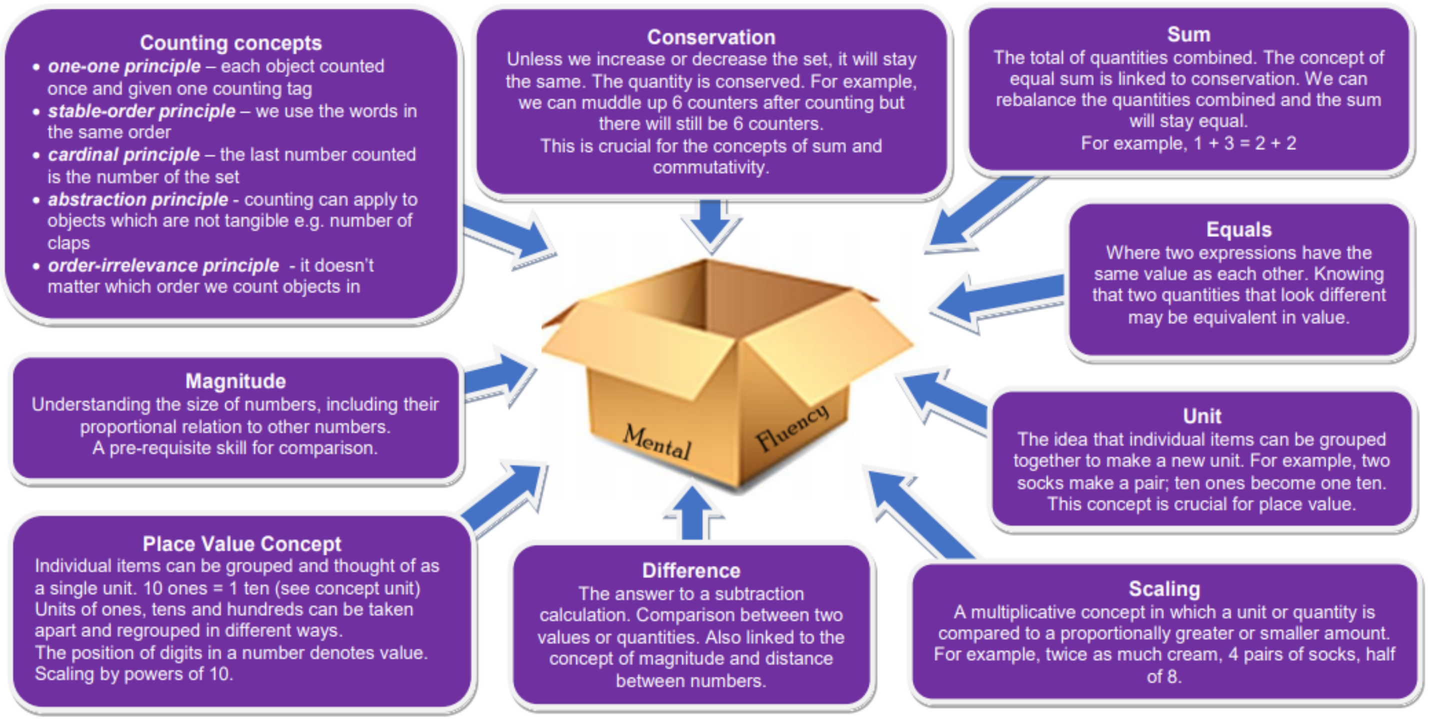
# Hadrian Park Primary School

## Fluency Progression Document

The NCETM set out 5 big ideas for mastery. These include coherence, representations, variation, mathematical thinking and fluency. They state that fluency demands more of students than memorisation of a single procedure or collection of facts. It encompasses a mixture of efficiency, accuracy and flexibility. Quick and efficient recall of facts and procedures is important in order for students to keep track of sub-problems, think strategically and solve problems. Fluency also demands the flexibility to move between different contexts and representations of mathematics, to recognise relationships and make connections, and to make appropriate choices from a whole toolkit of methods, strategies and approaches. This document aims to provide a structure in which teachers will explicitly teach these in a coherent and well thought out manner. The core mathematical concepts children need to become fluent are:



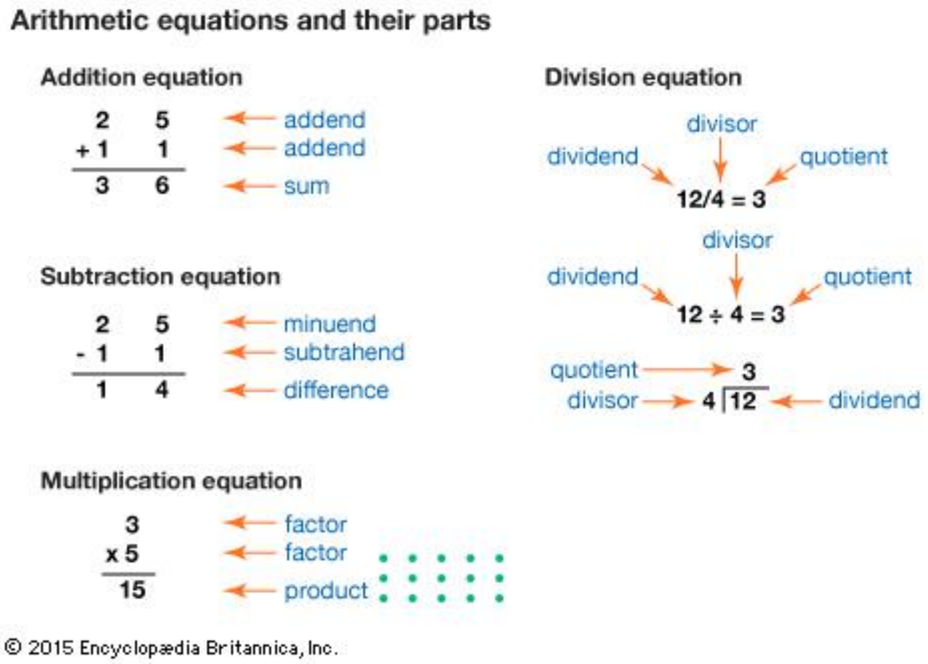
In order to achieve these, they will have to master the following skills:

