2022/2023

# Ellison Primary Academy Calculation Policy

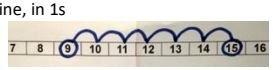
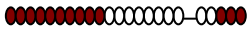
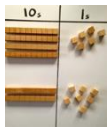
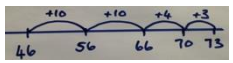
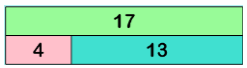
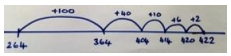
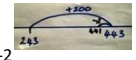
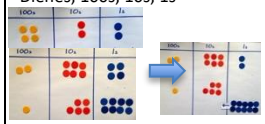
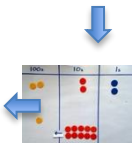
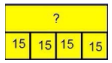
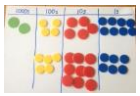
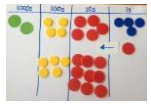
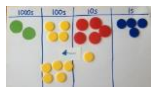
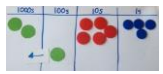
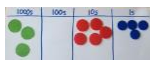
## Principles

- Specific practical equipment and approaches have been suggested for each age group to support children in developing the conceptual understanding that will enable them to move more rapidly and efficiently towards the formal written methods expected.
- It is recommended that teachers encourage children to simultaneously carry out the calculation Using one of the following: concrete, pictorial or abstracts.
- The 'Written Methods', 'With jottings …or in your head' and 'Just know it' sections list the national curriculum expectations of the year group for calculation.
- The 'Developing Conceptual Understanding' section illustrates how to build children's understanding of the formal methods using a range of specific practical equipment and representations. The expected language for the formal methods is modelled in this section in the older year groups – this language should be used throughout whenever the formal method is used.
- The 'Skills and knowledge to ensure fluency' section for each year group highlights the skills and knowledge that should be addressed on a regular basis within this year group to ensure that children have the requisite fluency to address the new approaches required.

S.Lewis
Ellison Primary Academy
9/9/2022

**Ellison Primary Academy 2022**

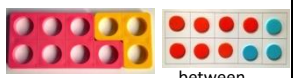
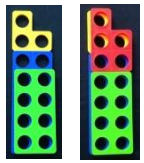
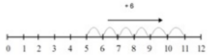
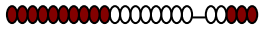
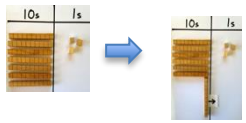
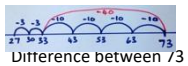
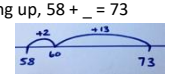
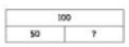
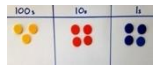
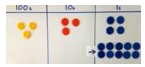
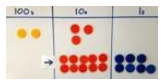
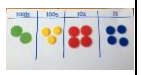
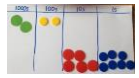
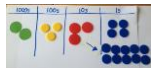
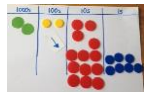
# Addition

