**Progression in Calculations**

Addition

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| Objective and Strategies | Concrete | Pictorial | Abstract |
| **EYFS and Year 1**  Combining two parts to make a whole: part- whole model  Joining two groups  and then recounting  all objects using  one-to-one  correspondence |  | Image 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].png  Image result for part whole model additionC:\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  Use pictures to add two numbers together as a group or in a bar.  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 | 4 + 3 = 7  10= 6 + 4  5  3  Use the part-part whole diagram as shown above to move into the abstract.  8  1 |
| **Year 1 and 2**  Starting at the bigger number and counting on  As a strategy, this  should be limited to adding small  quantities only (1, 2 or 3) with pupils  understanding that  counting on from the greater is more  efficient. Pupils should be encouraged to rely on number bonds  knowledge as time  goes on, rather than using counting on as their main strategy. | Start with the larger number on the bead string and then count on to the smaller number 1 by 1 to find the answer. | 12 + 5 = 17    Start at the larger number on the number line and count on in ones or in one jump to find the answer.  Bar Model:  ?  5  12 | 5 + 12 = 17  Place the larger number in your head and count on the smaller number to find your answer. |
| Regrouping to make 10.  This is an essential skill that will support column addition later on | 6 + 5 = 11  Start with the bigger number and use the smaller number to make 10. | Use pictures or a number line. Regroup or partition the smaller number to make 10.    Bar model:  5  ?  9  1  4  9 | 7 + 4= 11  If I am at seven, how many more do I need to make 10. How many more do I add on now? |
| Adding three single digits  Here the emphasis  should be on the  language rather than the strategy.  As pupils are using the beadstring,  ensure that they are explaining  using language such as; ‘1 more than 5 is equal to 6.’  ‘2 more than 5 is 7.’  ‘8 is 3 more than 5.’ | 4 + 7 + 6= 17  Put 4 and 6 together to make 10. Add on 7.    Following on from making 10, make 10 with 2 of the digits (if possible) then add on the third digit.  Add together three groups of objects. Draw a picture to recombine the groups to make 10. | C:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].pngC:\Users\b.smith\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\OZODVY09\pitr-Candy-icon[1].png  +  +  + | Combine the two numbers that make 10 and then add on the remainder. |
| **Year 2 and 3**  Column method- no regrouping | 24 + 15=  Add together the ones first then add the tens. Use the Base 10 blocks first before moving onto place value counters. | After practically using the base 10 blocks and place value counters, children can draw the counters to help them to solve additions.  T O |  |
| **Year 3 and 4**  Column method- regrouping | Make both numbers on a place value grid.  Add up the units and exchange 10 ones for one 10.    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. | Children can draw a pictoral representation of the columns and place value counters to further support their learning and understanding. | Start by partitioning the numbers before moving on to clearly show the exchange below the addition. |
| **Year 5 and 6**  Column method with regrouping. Dealing with larger numbers and decimals numbers. Children should also be able to solve inverse problems related to the column method. | As children move on to decimals, money and decimal place value counters can be used to support learning. |  | As the children move on, introduce decimals with the same number of decimal places and different. Money can be used here. |

Subtraction

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| Objective and Strategies | Concrete | Pictorial | Abstract |
| **EYFS and Year 1**  Taking away ones  When this is first  introduced, the  concrete representation should be based  upon the diagram.  Real objects should be placed on top of the images as one – to – one correspondence so  that pupils can take them away, progressing to  representing the group of ten with a tens rod and ones with ones cubes | Use physical objects, counters, cubes etc to show how objects can be taken away.  6 – 2 = 4 | Cross out drawn objects to show what has been taken away. | 18 -3= 15  8 – 2 = 6 |
| **Year 1 and 2**  Counting back  Subtracting 1,  2, or 3  by counting back  Pupils should be  encouraged to rely on  number bonds  knowledge as time  goes on, rather than  using counting back as  their main strategy | Make the larger number in your subtraction. Move the beads along your bead string as you count backwards in ones.  13 – 4  Use counters and move them away from the group as you take them away counting backwards as you go.  http://3.bp.blogspot.com/-mFqQPE4k1TE/VGzRNnUu30I/AAAAAAAAAJM/12p6qvgkmoE/s1600/EvenOdd_ColoredCounters_Scattered.jpg | Count back on a number line or number track    Start at the bigger number and count back the smaller number showing the jumps on the number line.    This can progress all the way to counting back using two 2 digit numbers. | Put 13 in your head, count back 4. What number are you at? Use your fingers to help. |
| Find the difference | 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. |
| Part Part Whole Model | 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?  10 - 6 = | 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 | 14 – 9 =  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. | 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=  How many do we take off to reach the next 10?  How many do we have left to take off? |
| **Year 3 and 4**  Column method without regrouping | 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. | Draw the Base 10 or place value counters alongside the written calculation to help to show working. | 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. |
| Column method with regrouping  **Year 5 and 6**  Column method  Subtract whole numbers with more than 4 digits, including using formal written methods. Also include 4 multi digits to include decimals. | 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.    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. | 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.  When confident, children can find their own way to record the exchange/regrouping.  Just writing the numbers as shown here shows that the child understands the method and knows when to exchange/regroup. | Children can start their formal written method by partitioning the number into clear place value columns.  Move chd onto using the column method to subract increasingly larger numbers. Including those where more than one borrow is required.    Then, develop an understanding of subtracting any number including decimals. |