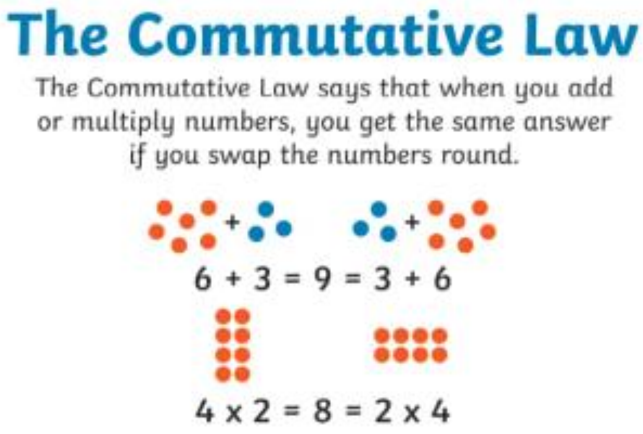
| | |
|---|---|
| **Subitising** | the ability to see number as pattern, such as dice patterns. This supports pupils to see numbers within numbers and better regrouping (partitioning). |
| **Regrouping (partitioning)** | the ability to break numbers up and recombine them flexibly |
| **Counting on and counting back** | in a variety of interval steps |
| **Reordering** | knowing when and how to reorder to make calculations easier |
| **Finding complements** | links to reordering, identifying useful complements pairs or trios of 1, 10, 60 etc. |
| **Applying the inverse** | use of fact family knowledge to 'undo' |
| **Rounding** | to a range of benchmark numbers |
| **Estimation** | both linear estimation on number lines and scales, and of quantities and calculations to support an increasing sense of what is reasonable |
| **Compensation** | to use rounding to add or subtract too much or too little and adjust accordingly |
| **Rebalancing** | to adjust the parts of addition and subtraction facts to make a calculation easier |
| **x ÷ by powers of 10** | |
| **Doubling and halving** | |
| **Rearranging** | to adjust the groups in multiplication and division to make a calculation easier |

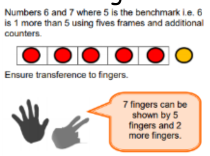
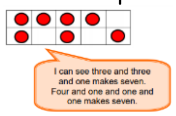
These are broken down below into skills which each year group should focus on. Below this are the Key Instant Recall Facts (KIRFs) for each year group.

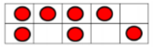
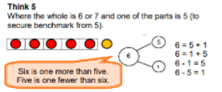
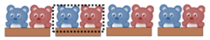
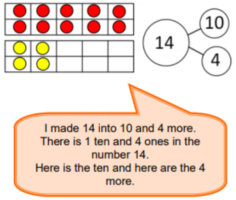
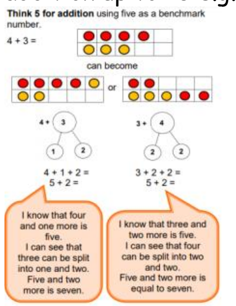
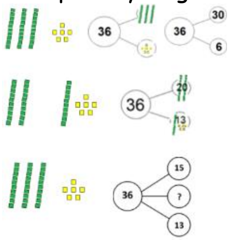
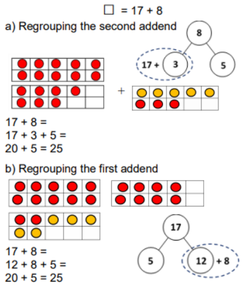
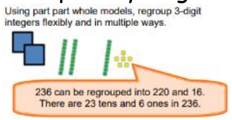
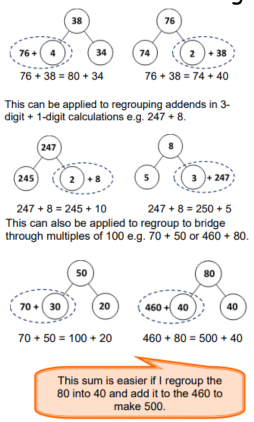
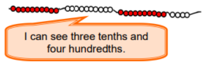
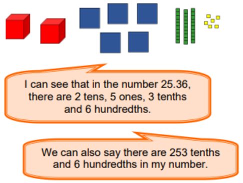
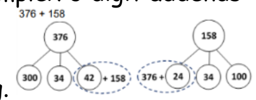
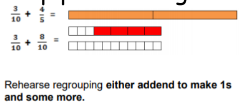
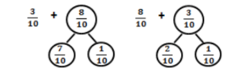
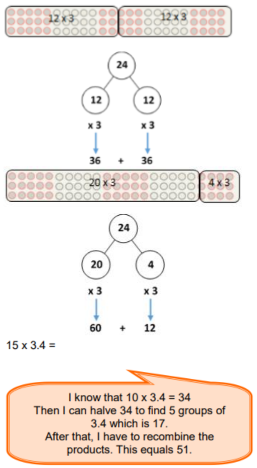
In all year groups, there should be a strong focus on **evaluation**. Children should be encouraged to regularly use, compare and evaluate the efficiency of different methods.

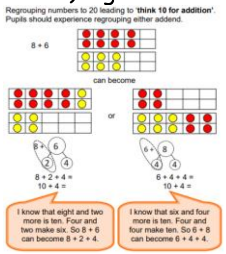
# DEFINITIONS

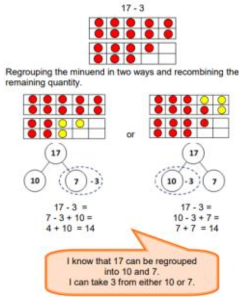


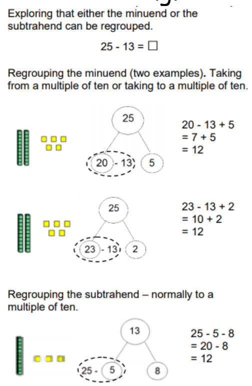



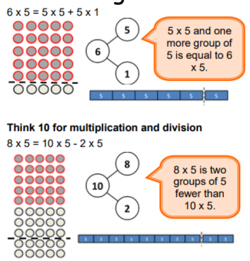
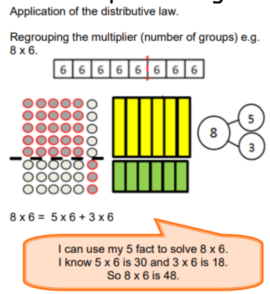

| Fluency skill | F2 | 1 | 2 | 3 | 4 | 5 and 6 |
|---|---|---|---|---|---|---|
| Subitising | Recognise groups up to 5 without the need to count<br><br>Identify 5 and use as a benchmark number e.g.<br><br><br>Identify numbers within a whole set | Recognise groups (up to 5) without the need to count and use this to identify numbers up to 10<br> | | | | |

