number and counting on  **Vocab:**  Number, larger, smaller, count, jump, greatest, least, biggest, smallest | Starting with the larger number and counting on the smaller number, one by one. | 12 + 5 = 17    Starting the with the larger number and counting on the smaller number, with ones or larger groups. | | 5 + 12 = 17  Hold the larger number in your head, counting on the smaller number. |
| Regrouping to make 10.  **Vocab:**  Ten, ones, part, whole, more, above, bigger, greatest, least, biggest, smallest | 6 + 5 = 11  Use of tens frames to show how a number can be bigger than ten. Ten plus some more. | Using a number line, starting with the largest number add on the smaller number (in this instance, 5.) Add 1 to 9 to make 10 and then the  remaining 4. | | 7 + 4= 11  Mentally, starting with the larger number add on the smaller number (in this instance, 4.) Add the 3 to make 10 then the remaining 1. |
| Adding three single digits  **Vocab:**  part, whole, more, above, biggest, smallest, combine, greatest, least | 4+7+6=17 Put 4 and 6 together to make 10. Then add the 7. | 3+5+5=13. Using objects, Start by adding the bigger numbers to make 10 (5+5) then add the 3 to make 13.  /Users/walkerblazey/Desktop/Screen Shot 2019-06-09 at 18.24.03.png | | Mentally, add the pair that make 10. Then add the remaining 7 to make 17. |
| Column method- no regrouping  **Vocab:**  exchange, total, altogether ones, tens, hundreds, thousands, tens of thousands, hundreds of thousands, millions, tens of millions, tenths, hundredths, thousandths, total, remaining (left over), place holder, decimal, represent, greatest, least | Using objects, layer the first number with sticks of ten and ones/place values.  24+15=39 44+15=59 | 34+22=56    32+23=56  Draw sticks of ten and ones/place value counters. Start by adding the tens followed by adding the ones. | | Start with the ones, and then the tens, total each column but ensure that children aware that the 2 in 21 represents twenty. |
| Column method- regrouping  **Vocab:**  exchange, total, altogether ones, tens, hundreds, thousands, tens of thousands, hundreds of thousands, millions, tens of millions, tenths, hundredths, thousandths, total, remaining (left over), place holder, decimal, represent, carry, greatest, least, biggest, smallest | Place the counters onto a place value grid. Start by adding the ones, tens then hundreds.    In this case 6+7=13. Exchange 10 of the ones for a ten leaving 3 remaining. Using place value counters, or sticks of diennes set out on pre-drawn place value grids. Works with money and decimals. | 38+13    Start with drawing 10s and ones. Add the ones then tens.    Count the ones. There is more than 10. Exchange ten ones for one ten. Count the 5 tens=50. Count the ones=1 left = 51.  Draw place value grids with counters. Add the ones first, carrying below, in this case 4+7=11, and then work the way through the columns right to left. | | Each child must know the value of each digit and what each number represents. Add each column in turn starting with right most column. Carry below when 10 is reached or passed. Add zeroes as place value holders after the decimal place where required ensuring decimals are lined up first. |
| Adding  fractions  **Vocab:**  Add, plus, altogether, total, numerator, denominator, convert, mixed number, improper. | Same denominators:    Denominators to stay the same, add the top numbers to create new fraction.  If the numbers create an improper fraction then the fraction can be converted back to mixed number.  In this circumstance, children can simplify the end result. In this circumstance: 2/3. | | Different denominators: | |