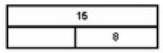
| Year | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **End of Year Expectations for Written Methods** | Read, write and interpret mathematical statements involving addition (+), subtraction (–) and equals to (=) signs | Add and subtract two two-digit numbers using concrete objects, pictorial representations in preparation to progress to formal written methods<br>46<br>+27<br>73<br>1 | Add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction<br>423<br>+ 88<br>511<br>1 1<br>This may also include the expanded methods for addition:<br>353+268=621<br>300+50+3<br>200+60+8<br>600+20+1=621<br>100 10 | Add and subtract numbers with up to 4 digits using the formal written methods of columnar addition where appropriate. They check the answer with the inverse.<br>2458<br>+ 596<br>3054<br>1 1 1 | Add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction) and decimal numbers. They check the answer with the inverse.<br>23454<br>+ 596<br>24050<br>1 1 1<br>£ 6.72<br>8.56<br>+ 2.30<br>£ 17.58 | Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why, including decimals with varying place values – including using 0 as a place holder.<br>124.9 + 7.25<br>124.90*<br>+ 7.25<br>132.15<br>11 |
| **Developing conceptual understanding**<br>Pictorial to concrete using year group expected language<br><br>(may include these examples and further concrete methods) | **Concrete**<br>Number bonds<br><br>(Ten frame)<br><br>Numicon<br><br>Use bonds of 10 to calculate bonds of 20<br><br><br>**Pictorial**<br>Count all<br><br><br>Count on<br><br><br>Count on, on number track/Number line, in 1s<br><br><br><br><br><br><br>To use the part-part whole method<br><br><br><br>To use bar modelling to represent calculation. | **Concrete**<br>Number track / Number line – jumps of 1 then efficient jumps using number bonds<br>18 + 5 = 23<br><br><br>Partition and recombine<br>46 + 27 = 60 + 13 = 73<br><br><br><br>24 +10 +10 +10 = 54<br><br><br><br>**Pictorial**<br>46 + 27 = 73 Count in tens then bridge.<br><br><br><br><br><br>To use bar modelling to represent calculation. | Concrete and Pictorial<br>Number line: 264 + 158 efficient jumps(Support mental strategy)<br><br><br><br>40 + 80 = 120 using 4 + 8 = 12<br>So 400 + 800 = 1200<br><br>243 + 198<br>by +200 then -2<br>(Round and adjust)<br><br><br><br>Pairs that make 100<br>23 + 77<br><br><br>Place value counters or Dienes, 100s, 10s, 1s<br><br><br><br><br>= 422<br>(Also with £, 10p and 1p)<br><br><br><br>To use bar modelling to represent calculation. | Concrete and Pictorial<br>Place Value Counters 2458 + 596<br><br>Show 2458 and 596<br><br><br>Combine the 1s.<br>Exchange ten 1s for a 10 counter.<br><br><br>Combine the 10s.<br>Exchange ten 10s for a 100 counter.<br><br><br>Combine the 100s.<br>Exchange ten 100s for a 1000 counter<br><br><br>Read final answer<br>Three thousand and fifty-four.<br> | Abstract<br>Set out the calculation In columns.<br>23454<br>+ 596<br><br>Find the sum of the ones.<br>4 ones + 6 ones = 10 ones (or 1 ten and 0 ones) so record 0 in the ones and 1 below the line in the tens.<br>23454<br>+ 596<br>0<br>1<br><br>Find the sum of the tens.<br>5 tens + 9 tens + 1 ten = 15 tens (or 1 hundred and 5 tens) so record a 5 in the tens and 1 below the line in the hundreds.<br>23454<br>+ 596<br>50<br>1 1<br><br>Find the sum of the hundreds.<br>4 hundreds + 5 hundreds + 1 hundred = 10 hundreds (or 1 thousand and 0 hundreds) so record a 0 in the hundreds and a 1 in the thousands.<br>23454<br>+ 596<br>050<br>1 1 1<br><br>Find the sum of the thousands.<br>3 thousands + 1 thousand = 4 thousands so record a 4 in the thousands column.<br>23454<br>+ 596<br>4050<br>1 1 1<br><br>Find the sum of the ten thousands.<br>There are only 2 ten thousands so record a 2 in the final column.<br>23454<br>+ 596<br>24050<br>1 1 1 | Abstract<br><br>As with Year 5, also begin to increase knowledge of different addition methods and select the most appropriate.<br><br>As the children move on, introduce decimals with the same number of decimal places and different. Money can be used here.<br><br>2 3 . 3 6 1<br>9 . 0 8 0<br>5 9 . 7 7 0<br>+ 1 . 3 0 0<br>9 3 . 5 1 1<br>2 1 2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **With jottings**<br><br>**… or in your head** | **Abstract**<br>Solve one-step problems that involve addition and subtraction, using missing number problems such as 7 = □ – 9 | **Abstract**<br>Add and subtract numbers mentally, including:<br>* a two-digit number and ones<br>* a two-digit number and tens<br>* two two-digit numbers<br>* adding three one-digit numbers | **Abstract**<br><br>Add and subtract numbers mentally, including:<br>* a three-digit number and ones<br>* a three-digit number and tens<br>* a three-digit number and hundreds | **Abstract**<br><br>Solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why | Add and subtract numbers mentally with increasingly large numbers | Perform mental calculations, including with mixed operations and large numbers. |
| **Just know it!** | Represent & use number bonds and related subtraction facts within 20<br>Add and subtract one-digit and two-digit numbers to 20, including zero | Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100 | FOR ALL YEAR GROUPS:<br><br>Apply known facts | | | |
| **Skills and knowledge to ensure fluency** (To be used on a regular basis) | 1 more | 10 more<br>Number bonds: 20, 12, 13 | Add multiples of 10, 100 | Add multiples of 10s , 100s, 1000s | Add multiples of 10s , 100s, 1000s, tenths, | Add multiples of 10s , 100s, 1000s, tenths, hundredths |
| | Number bonds: 5, 6 | Number bonds: 14,15<br>Add 1 digit to 2 digits by bridging. | Add single digit bridging through boundaries | Fluency of 2 digit + 2 digit | Fluency of 2 digit + 2 digit including with decimals | Fluency of 2 digit + 2 digit including with decimals |
| | Largest number first.<br>Number bonds: 7, 8 | Partition second number, add tens then ones | Partition second number to add<br>Pairs of 100 | Partition second number to add<br>Decimal pairs of 10 and 1 | Partition second number to add | Partition second number to add |
| | Add 10.<br>Number bonds: 9, 10 | Add 10 and multiples.<br>Number bonds: 16 and 17 | Use near doubles to add | Use near doubles to add | Use number facts, bridging and place value | Use number facts, bridging and place value |
| | Ten plus ones.<br>Doubles up to 10 | Doubles up to 20 and multiples of 5<br>Add near multiples of 10. | Add near multiples of 10 and 100 by rounding and adjusting | Adjust both numbers before adding<br>Add near multiples | Adjust numbers to add | Adjust numbers to add |
| | Use number bonds of 10 to derive bonds of 11 | Number bonds: 18, 19<br>Partition and recombine | Partition and recombine | Partition and recombine | Partition and recombine | Partition and recombine |