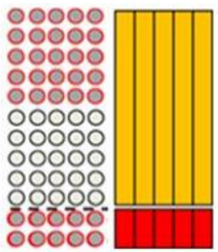
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | e.g.<br><br>I can see 3 and 3 and 1. I can see 4 and 1 and 1 and 1. I can see 4 and 3. | | | | | | |
| Regrouping (partitioning) | Use 5 as a benchmark number<br><br><br>Understand a whole = part and part<br><br><br>Identify a group as a unit e.g. a unit is 2 teddies<br> | 'Think 10' – able to partition a number into 10 and some more e.g.<br><br><br>Able to regroup a whole up to 10 into different parts and understand the commutativity of this<br><br>Able to use 5 as a benchmark for regrouping for addition up to 10 e.g.<br><br><br>Able to use 10 as a benchmark for | Regroup two digit numbers flexibly and in multiple ways e.g.<br><br><br>Able to 'think 10' for addition e.g.<br> | Regroup three digit numbers flexibly and multiple ways e.g.<br><br><br>Regroup for addition to allow bridging through 10 and 100. Work flexibly and reason about the most efficient methods e.g.<br><br><br>Regroup for subtraction to allow bridging through 10 and 100. Work flexibly with both the minuend and the subtrahend. | Regroup four digit numbers flexibly and in multiple ways<br><br>Regroup tenths and hundredths flexibly and in multiple ways e.g.<br><br><br><br>In addition, regroup to 'think 100' with more complex 3 digit addends<br>e.g.<br><br><br>In subtraction, regroup to 'think 100' with more complex 3 digit numbers<br><br>Use regrouping strategies to fractional part wholes, as well as other measures such as time and money e.g. | Use regrouping as a valid method in a multi-step problem e.g.<br><br><br><br>Regroup for multiplication in a variety of ways e.g. 24 x 3<br><br><br>Regroup for division in a variety of ways e.g. 72 ÷ 3 |

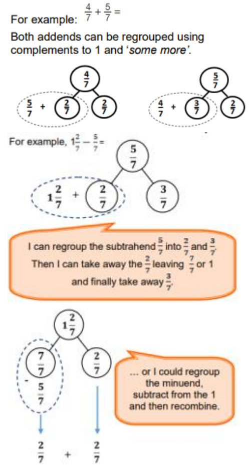
<table>
<tr>
<td></td>
<td></td>
<td>regrouping for addition up to 20 (think “10 and some more”) e.g.


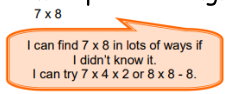
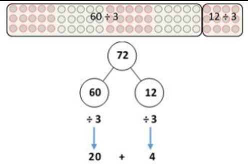

Able to use 10 as a benchmark for regrouping for subtraction up to 20, using wither the minuend or the subtrahend, without bridging through ten e.g.


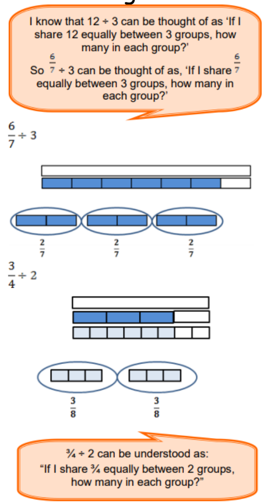

Able to use 10 as a benchmark for regrouping for subtraction up to 20, using either the minuend or the subtrahend, bridging</td>
<td>Able to 'think 10' for subtraction e.g.


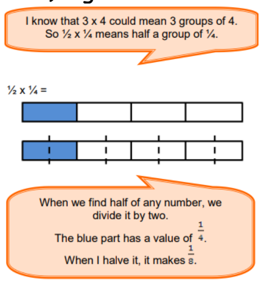

'Think 5' for multiplication and division e.g.

</td>
<td>In multiplication, regroup to the '5' benchmark, working flexibly to regroup either the multiplier or the multiplicand e.g.


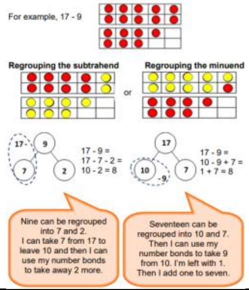
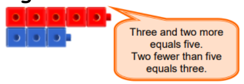
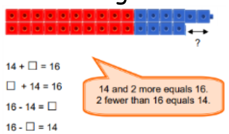
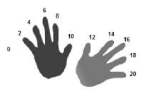
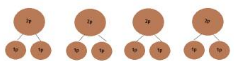
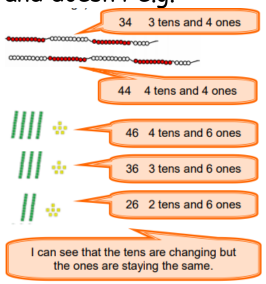
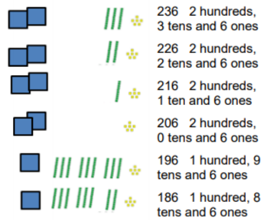
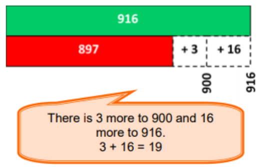
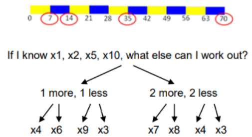

In multiplication, regroup to the 10 benchmark working flexibly to regroup either the multiplier or the multiplicand e.g. 12 x 5


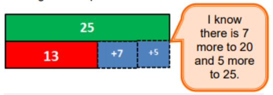
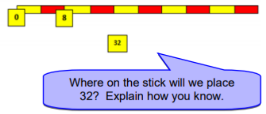
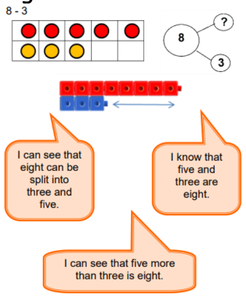
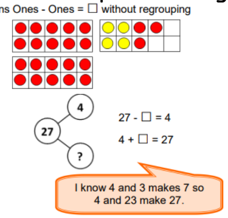
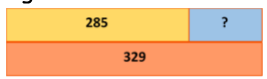
12 x 5 = 10 x 5 + 2 x 5</td>
<td>