**Subtraction**

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| Objective and Strategies | Concrete | Pictorial | | Abstract |
| Taking away ones  **Vocab:**  Take away, subtract, minus, less than, difference, jump, tens, ones, greatest, least | Use physical objects, counters, cubes etc to show how objects can be physically taken away.  6 – 2 = 4 | Cross out drawn objects to show what has been taken away.  Draw a number line, starting from the biggest number, jump the smaller number by jumping back in ones    If subtracting a 2 digit number, subtract the tens then the ones. | | 18 -3= 15  8 – 2 = 6  Hold a number in your head and count back in ones. Use fingers to support mental calculation. |
| Find the difference  **Vocab:**  Take away, subtract, minus, less than, fewer than, more than, greater than, difference, jump, tens, ones, bigger, smaller, biggest, smallest greatest, least | Compare amounts and objects to find the difference.    Image result for two towers of cubes  Use cubes to build towers or make bars to find the difference  Use basic bar models with items to find the difference | Count on to find the difference.  http://image.slidesharecdn.com/intro-to-sm-1220840292402057-8/95/intro-to-singapore-math-13-728.jpg?cb=1345557040  Draw bars to find  the difference between 2 numbers. | | Hannah has 23 sandwiches, Helen has 15 sandwiches. Find the difference between the number of sandwiches.  Hold numbers mentally, count on from 15 to 23, or back 15 from 23. |
| Part Part Whole Model  **Vocab:**  Whole, Part, Take away, subtract, minus, less than, fewer than, more than, greater than, difference, jump, tens, ones, bigger, smaller, biggest, smallest greatest, least | Pre-drawn part part whole. Link to addition- use the part whole model to help explain the inverse between addition and subtraction.  If 10 is the whole and 6 is one of the parts. What is the other part?  We know that 6+4 and 4+6=10.  10 - 6 = | Draw out part part whole: use a pictorial representation of objects to show the part part whole model. | | 10  5  Move to using numbers within the part whole model. |
| Make 10  **Vocab:**  Take away, subtract, minus, less than, fewer than, more than, greater than, difference, jump, tens, ones, bigger, smaller, biggest, smallest greatest, least | 14 – 5 =  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. | Draw a number line. Start at 13. Take away 3 to reach 10. Then take away the remaining 4 so you have taken away 7 altogether. You have reached your answer. | | 16 – 8=  Upwards from 8 to 16: how many do we take off to reach the next 10= 2. Then add the remaining 6 to get to 16. 6+2=16.    Backwards from 16. Take 6 to get to 10, then the remaining 2 to get to 8. |
| Column method without regrouping  **Vocab:**  Take away, subtract, minus, less than, fewer than, more than, greater than, difference, jump, thousands, hundreds, tens, ones, bigger, smaller, biggest, smallest, partition, greatest, least, tens of thousands, hundreds of thousands, millions, tens of millions, tenths, hundredths, thousandths, | Use Base 10 to make the bigger number then take the smaller number away.  Show how you partition numbers to subtract. Again make the larger number first. | 34-21  C:\Users\JackWalker\AppData\Local\Microsoft\Windows\INetCache\Content.MSO\84F7C065.tmp  Draw bigger number with sticks of 10 and ones. Subtract ones then tens leaving you with 13.  Draw the Base 10 or place value counters alongside the written calculation to help to show working. Cross off the numbers as you go. | | http://media.showmeapp.com/files/205114/pictures/thumbs/1100814/last_thumb1379615590.jpg  [https://encrypted-tbn3.gstatic.com/images?q=tbn:ANd9GcS1ohiHkzn0cS0nvwRP-5EyK0TDGl_A1tbsAl0XjNPBssTas4YVeQ](http://www.google.co.uk/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0CAcQjRxqFQoTCPyKt_H6h8kCFUNEFAodiFAGCA&url=http://huppiemama.com/teaching-subtraction-using-manipulatives/&bvm=bv.106923889,d.d2s&psig=AFQjCNEr_xOQu7fhwvMOMFTIen6kpdc03g&ust=1447317198959935)This will lead to a clear written column subtraction. Children must have clear understanding of the place value of each digit. |
| Column method with regrouping  **Vocab:**  Take away, subtract, minus, less than, fewer than, more than, greater than, difference, jump, thousands, hundreds, tens, ones, bigger, smaller, least, biggest, greatest smallest, partition, exchange, decimals, place holder, tens of thousands, hundreds of thousands, millions, tens of millions, tenths, hundredths, thousandths, | Use Base 10/place value counters. 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  Start with the ones, can I take away 8 from 4 easily? I need to exchange one of my tens for ten ones.    Now I can subtract my ones.  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. | Sticks of 1o and one. 32-17     1. Draw sticks of 10/ones (32)   2)Only 2 ones, so exchange a ten for 10 ones. Then subtract 7   1. Subtract the ten. 2. You are left with one ten and 5 ones=15.     When confident, children can find their own way to record the exchange/regrouping. | | Children can start their formal written method by partitioning the number into clear place value columns. Applies to use of decimals (remembering place holders.) Cross numbers off like above.  See use of place holder below. |
| Subtracting fractions  **Vocab:**  Take, subtract, minus, numerator, denominator, convert, mixed number, improper. | Same denominator:    Denominators to stay the same, subtract the top numbers to create new fraction.  In this circumstance, children can simplify the end result. In this circumstance: 1/3 | | Different denominator: | |