**Ellison Primary Academy 2022**

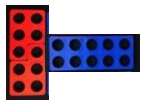
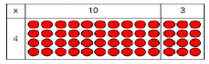
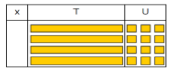
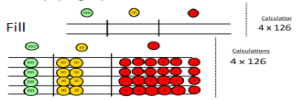
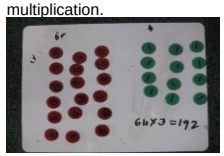
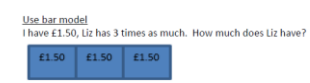
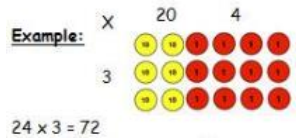
# Subtraction

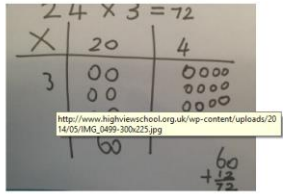
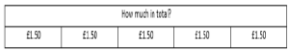
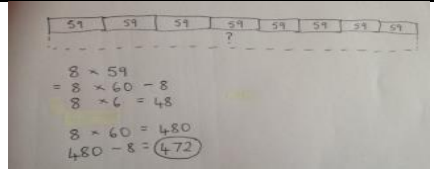
| Year | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **End of Year Expectations for Written Methods** | Read, write and interpret mathematical statements involving addition (+), subtraction (–) and equals to (=) signs | *Add and subtract two two-digit numbers using concrete objects, pictorial representations progressing to formal written methods (expanded)* | Add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction, including the expanded method.<br>300 30 11<br>- 100 40 1<br>200 10 8<br>6 1<br>7 3<br>- 4 6<br>2 7<br>2 3 1<br>3 4 4<br>- 1 8 7<br>1 5 7<br>Pupils continue to use the number line to support mental calculation<br>(a) 81-57 = difference +3 +20 +1 =24<br>57 60 80 81<br>(b) 81 – 57 = take away<br>81 = 80 1 "1 take away 7 is tricky so exchange"<br>- 57 - 50 7<br>70 11<br>- 50 7<br>20 4 = 24 | Add and subtract numbers with up to 4 digits using the formal written methods of columnar addition where appropriate<br>1<br>2 3 1<br>2 3 4 4<br>- 1 8 7<br>2 1 5 7 | Add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction), including decimals.<br>5 13 1<br>2 3 4 6 7<br>- 1 2 6 8 4<br>1 3 7 8 3<br>5 12 1<br>2 6 3 . 0<br>- 2 6 . 5<br>2 3 6 . 5<br>The children check answer with the inverse | Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why, including decimals with varying place values – including using 0 as a place holder.<br>324.9 – 7.25=<br>6 13 1<br>1 2 3 4 6 7<br>- 1 2 2 6 8 4<br>1 1 1 3 7 8 3<br>1 1 8 1<br>3 2 4 9 0<br>- 7 2 5<br>3 1 7 6 5<br>The children continue to check answer with the inverse |
| **Developing conceptual understanding** Concrete to pictorial using year group expected language<br>(may include these examples and further concrete methods) | **Concrete**<br>Number bonds<br><br>7 and 10<br>between<br>Difference between 13 and 8<br>13 – 8 = _<br>8 + _ = 13<br><br><u>Pictorial</u><br>6 less than 10 is 4<br><br>Count out, then count how many are left.<br>7 – 4 = 3<br><br>Count on, on a number track then number line.<br>11 – 5 = 6<br> | **Concrete**<br>Number track / Number line – jumps of 1 then efficient jumps using number bonds<br>23 – 5 = 18<br><br><br>*'Where's the Exchange to 'forty and six?' create 'sixty thirteen'*<br><br><u>Pictorial</u><br>*'Twenty seven'*<br>*'Now take away the forty and six'*<br>Using a number line, 73 – 46 = 26<br><br>Difference between 73 – 58 by counting up, 58 + _ = 73<br><br>Taking away and exchanging, 73 – 46<br><br>Bar modelling for subtraction. | **Concrete and pictorial**<br>Taking away and exchanging, 344 – 187<br>Place value counters<br>*'Where's the one hundred and eighty and seven?*<br><br>*Exchange to create three hundred and thirty and fourteen. Now take away the 'seven'*<br><br><br>*Exchange to create two hundred, thirteen tens and seven Now take away the 'eighty'*<br><br>*Now take away the 'one hundred'*<br><br> | **Concrete and pictorial**<br>Taking away and exchanging, 2344 – 187<br>Place value counters<br>*Where's the one hundred and eighty-seven?*<br><br>*Exchange a 10 for ten 1s to create two thousand, three hundred and thirty and fourteen.*<br><br>*Now take away 'seven'.*<br><br>*Exchange a 100 for ten 10s to create two thousand, two hundred, thirteen tens and seven.*<br><br>*Now take away 'eighty'*<br><br>*Now take away 'one hundred'*<br><br>*There are no thousands to take away.