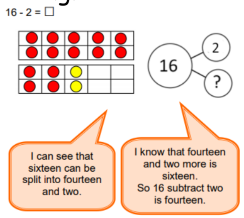
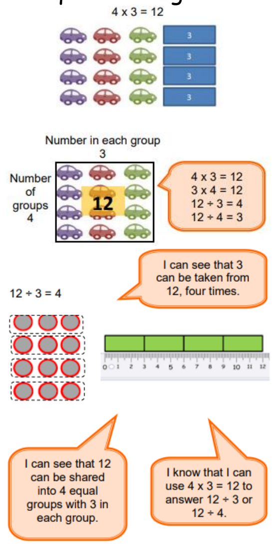
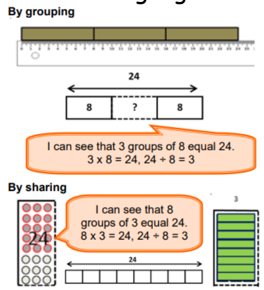

Use regrouping methods to find unknown products in multiplication e.g.

</td>
<td>

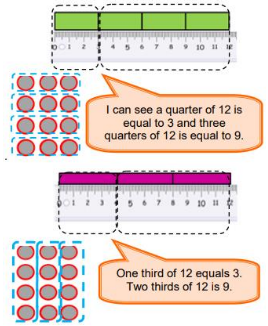
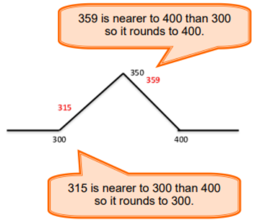
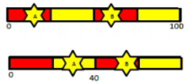
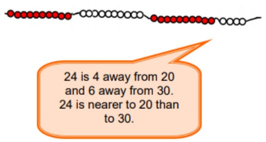

Regroup for division of fractions by whole numbers e.g.


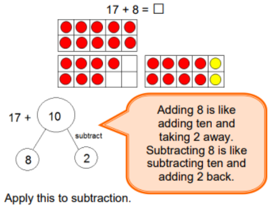
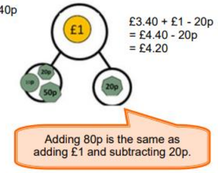
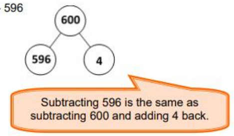
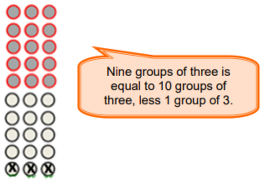
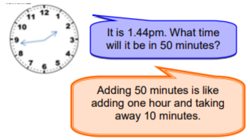
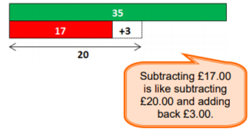
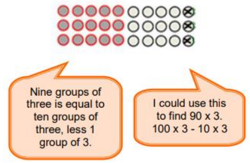
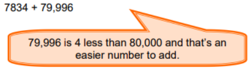
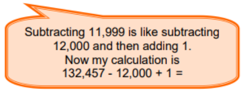

Regroup fractions for multiplication (focus on this understanding before applying the rule) e.g.

</td>
</tr>
</table>

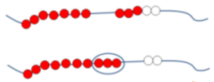
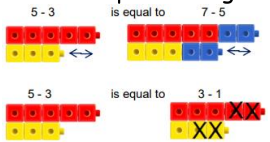
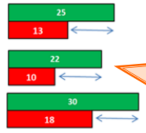
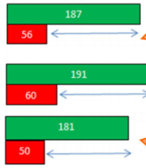
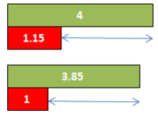
| | | | | | | |
|---|---|---|---|---|---|---|
| | | through ten e.g.<br> | | | | |
| Counting on and back | Be able to count fluently. To do this, children need to have mastered:<br>The one-one principle – each object is counted once and given one counting tag<br><br>The stable-order principle –we use the words in the same order<br><br>The cardinal principle – the last number counted is the number of the set<br><br>The abstraction principle - counting can apply to objects which are not tangible e.g. number of claps<br>□<br>The order-irrelevance | Count on to find the total and difference e.g.<br><br><br>Count on to find the total and difference and link this knowledge to fact families e.g.<br><br><br>Be able to skip count in a variety of ways to promote the 2x tables and doubles e.g.<br>Counting groups of objects with two hands (drawing out understanding of doubles).<br><br>To include opportunities to count in 2s in several ways<br><br> | Count in units where units are different e.g. 36 = ten, twenty, thirty, one, two, three, four, five, six<br><br>Count on and back from any two digit number and notice what changes and doesn't e.g.<br><br><br>Skip count in 3's in a variety of ways, forwards, backwards and from different starting points.<br><br>Count on to find complements to benchmark numbers within 100 e.g. | Count on and back from any three digit number and notice what changes and what doesn't e.g.<br><br><br>Count on to find complements to benchmark numbers within 1000 e.g.<br>916 – 897.<br><br><br>Understand the connections between the 3, 4 and 8 times tables and know strategies to be able to work out unknowns | Count on and back from any four digit number and notice what changes and what doesn't e.g.<br><br><br>Count on and back in multiples and make counting connections e.g. counting in 6's, 60's, 600's, 0.6's<br><br>Count in 25's, 50's, 0.1's and 0.001's<br><br>Skip count all the times tables and understand the connections between them<br> | |