**Multiplication**

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| Objective and Strategies | Concrete | Pictorial | Abstract |
| Doubling  **Vocab:**  Double, half, multiply by 2, 2 times, 2 groups of, 2 lots of, combine, total. | Use cubes or counters etc to show how to double a number. | Draw pictures to show how to double a number. | Partition a number and then double each part before recombining it back together.  Hold numbers in head. |
| Counting in multiples/  repeated addition  **Vocab:**  Multiple, groups of, lots of, count on, add, jumps of, pattern | Count in multiples supported by concrete objects in equal groups. | Use a number line or pictures to continue support in counting in multiples. | Write number sentences to show repeated addition.  Count in multiples of a number aloud. Memorise patterns and sequences.  Write sequences with multiples of numbers.  2, 4, 6, 8, 10  2x5=10 or 5x2=10  5, 10, 15, 20, 25 , 30  Link directly to times tables facts- see above.  Nth term:  N: 1 2 3 4 5  3 7 11 15 19  Going in 4s. 1x4=4 -1 = 3  4n-1 |
| Arrays- showing commutative multiplication  **Vocab:**  Array, groups of, lots of, columns, rows, commutativity, commutative, inverse, scale factor of … | http://www.australiancurriculumlessons.com.au/wp-content/uploads/2013/05/arrays-multiplication-division-lesson.jpgCreate arrays using counters/ cubes to show multiplication sentences. | Draw arrays in different rotations to find **commutative** multiplication sentences.  http://mathcentral.uregina.ca/QQ/database/QQ.02.06/maro1.1.gif  Link arrays to area of rectangles.  Children challenged to find associated facts e.g. 40x2, 4x20, 40x20 to broaden understanding. | Use an array to write multiplication sentences and reinforce repeated addition.  15= 5x3 15= 3x5 |
| Written multiplication  **Vocab:**  groups of, lots of, carry, place holder, multiply, times, product, column, row, total, tens of thousands, hundreds of thousands, millions, tens of millions, tenths, hundredths, thousandths, | 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.    Fill each row with 126.    Add up each column, starting with the ones making any exchanges needed.      Then you have your answer. | http://www.highviewschool.org.uk/wp-content/uploads/2014/05/IMG_0499-300x225.jpgThey 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.  Bar modelling and number lines can support learners when solving problems with multiplication alongside the formal written methods.  C:\Users\nathan.crook\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.Outlook\3IR2FLXR\photo (7).JPG  *C:\Users\nathan.crook\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.Outlook\3IR2FLXR\photo (5).JPG* | Start with multiplying by one digit numbers and showing the clear addition alongside the grid. Moving onto multiplying by a 2 digit number.  http://www.mumsnet.com/system/1/assets/files/000/006/988/6988/35010b289/original/328x164xgrid-method-explained-2.jpg.pagespeed.ic.zL-KyDdiL2.jpg    Start with long multiplication, reminding the children about lining up their numbers clearly in columns.  If it helps, children can write out what they are solving next to their answer. http://ictedusrv.cumbria.ac.uk/maths/SecMaths/U1/images/pic018.gif  Moving on to a compact method. Carrying the numbers below each row and remembering the place holder when starting to multiply by the ten. If a decimal is in the question, the answer requires the same amount of decimal spaces.  /Users/walkerblazey/Desktop/Screen Shot 2019-06-09 at 19.50.08.png |
| Multiplying Fractions  **Vocab:**  Denominator, numerator, convert, mixed number, improper fraction, product, multiply, times. |  | | |
| Multiplying Decimals  **Vocab:**  Decmal, decimal place, product, multiply, times. |  | | |
| Multiplying by 10,100,1000  **Vocab:**  Decimal place, place holder, jump, column, multiply, times, product |  | | |