*<br> | **Abstract**<br>*Set out the calculation in columns*<br>5 2 3 4 4<br>- 1 1 8 7<br>*The 1s column: four subtract seven Because seven is greater than four, exchange a 10 for ten 1s. So there are now three 10s and fourteen 1s.*<br>5 2 3 4 4<br>- 1 1 8 7<br>7<br>*Fourteen 1s subtract seven 1s makes seven 1s – record this.*<br>*The 10s column: three subtract eight. Because eight is greater than three, exchange a 100 for ten 10s. So there are now two 100s and thirteen 10s.*<br>5 2 3 4 4<br>- 1 1 8 7<br>7<br>*Thirteen 10s subtract eight 10s makes five 10s – record this.*<br>5 2 3 4 4<br>- 1 1 8 7<br>5 7<br>*The 100s column: two subtract one. Two 100s subtract one 100 makes one 100 – record this.*<br>5 2 3 4 4<br>- 1 1 8 7<br>2 5 7<br>*The 1000s column: two subtract one. Two 1000s subtract one 1000 makes one 1000 – record this.*<br>5 2 3 4 4<br>- 1 1 8 7<br>1 1 5 7<br>*The 10,000s column: there are only five 10000s with nothing to subtract. So record 5.*<br>5 2 3 4 4<br>- 1 1 8 7<br>5 1 1 5 7 | **Abstract**<br>As with Year 5, also begin to increase knowledge of different addition methods and select the most appropriate.<br>As the children move on, introduce decimals with the same number of decimal places and different. Money can be used here. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | <br>Bar modelling for subtraction. | | | | | |
| **With jottings**<br><br>**… or in your head** | **Abstract**<br>Solve one-step problems that involve addition and subtraction, and missing number problems such as 7 = □ – 9 | **Abstract**<br>Add and subtract numbers mentally, including:<br>* a two-digit number and ones<br>* a two-digit number and tens<br>* two two-digit numbers<br>* adding three one-digit numbers | **Abstract**<br><br>Add and subtract numbers mentally, including:<br>* a three-digit number and ones<br>* a three-digit number and tens<br>* a three-digit number and hundreds | **Abstract**<br><br>Solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why | Add and subtract numbers mentally with increasingly large numbers | **Abstract**<br>Perform mental calculations, including with mixed operations and large numbers. |
| **Just know it!** | Represent and use number bonds and related subtraction facts within 20<br>Add and subtract one-digit and two-digit numbers to 20, including zero | Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100 | FOR ALL YEAR GROUPS:<br><br>Apply known facts | | | |
| **Skills and knowledge to ensure fluency**<br>(To be used on a regular basis) | 1 less | 10 less<br>Number bonds, subtraction: 20, 12, 13 | Subtract multiples of 10 and 100 | Subtract multiples of 10s , 100s, 1000s | Subtract multiples of 10s , 100s, 1000s, tenths, | Subtract multiples of 10s , 100s, 1000s, tenths, hundredths |
| | Number bonds, subtraction: 5, 6 | Number bonds, subtraction: 14, 15 Subtract 1 digit from 2 digit by bridging | Subtract single digit by bridging through boundaries | Fluency of 2 digit subtract 2 digit | Fluency of 2 digit - 2 digit including with decimals | Fluency of 2 digit - 2 digit including with decimals |
| | Count back<br>Number bonds, subtraction: 7, 8 | Partition second number, count back in 10s then 1s | Partition second number to subtract | Partition second number to subtract<br>Decimal subtraction from 10 or 1 | Partition second number to subtract | Partition second number to subtract |
| | Subtract 10.<br>Number bonds, subtraction: 9, 10 | Subtract 10 and multiples of 10<br>Number bonds, subtraction: 16, 17 | Subtract near multiples of 10 and 100 by rounding and adjusting | Subtract near multiples by rounding and adjusting | Difference between | Use number facts bridging and place value |
| | Teens subtract 10. | Subtract near multiples of 10 | | | Adjust numbers to subtract | Adjust numbers to subtract |
| | Difference between | Difference between<br>Number bonds, subtraction: 18, 19 | Difference between | Difference between | Difference between | Difference between |