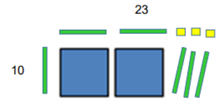
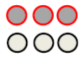
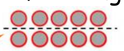
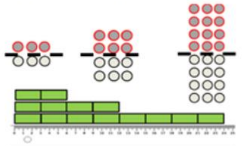
| | | | | | | |
|---|---|---|---|---|---|---|
| | principle - it doesn't matter which order we count objects in<br><br>Be able to count on when an addend is given, rather than count all<br><br>Be able to identify the largest number and count on from it | Be able to skip count in 5s and 10s in a variety of ways, forwards, backwards and from different starting points. | Drawing out complements to benchmark numbers.<br> | e.g.<br> | | |
| Reordering and finding complements | | Reorder to ensure efficient counting e.g.<br>There are 6 animals.<br><br>How many different ways can you sort the animals? | Reorder numbers to find complements when adding three one digit numbers e.g. 6+7+4 (add the 6 and 4 first to make 10) | Reorder three or more numbers up to 1000 to find complements e.g. 75+95+25 can be reordered into 75+25 to make the benchmark 100, then add 95 to total 195. Or 6+9+4+5+1 (reorder to make number bonds to 10) | Reorder three or more numbers up to 10,000 to find complements e.g.<br>800+240+360<br>310+700+30 =<br><br>Reorder three or more numbers involving tenths and hundredths to find complements e.g.<br>1.5+3+0.5<br>2.5+25+5+2.5= (reorder to make wholes) | Reorder three or more numbers to find complements where the arrangement is more complex e.g.<br>£3.99+£7.80+£2.01 |
| Applying the inverse | | Think addition to solve subtraction with numbers to 10 e.g.<br> | Think addition to solve subtraction with numbers up to 100 e.g.<br><br><br>Understand the relationship between multiplication and | Think addition to solve subtraction with numbers up to 1000 e.g.<br><br>329 - 285 = ☐ so 285 + ☐ = 329<br><br>Think multiplication for division by grouping | | |

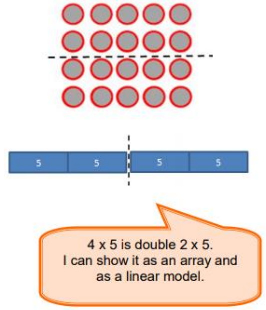
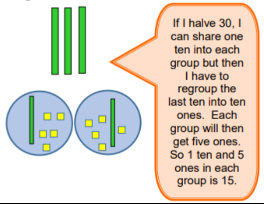
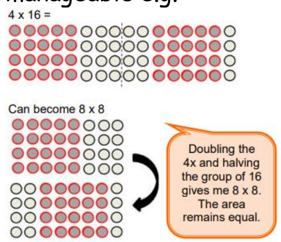
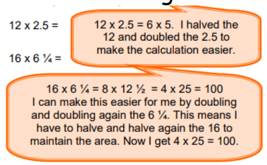
| | | | | | | |
|---|---|---|---|---|---|---|
| | | Think addition to solve subtraction with numbers up to 20 e.g.<br><br> | division. In multiplication, understand the interrelationship between multiplier, multiplicand and product. In division, understand the relationship between the dividend, divisor and quotient e.g.<br><br><br>Make the connections between multiplication and division and | AND sharing e.g.<br><br><br>Make further connections between multiplication and division and fractions | | |