**Division**

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| Objective and Strategies | Concrete | Pictorial | Abstract |
| Sharing objects into groups  **Vocab:**  Share, divide, part, whole, fair, groups of, lots of, inverse, divisor, factor, multiple | I have 10 cubes, can you share them equally in 2 groups? Physically move the objects to share equally. | Children use pictures or shapes to share quantities.  C:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\C9ORAZE7\Simple-Flower-Outline-12183-large[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\C9ORAZE7\Simple-Flower-Outline-12183-large[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\C9ORAZE7\Simple-Flower-Outline-12183-large[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\C9ORAZE7\Simple-Flower-Outline-12183-large[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\C9ORAZE7\Simple-Flower-Outline-12183-large[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\C9ORAZE7\Simple-Flower-Outline-12183-large[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\C9ORAZE7\Simple-Flower-Outline-12183-large[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\C9ORAZE7\Simple-Flower-Outline-12183-large[1].png  8 ÷ 2 = 4 | Share 9 buns between three people. Knowing that 3x3=9.  9 ÷ 3 = 3 |
| Division as grouping  **Vocab:**  Share, divide, part, whole, fair, groups of, lots of, inverse, divisor, factor, multiple | Physically divide quantities into equal groups.Use cubes, counters, objects or place value counters to aid understanding. | Use a number line to show jumps in groups. The number of jumps equals the number of groups.    http://gcamath3.weebly.com/uploads/9/1/4/0/9140392/200455_orig.jpgThink 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. | 28 ÷ 7 = 4  Divide 28 into 7 groups. How many are in each group? Count in sevens to 28, realising there are 4 sevens that make 28. |
| Division within arrays  **Vocab:**  Array, groups of, lots of, columns, rows, commutativity, commutative, inverse, scale factor of …, divisor, factor, multiple | Link division to multiplication by creating an array and thinking about the number sentences that can be created.  Eg 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  Extend with associated facts: e.g. 70x4=280. |
| Division with a remainder  **Vocab:**  Share, divide, part, whole, fair, groups of, lots of, inverse, remainder, divisor, factor, multiple | 14 ÷ 3 =  Divide objects between groups and see how much is left over  Image result for counters | Draw groups of or 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. | http://amsi.org.au/teacher_modules/G7/G7_qt2%202.pngComplete written divisions and show the remainder using r.  Express the remainder as a fraction 5 over 8. 5 were left, 8 was the number dividing by. |
| Short division moving towards longer division.  **Vocab:**  Share, divide, part, whole, fair, groups of, lots of, inverse, remainder, columns, rows, thousands, hundreds, tens, ones, partition, tens of thousands, hundreds of thousands, millions, tens of millions, tenths, hundredths, thousandths, divisor, factor, multiple | Use place value counters to divide using the bus stop method alongside  42 ÷ 3=  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 ten ones and then share the ones equally among the groups.  We look how much in 1 group so the answer is 14. | http://www.studyzone.org/testprep/math4/d/division2.gifStudents can continue to use drawn diagrams with dots or circles to help them divide numbers into equal groups.  Encourage them to move towards counting in multiples to divide more efficiently. | Begin with divisions that divide equally with no remainder.  Move onto divisions with a remainder.  Finally move into decimal places to divide the total accurately.  Remainder can be expressed as a decimal by using zero to divide out the number in this 14.6 but could be expressed as 14 and 21/35.  Count in 35 by using partitioning.  30 +5 = 35  60 +10= 70  90 +15= 105  120 +20= 140  150 + 25= 175  180 + 30= 210  as far as needed. |
| Dividing Fractions  **Vocab:**  Divisor, denominator, numerator, mixed number, improper fraction, divide, share, keep, flip, share.  Operation changes because when you share gets bigger because when you share a fraction, you are dividing into even smaller pieces meaning the denominator increases as a number- hence the multiplying. |  | | |
| Dividing by 10,100,1000  **Vocab:**  Decimal place, place holder, jump, move, spaces, column, share, divide |  | | |

**Other/Cross-over**

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| Percentage  **Vocab:**  Part, whole, partition, divide, multiply, times |  |
| Fraction of an amount  **Vocab:**  Denominator, numerator, mixed number, part, whole |  |
| Order of operations  **Vocab:**  BIDMAS, brackets, indices, division, multiplication, addition, subtraction, order. |  |