**Ellison Primary Academy 2022**

# Multiplication

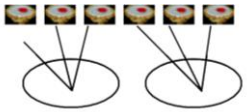
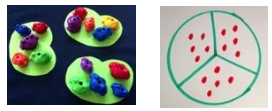
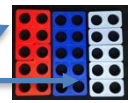
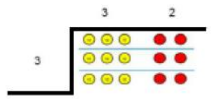
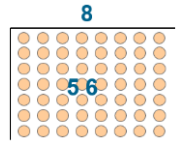
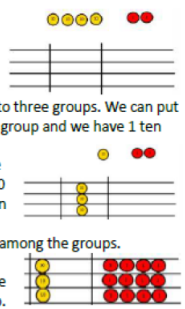
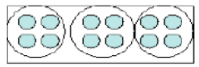
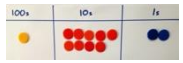
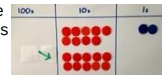
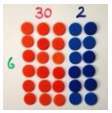
| Year | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **End of Year Expectations for Written Methods** | Solve one-step problems involving multiplication by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher. | Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs | Write and calculate mathematical statements for x using the multiplication tables they know progressing to formal written methods.<br>23 x 4 = ?<br>2 3<br>x 4<br>1 2 ---4 x 3<br>8 0 ---4 x 20<br>9 2<br>Moving to<br>2 3<br>x 4<br>9 2 | Progressing to the expanded short multiplication method (least significant digit first)<br>136<br>x 5<br>30<br>150<br>500<br>680<br>Moving to the formal written method.<br>136<br>X 5<br>680<br>13 | 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<br>Multiply ThHTU x U using the formal written method, e.g. 1345 x 6<br>1345<br>x 6<br>8070<br>223<br>Progressing to the expanded written form for TU x TU<br>72<br>x 38<br>16 ( 2 X 8)<br>560 (70 X 8)<br>60 (2 X 30)<br>2100 (70 X 30)<br>2736<br>1<br>Leading to: 156<br>X 13<br>468<br>1560<br>2028<br>1 1 | Pupils multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication.<br>156<br>X 13<br>468<br>1560<br>2028<br>1 1 |
| **Developing conceptual understanding**<br>Concrete to pictorial using year group expected language<br><br>(may include these examples and further concrete methods) | **Concrete**<br>2 frogs on each lily pad.<br>(as an array)<br><br><br><br><br> | **Concrete**<br>5 frogs on each lily pad<br>5 x 3 = 15 (as an array)<br><br><br><br>Link to repeated addition<br>5+5+5=15<br>3 lots of 5=15<br>3x5=15<br><br>5 x 2 = 2 x 5<br>(Commutative)<br>**Pictorial**<br>Link to repeated addition<br> | **Concrete**<br>Show the link with arrays to first introduce the grid method.<br><br>4 rows of 10<br>4 rows of 3<br>Move on to using Base 10 to move towards a more compact method.<br><br>4 rows of 13<br>Move on to place value counters to show how we are finding groups of a number.We are multiplying by 4 so we need 4 rows.<br><br>each row with 126. | **Concrete**<br>Children can continue to be supported by place value counters at the stage of multiplication.<br><br>**Pictorial**<br><br><br>24 x 3 = 72 | **Abstract**<br>FOR BOTH YEAR GROUPS:<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<br>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>Bar modelling and number lines can support learners when solving problems with multiplication alongside the formal written methods. |