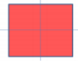
| | | | | | | |
|---|---|---|---|---|---|---|
| | | | fractions e.g.<br><br> | | | |
| Rounding | | | | Identify the midpoint between a set of numbers under 1000 (and use this in order to understand rounding) e.g.<br><br> | Round to the nearest 10, 100, 1000 and other units such as money and time | Round to the nearest 10, 100, 1000, 10,000 and other units such as money, time, decimal numbers, negative numbers<br><br>Use rounding as an estimation for multiplication and division e.g.<br>688 x 79 =<br>688 rounds to 700 and 79 rounds to 80. The calculation 688 x 79 is close to 700 x 80, which is 56,000.<br><br>789 ÷ 79 =<br>789 rounds to 800 and 79 rounds to 80. The calculation 789 ÷ 80 is close to 800 ÷ 80, which equals 10. |
| Estimation | | | Estimate the distance of numbers from target numbers under 100 e.g.<br><br><br>Drawing out understanding of the distance of numbers to target numbers.<br><br> | Estimate the distance of numbers from target numbers under 1000 to prepare for rounding e.g. 234 is 4 from 230 and 6 from 240. 240 is nearer to 230 than 240 | Estimate the distance of numbers from target numbers up to 10,000, including tenths and hundredths to prepare for rounding e.g. 2134 is 34 from 2100 and 66 from 2200. 2134 is nearer to 2100 than 2200. | Estimate the distance of numbers from target numbers up to 1,000,000, including decimal numbers and negative numbers, to prepare for rounding e.g. 20,034 is 4 from 20,030 and 6 from 20,040. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | 20,034 is nearer to 20,030 than to 20,040. |
| Compensation | | | 'Think 10', use benchmark numbers and compensate for trickier calculations e.g.<br><br><br>Apply this to subtraction. | Use benchmark numbers and compensate for adding and subtracting numbers up to 1000, including money e.g.<br>£3 and 40p add 80p<br>£3 and 40p<br><br><br>632 - 596<br><br><br><br>Use known facts to compensate for unknown multiplication and division calculations up to 12x tables e.g.<br>9 x 3 = 10 x 3 - 3<br>9 x 3 = 10 x 3 - 1 x 3<br><br> | Use benchmark numbers and compensate for adding and subtracting numbers up to 10,000, including money and time e.g. "I could think of 2550 + 490 as compensation because adding 490 is like adding 500 and taking ten away. Now my calculation looks like this:<br>2550 + 500 - 10 = 3040.<br><br><br><br><br><br>Compensate in multiplication and division with numbers up to 1000 e.g.<br>3 x 9 = 3 x 10 - 3<br><br> | Use number knowledge to look for 'nearly numbers' in calculations (including decimals) e.g.<br>7834 + 79,996<br><br><br>132,457 - 11,999 =<br><br> |
| Rebalancing | | | Understand the concept of equal sum (that the sum remains equal when the addends are rebalanced in addition) with numbers up to 20 | Use the equal sum concept with numbers up to 1000 as a method to solve addition | Use the equal sum concept with numbers up to 10,000, including units of time and money, as a method to solve addition | Apply the equal sum concept to a range of numbers and missing number problems (including units of time |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | e.g.<br><br>I can prove that 7 + 5 = 10 + 2 using a bead string.<br><br>Understand the concept of equal difference (subtracting the same quantity from both subtrahend and minuend maintains the difference) with numbers up to 20 e.g.<br><br> | calculations e.g.<br>e.g. 52 + 37<br>52 + 37<br>I move 2 beads from the 52 and give them to the 37.<br>Now I can solve 50 + 39. It's easier.<br><br>Use the equal difference concept with numbers up to 1000 as a method to solve subtraction calculations e.g.<br><br><br>I can take 3 from each number and the difference will remain equal.<br>I can add 5 to each number and the difference will remain equal.<br>If I wanted to solve 21 - 16, I can take 1 from each number and solve it as 20 - 15.<br>That is an easier calculation. | calculations e.g.<br>255 + 49 is easier if I take one from the 255 and give it to the 49. My sum stays equal.<br>Then my sum becomes 254 + 50 = 304.<br><br>It is 1.44pm. What time will it be in 50 minutes?<br>10 minutes<br>1 hour 44 minutes + 50 minutes =<br>1 hour 34 minutes + 60 minutes =<br>2 hours and 34 minutes =<br>2.34pm<br>If I give 10 minutes from the 1 hour 44 to the 50 minutes then I can add on 1 hour.<br><br>Use the equal difference concept with numbers up to 10,000, including units of time and money as a method to solve subtraction calculations e.g.<br><br><br>I can add 4 to each number and the difference will remain equal.<br>I can take 6 from each number and the difference will remain equal.<br>Which strategy did you prefer? Explain why.<br><br>Use equal difference concept with tenths and simple fractions e.g.<br>6.4 - 3.9   6.6 - 3.2   7.7 - 4.8   $1\frac{2}{7} - \frac{5}{7}$ | and money) e.g.<br>24 + □ = 30 + 3.<br>39 + 52   345 + 198<br>0.39 + 6.54   5.1 + 2.7 = □ + 4.8<br>7834 + 79,996<br>79,996 is 4 away from 80,000.<br>I can rebalance the sum by taking 4 from 7834 and giving it to the 79,996.<br>Now I have 80,000 + 7,830 = 87,830.<br><br>Use the equal difference concept with a range of numbers, decimals and fractions e.g.<br>132,457 - 11,999 =<br>11,999 is nearly 12,000. If I add one to each number the difference will stay equal.<br>Now my calculation is 132,458 - 12,000 =<br>□ = 4 - 1.15<br><br><br>It is easier if I subtract 0.15 from each number. The difference will stay the same. Now my calculation is 3.85 - 1 =<br><br>£122.56 - £87.99   9.1 - 6.7   15.3 - 5.7 |
| X ÷ by powers of 10 | | | | Understand the concept of x and ÷ 10, and use known facts to multiply and divide by | Understand the concept of x and ÷ 10, and use known facts to multiply and divide by 10, 100 and 1000 e.g. 4000 x 6, 240 ÷ 4, 750mm = _____ cm. | X and ÷ by powers of 10, including 2 step problems. Includes decimals e.g.<br>The division diagram shows 7,200 ÷ 200 = 36<br>Use the diagram to solve:<br><br><br>3,600 ÷ 200 = □<br>18,000 ÷ 200 = □<br>5,400 ÷ □ = 27<br>□ = 6,600 ÷ 200<br>5600 ÷ 80   30 = □ ÷ 12   270 ÷ 9 = □ ÷ 0.9<br>7 x 0.001   1.8 ÷ 0.1   3.25 ÷ 0.00001 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | 10 and 100 e.g.<br><br><br><br><br>☐ = 120 ÷ 3<br> | | Circle two numbers that multiply together to equal 10 million<br>200 2,000 5,000 50,000<br>"I know that 10 million has 8 place values columns and 7 0's. I know that 2 x 5 = 10. This already has one 0, therefore I could use 2000 x 5000 or 200 x 50,000" |
| Doubling and halving | Be able to find double of a number (up to 10) using concrete resources e.g.<br>**Outdoors**<br>Have number shapes hidden around the outdoor area.<br>Give each child a number shape and ask them to find another one the same to make a double. Encourage them to say the double they have found, e.g. Double 5 is 10<br><br><br>Be able to link 'fair sharing' between 2 to the language of 'equal parts' and 'half' | Find doubles up to 20 and link this to repeated addition e.g.<br>Build / Represent / Add / Double<br>1 + 1 = 2 / Double 1 is 2<br>2 + 2 = __ / Double 2 is __<br>3 + 3 = __ / Double 3 is __<br>__ + __ = __ / Double 4 is __<br><br>Understand the link between doubling, halving odds and evens | Find doubles and near doubles with numbers up to 100 e.g.<br>**Finding doubles and near doubles**<br><br><br><br><br>Relate repeated addition to multiplication e.g. 3 + 3 = 2 x 3<br><br>Use doubling to relate multiplication facts e.g.<br><br> | Find doubles and near doubles with numbers up to 1000 e.g.<br><br><br>Use doubling and halving to find unknown products e.g.<br>To include 'double and double' strategy for x8 and halving strategy for finding x5.<br><br><br><br>Be able to generalise what happens when we halve a number that is an odd multiple of 100 e.g. "If I halve 700, I can share three hundreds into each | Find doubles and near doubles with numbers up to 10,000.<br><br>Use doubling and halving to find unknown products in multiples of 10 e.g. 9 x 200 "I know that 9 x 100 = 900, and 200 is double 100, so to find the product I can double 900 to get 1800." | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | <br>Be able to generalise what happens when we halve a number that is an odd multiple of 10 e.g.<br> | group but then I have to regroup the last hundred into ten tens. Each group will then get five tens. So three hundreds and 5 tens in each group is 350."<br>"Where there is an odd multiple of ten or hundred, I will always have to regroup my last ten or hundred into the next place value column down. Then I will share half of that between the two groups which will always be 5 units (5 ones or 5 tens)" | | |
| Rearranging | | | | | Rearrange the multiplier and multiplicand using knowledge of doubles and halves to make a calculation more manageable e.g.<br> | Use the relationship between doubling and halving to manipulate the multiplicand and the multiplier to find more efficient calculations e.g.<br><br>Use halving and halving for division, understanding why the halving needs to be done to the dividend and divisor and not the |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | quotient e.g.<br><br>72 ÷ 4 = (72 ÷ 2) ÷ 2<br>When I am dividing by 4, I like to halve the number and halve it again.<br>For example, If I shared 12 cookies among 4 children each child would get 3 cookies.<br>12 ÷ 4 = 3<br><br>I can also see that 6 cookies shared between 2 people would give the same group size. The size of the group hasn't changed. So 12 ÷ 4 can be changed into 6 ÷ 2.<br><br>As I am trying to find out the group size, I can also see that 3 ÷ 1 gives me the group size. So 12 ÷ 4 can be thought of as 6 ÷ 3 and 3 ÷ 1. I can see all of these in the array.<br>Applying this conceptual understanding to larger numbers encourages playfulness with division.<br>*364 ÷ 16 =*<br>182 ÷ 8 =<br>91 ÷ 4 =<br>45.5 ÷ 2 =<br>22.75<br>I saw that I could halve both the dividend and the divisor, so I did to see if it made it easier. Then I realised that I could halve them again and again.<br>Apply halving and doubling to fractions e.g.<br>Pupils have already secured conceptual understanding of this rule, for example:<br>5 x 4 = 10 x 2 = 20 x 1<br>Apply this understanding to fractions, for example:<br>½ x ¼ =<br>If we double the first term and halve the second, we can transform the calculation to:<br>$1 \times \frac{1}{8} = \frac{1}{8}$ |

## Key Instant Recall Facts (KIRFS)

Fluency also means automatic recall of key facts. These are the facts which children should be able to recall at the end of each year group. They will need to explicitly be taught strategies (doubles and near doubles, compensating etc.) to work them out as well as lots of practice in order to achieve automaticity in recall.