Multiplication

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| Objective and Strategies | Concrete | Pictorial | Abstract |
| **Year 1 and 2**  Doubling | Use practical activities 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. |
| Counting in multiples | Count in multiples supported by concrete objects in equal groups. | Use a number line or pictures to continue support in counting in multiples. | Count in multiples of a number aloud.  Write sequences with multiples of numbers.  2, 4, 6, 8, 10  5, 10, 15, 20, 25 , 30 |
| Repeated addition | Use different objects to add equal groups. |  | Write addition sentences to describe objects and pictures. |
| Arrays- showing commutative multiplication | 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. | Use an array to write multiplication sentences and reinforce repeated addition. |
| **Year 3**  Grid Method  Children should always consider whether partitioning is the best strategy –if it is possible to use strategies such as  doubling (some may use doubling twice for ×4), they need to choose the  most efficient strategy.  Children may wish to make jottings, including a full grid as exemplified  here – but  grid method is  not a formal method and its only purpose is to record mental calculations. This  supports the development of the  necessary mental  calculating skills but does not hinder the introduction of formal written methods in Year  4.Concrete  manipulatives are  essential to develop  understanding. | 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. | Children can represent the work they have done with place value counters in a way that they understand.  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. | Start with multiplying by one digit numbers and showing the clear addition alongside the grid.  http://www.mumsnet.com/system/1/assets/files/000/006/988/6988/35010b289/original/328x164xgrid-method-explained-2.jpg.pagespeed.ic.zL-KyDdiL2.jpg  Moving forward, multiply by a 2 digit number showing the different rows within the grid method. |
| **Year 4**  Column multiplication  Multiply two-digit and three-digit numbers by a one-digit number using formal written layout.  **Year 5**  Column multiplication  Multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers.  **Year 6**  Column multiplication  Multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long and short multiplication. | https://primarysite-prod.s3.amazonaws.com/0c4eb252d34643748228179a3d582154_1x1.jpegChildren can continue to be supported by place value counters at the stage of multiplication.  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.  Use concrete apparatus to develop understanding of multiplication of 2 digits by 1 digit using the expanded method | 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* | Moving onto 3 digits by 1 digit    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  Move away from noting down when ready  http://amsi.org.au/teacher_modules/B1/B1t102.png  Move chd onto short method of multiplying TU X U  Chd should be confident with using expanded notation to multiply    Develop short method of multiplying with up to 4 digits by 1 or 2 digits including use of decimals    Show chd the importance of lining up numbers including the decimal point. Talk about disregarding the decimal point and replacing it by however many decimal places if this is easier for chd.  http://www.bbc.co.uk/staticarchive/4d7f24f3efdfff596d595a9c9f3dbf454cd6b895.gif |

Division

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| Objective and Strategies | Concrete | Pictorial | Abstract |
| **Year 1**  Sharing objects into groups | I have 10 cubes, can you share them equally in 2 groups? | 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.  9 ÷ 3 = 3 |
| **Year 2**  Division as grouping | 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? |
| Division within arrays | 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 |
| **Year 3**  Division with a remainder | 14 ÷ 3 =  Divide objects between groups and see how much is left over  Image result for counters | 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.  http://amsi.org.au/teacher_modules/G7/G7_qt2%202.png |
| **Year 4**  Division through vertical method focussing on grouping |  |  | Teach chd vertical method through grouping multiples of the divisor. Examples to include remainders.    Link to work done on concrete and pictorial learning done previously |
| **Year 5**  Short division  Pupils start with dividing 4-digit  numbers by 2, 3 and 4, where no  regrouping is required. Place value counters are used simultaneously in a place value chart, to develop conceptual understanding.  They progress to calculations that  require regrouping in the hundreds  or tens columns.  Pupils build on their conceptual  knowledge of division to become  confident with dividing numbers  where the tens digit is smaller than  the divisor, extending this to any digit being smaller than the divisor.  **Year 6**  Short division  Children to be able to divide so that there are no remainders, going into the decimal values if needed.  Use written division methods in cases where the answer has up to two decimal places. | 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. | Students move onto representing concept learn using concrete apparatus to drawing to represent different values: | Moving onto short division; begin with divisions that divide equally with no remainder.  Move onto divisions with a remainder.  Pupils should be encouraged to note down multiples when dividing by a 2 digit number    35  70  105  140  ... |