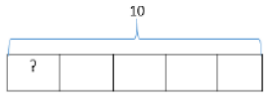
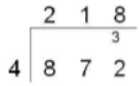
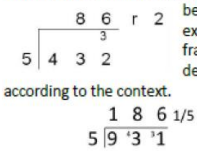
<table>
<tr>
<td></td>
<td><u>Pictorial</u><br><br><br><br>3 x 2 =<br>3 lots of 2 =</td>
<td><br></td>
<td><u>Pictorial</u><br>Children can represent the work they have done with place value counters in a way that they understand.<br><br>They can draw the counters, using colours to show different amounts or just use circles in the different columns to show their thinking as shown below.<br><br><br><br>Continued use of the bar model to aid confidence with problems<br><br><br><u>Abstract</u><br><table><tr><td>X</td><td>10</td><td>3</td></tr><tr><td>4</td><td>40</td><td>12</td></tr></table></td>
<td><u>Abstract</u><br>43 x 6 by partitioning<br><table><tr><td>X</td><td>40</td><td>3</td></tr><tr><td>6</td><td>240</td><td>18</td></tr></table><br><br>40 x 6 = 240<br>3 x 6 = 18<br>43 x 6 = 258<br><br>If I know 4 x 6 = 24<br>the 40 x 60 is ten times bigger.</td>
<td colspan="2"><br><br><br><u>Children could use the bar model, number lines, informal jottings to support their mental computation for up to 4 digits and decimals</u><br>Abdi's bike cost £127.50. Ahmed buys a bike that cost 3 times as much as Abdi's, how much did Ahmed spend?<br><br></td>
</tr>
<tr>
<td>With jottings<br><br>… or in your head</td>
<td><u>Abstract</u><br>Solve one-step problems involving multiplication by calculating the answer using recall of number facts with the support of the teacher</td>
<td><u>Abstract</u><br>Show that multiplication of two numbers can be done in any order (commutative).<br>Solve problems involving multiplication using repeated addition, mental methods, and multiplication facts, including problems in contexts</td>
<td><u>Abstract</u><br>Write and calculate mathematical statements for multiplication using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental methods</td>
<td><u>Abstract</u><br>Use place value, known and derived facts to multiply mentally, including: multiplying by 0 and 1; multiplying together three numbers<br>Recognise and use factor pairs and commutativity in mental calculations</td>
<td><u>Abstract</u><br>Multiply and divide numbers mentally drawing upon known facts<br>Multiply whole numbers and those involving decimals by 10, 100 and 1000<br>Identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers establish whether a number up to 100 is prime</td>
<td><u>Abstract</u><br>Perform mental calculations, including with mixed operations and large numbers</td>
</tr>
<tr>
<td>Just know it!</td>
<td>Count in multiples of twos, fives and tens</td>
<td>Recall and use x and ÷ facts for the 2, 5 and 10 x tables, including recognising odd and even numbers.</td>
<td>Recall and use x and ÷ facts for the 3, 4 and 8 times tables.</td>
<td>Recall x and ÷ facts for x tables up to 12 x 12.</td>
<td>Recall prime numbers up to 19.<br>To know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers.<br>Recognise and use square numbers and cube numbers, and the notation for squared (²) and cubed (³)</td>
<td>Apply known facts</td>
</tr>
</table>