Adding 1 | Bonds to 10 | Adding 10 | Bridging/ compensating
Adding 2 | Adding 0 | Doubles | Near doubles

Y1 facts
Y2 facts

| + | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 + 0 | 0 + 1 | 0 + 2 | 0 + 3 | 0 + 4 | 0 + 5 | 0 + 6 | 0 + 7 | 0 + 8 | 0 + 9 | 0 + 10 |
| 1 | 1 + 0 | 1 + 1 | 1 + 2 | 1 + 3 | 1 + 4 | 1 + 5 | 1 + 6 | 1 + 7 | 1 + 8 | 1 + 9 | 1 + 10 |
| 2 | 2 + 0 | 2 + 1 | 2 + 2 | 2 + 3 | 2 + 4 | 2 + 5 | 2 + 6 | 2 + 7 | 2 + 8 | 2 + 9 | 2 + 10 |
| 3 | 3 + 0 | 3 + 1 | 3 + 2 | 3 + 3 | 3 + 4 | 3 + 5 | 3 + 6 | 3 + 7 | 3 + 8 | 3 + 9 | 3 + 10 |
| 4 | 4 + 0 | 4 + 1 | 4 + 2 | 4 + 3 | 4 + 4 | 4 + 5 | 4 + 6 | 4 + 7 | 4 + 8 | 4 + 9 | 4 + 10 |
| 5 | 5 + 0 | 5 + 1 | 5 + 2 | 5 + 3 | 5 + 4 | 5 + 5 | 5 + 6 | 5 + 7 | 5 + 8 | 5 + 9 | 5 + 10 |
| 6 | 6 + 0 | 6 + 1 | 6 + 2 | 6 + 3 | 6 + 4 | 6 + 5 | 6 + 6 | 6 + 7 | 6 + 8 | 6 + 9 | 6 + 10 |
| 7 | 7 + 0 | 7 + 1 | 7 + 2 | 7 + 3 | 7 + 4 | 7 + 5 | 7 + 6 | 7 + 7 | 7 + 8 | 7 + 9 | 7 + 10 |
| 8 | 8 + 0 | 8 + 1 | 8 + 2 | 8 + 3 | 8 + 4 | 8 + 5 | 8 + 6 | 8 + 7 | 8 + 8 | 8 + 9 | 8 + 10 |
| 9 | 9 + 0 | 9 + 1 | 9 + 2 | 9 + 3 | 9 + 4 | 9 + 5 | 9 + 6 | 9 + 7 | 9 + 8 | 9 + 9 | 9 + 10 |
| 10 | 10 + 0 | 10 + 1 | 10 + 2 | 10 + 3 | 10 + 4 | 10 + 5 | 10 + 6 | 10 + 7 | 10 + 8 | 10 + 9 | 10 + 10 |

| - | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 - 0 | 1 - 1 | | | | | | | | | |
| 2 | 2 - 0 | 2 - 1 | 2 - 2 | | | | | | | | |
| 3 | 3 - 0 | 3 - 1 | 3 - 2 | 3 - 3 | | | | | | | |
| 4 | 4 - 0 | 4 - 1 | 4 - 2 | 4 - 3 | 4 - 4 | | | | | | |
| 5 | 5 - 0 | 5 - 1 | 5 - 2 | 5 - 3 | 5 - 4 | 5 - 5 | | | | | |
| 6 | 6 - 0 | 6 - 1 | 6 - 2 | 6 - 3 | 6 - 4 | 6 - 5 | 6 - 6 | | | | |
| 7 | 7 - 0 | 7 - 1 | 7 - 2 | 7 - 3 | 7 - 4 | 7 - 5 | 7 - 6 | 7 - 7 | | | |
| 8 | 8 - 0 | 8 - 1 | 8 - 2 | 8 - 3 | 8 - 4 | 8 - 5 | 8 - 6 | 8 - 7 | 8 - 8 | | |
| 9 | 9 - 0 | 9 - 1 | 9 - 2 | 9 - 3 | 9 - 4 | 9 - 5 | 9 - 6 | 9 - 7 | 9 - 8 | 9 - 9 | |
| 10 | 10 - 0 | 10 - 1 | 10 - 2 | 10 - 3 | 10 - 4 | 10 - 5 | 10 - 6 | 10 - 7 | 10 - 8 | 10 - 9 | 10 - 10 |
| 11 | | 11 - 1 | 11 - 2 | 11 - 3 | 11 - 4 | 11 - 5 | 11 - 6 | 11 - 7 | 11 - 8 | 11 - 9 | 11 - 10 |
| 12 | | | 12 - 2 | 12 - 3 | 12 - 4 | 12 - 5 | 12 - 6 | 12 - 7 | 12 - 8 | 12 - 9 | 12 - 10 |
| 13 | | | | 13 - 3 | 13 - 4 | 13 - 5 | 13 - 6 | 13 - 7 | 13 - 8 | 13 - 9 | 13 - 10 |
| 14 | | | | | 14 - 4 | 14 - 5 | 14 - 6 | 14 - 7 | 14 - 8 | 14 - 9 | 14 - 10 |
| 15 | | | | | | 15 - 5 | 15 - 6 | 15 - 7 | 15 - 8 | 15 - 9 | 15 - 10 |
| 16 | | | | | | | 16 - 6 | 16 - 7 | 16 - 8 | 16 - 9 | 16 - 10 |
| 17 | | | | | | | | 17 - 7 | 17 - 8 | 17 - 9 | 17 - 10 |
| 18 | | | | | | | | | 18 - 8 | 18 - 9 | 18 - 10 |
| 19 | | | | | | | | | | 19 - 9 | 19 - 10 |
| 20 | | | | | | | | | | | 20 - 10 |

Children will also need to recall the inverse subtraction fact

## EYFS

- Recognise the number 0-20
- Know one more and 1 less for number 0-20
- Know the days of the week in order
- Identify 2D shapes: circle, square, triangle, rectangle, hexagon, pentagon

- Identify 3D shapes: sphere, cylinder, cone, cubes, cuboids

Year 1

- Facts within 10 as above and related subtraction facts
- Know o'clock and half past times
- Know the seasons in order
- Know the months of the year in order
- Identify 3D shapes: pyramids, square based pyramids

Year 2

- Facts within 20 as above and related subtraction facts
- Doubles and halves of numbers to 20
- Multiplication and division facts 2, 5 and 10 x tables
- Multiplication facts for 3 x tables (although this is not covered in more depth until year 3, there have been questions on year 2 SATs covering counting in 3's)
- Know quarter past and quarter to times, as well as intervals of 5
- Number of minutes in an hour; number of hours in a day
- Coin recognition up to £2 and note recognition
- Know 100p=£1
- Identify 2D shapes: quadrilaterals, regular and irregular polygons
- Identify 3D shapes: cuboids, prisms

Year 3

- Sums and differences between pairs of numbers which are multiples of 10 and 100
- Doubles and halves of multiples of 10 or 100
- Complements to 100
- Complements to 60 (time)
- Complements of fractions with the same denominator that make 1 e.g. 3/7 + 4/7 = 1
- x 3, x 4, x 8 facts including division facts
- Number of seconds in a minute, number of minutes in an hour, number of hours in a day, number of days in a week
- Number of days in each month and in a year including a leap year
- Recognise right angles
- Recognise parallel and perpendicular lines
- Recognise horizontal and vertical

Year 4

- Review addition and subtraction facts within 20, ensure application to 10, 100 and 1000 (6 + 3, 60 + 30, 600 + 300, 6000 + 3000)
- Doubles and halves of multiples of 10, 100 or 1000 (6 + 6, 60 + 60, 600 + 600, 6000 + 6000)
- All multiplication and division facts to 12 x 12

- Multiplication and division by zero and one facts
- Division and multiplication by 10 and 100
- Conversion of kilometres to metres, hours to minutes, years to months, weeks to days
- Complements of tenths that make 1
- Complements of hundredths that make 1
- Convert between decimals and fractions for $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{4}$ and any number of tenths and hundredths
- Read roman numerals to 100
- Know right angles = 90 degrees
- Know the types of triangle (isosceles, equilateral, scalene)

## Year 5

- Identify prime numbers up to 20 (2, 3, 5, 7, 11, 13, 17, 19)
- Recall metric conversions (1 kilogram = 1000 grams, 1 kilometre = 1000 metres, 1 metre = 100 centimetres, 1 metre = 1000 millimetres, 1 centimetre = 10 millimetres 1 litre = 1000 millilitres)
- Recall square numbers up to 12 squared and their square roots
- Read Roman numerals to 1000
- Know angles on a straight line = 180 degrees
- Know angles in a triangle = 180 degrees
- Know angles around a point = 360 degrees

| | | |
|---|---|---|
| 1/2 | 0.5 | 50% |
| 1/4 | 0.25 | 25% |
| 3/4 | 0.75 | 75% |
| 1/5 | 0.2 | 20% |
| 1/10 | 0.1 | 10% |
| 2/5 | 0.4 | 40% |
| 1/100 | 0.01 | 1% |
| 9/100 | 0.09 | 9% |
| 21/100 | 0.21 | 21% |
| 1/20 | 0.05 | 5% |

## Year 6

- Convert between decimals, fractions and percentages

- Identify prime numbers up to 50 (2, 3, 5, 7, 11, 13, 17, 19, 23, 27, 29, 31, 37, 41, 43, 47)
- Illustrate and name parts of a circle, including radius, diameter and circumference and know that the diameter is twice the radius


Sources and references

Herts for Learning Progression in Mental Maths: http://tannerswood.herts.sch.uk/wp-content/uploads/2016/04/Progression_mental_mathematics_september_2017.pdf

White Rose Primary and EYFS schemes of learning: https://whiterosemaths.com/resources/schemes-of-learning/primary-sols/

Power Maths by Pearson: https://www.activelearnprimary.co.uk/start#powermaths

Fluent in Five by Third Space Learning

Progression in Geometry document, Woodlands School: https://www.woodlands-sch.org.uk/wp-content/uploads/2015/08/Progression-in-geometry-doc.pdf

Mathematics Programme of Study: key stages 1 and 2. National curriculum in England:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/335158/PRIMARY_national_curriculum_-_Mathematics_220714.pdf

Daniel Willingham: Is it true that some people just can't do math? https://www.aft.org/sites/default/files/periodicals/willingham.pdf

Jo Boaler, What is Number Sense: https://www.youcubed.org/resources/what-is-number-sense/

Jo Boaler, Fluency Without Fear: https://www.youcubed.org/evidence/fluency-without-fear/

Jenny Field, A whole school intervention for teaching, learning and understanding times tables: file:///C:/Users/staff/OneDrive/2019-2020/Maths%20Lead/Research/26932%20FIELD_A_Whole_School_Intervention_for_Teaching_Learning_and%20Understanding_Jan%202020.pdf

Cambridge Maths Espresso: What are the issues in learning and assessing times tables? file:///C:/Users/staff/OneDrive/2019-2020/Maths%20Lead/Research/espresso_1_learning_and_assessing_times_tables.pdf

Archemides NE Maths Hub: Teaching Times Tables: A Whole school Approach https://carmelarchimedesmathshub.org.uk/wp-content/uploads/2018/10/Times-Table-A-Whole-School-Approach.pdf

NCETM sources:

https://www.ncetm.org.uk/resources/50006

https://www.ncetm.org.uk/resources/40533

https://www.ncetm.org.uk/resources/45233

https://www.ncetm.org.uk/files/111737428/Fluency+handout.pdf

https://www.ncetm.org.uk/resources/49037

KIRFS: https://redmile.leics.sch.uk/pdfs/curriculum/maths-kirfs.pdf