| | | | | | | |
|---|---|---|---|---|---|---|
| **Skills and knowledge to ensure fluency**<br>(To be used on a regular basis)<br><br>**Based on Maths Passport objectives** | • Count in multiples of 2.<br>• Count in multiples of 5.<br>• Count in multiples of 10.<br>• Know and use numbers bonds (and related subtraction facts) to 20.<br>• Recall and can use the halves and doubles of numbers to at least 20. | • Count in tens from any number, forward and backward.<br>• Count in steps of 2, 3, and 5 from 0, forward and backward.<br>• Recall addition and subtraction facts to 20.<br>• Find related addition and subtraction facts to 100.<br>• Recall multiplication and division facts for the 2 multiplication table.<br>• Recall multiplication and division facts for the 5 multiplication table.<br>• Recall multiplication and division facts for the 2 multiplication table.<br>• Recognise odd and even numbers. | • Count from 0 in multiples of 4.<br>• Count from 0 in multiples of 8.<br>• Count from 0 in multiples of 50.<br>• Recall and use multiplication and division facts for the 3 multiplication table.<br>• Recall and use multiplication and division facts for the 4 multiplication table.<br>• Recall and use multiplication and division facts for the 8 multiplication table.<br>• Calculate10 times bigger<br>• Double larger numbers and decimals | • Count in multiples of 6.<br>• Count in multiples of 7.<br>• Count in multiples of 9.<br>• Count in multiples of 25.<br>• Recall and use multiplication and division facts for multiplication tables up to 12 × 12.<br>• Recognise and the factor pairs of multiplication tables us to 12 x 12. | • Count in any multiples of multiplication tables up to 12.<br>• Identify all factor pairs of a number, and common factors of two numbers.<br>• Count in multiples of 25 and 50.<br>• Recall square numbers and the notation for them.<br>• Recall cube numbers and the notation for them.<br>• Recall prime numbers up to 19.<br>• Find out whether a number up to 100 is prime and use the vocabulary of prime factors. | • Knowledge of multiples and factors, including all factor pairs of a number, for multiplication tables up to 12 x 12 and beyond.<br>• Identify common factors and common multiples of two numbers.<br>• Knowledge of square numbers and cube numbers and the notation for them.<br>• Identify prime numbers greater than 100 and use the vocabulary of prime factors and composite (non-prime) numbers.<br>• Knowledge of multiples and factors, including all factor pairs of a number, for multiplication tables up to 12 x 12 and beyond.<br>• Identify common factors and common multiples of two numbers. |

**Ellison Primary Academy 2022**

# Division

| Year | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **End of Year Expectations for Written Methods** | Pupils solve one-step problems involving division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher. Pupils use sharing and grouping to solve division problems.<br>Sharing<br>e.g. 6 cakes are shared equally between 2 people. How many cakes does each person get?<br><br>Grouping<br>How many pairs of socks can we make from this pile of socks? Count the pairs.<br> | Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs | Write and calculate mathematical statements for ÷ using the multiplication tables they know progressing to formal written methods.<br>8<br>7 \| 5 6 | Pupils practise mental methods and extend this to three-digit numbers to derive facts, (for example 600 ÷ 3 = 200 can be derived from 2 x 3 = 6).<br>Pupils practise to become fluent in the formal written method of short multiplication and short division with exact answers<br>2 3<br>6 \| 1 3 8 | Pupils divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context, e.g.<br>*432 school children go on a camping trip. Each tent sleeps five. How many tents will they need to take?*<br>432 ÷ 5 becomes<br>8 6 r2<br>5 \| 4 3 2<br>Answer: 86 remainder 2<br>*Answer: They will need to take 87 tents* | Pupils divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context, e.g.<br>*Chocolates are packed in trays of 15. If I have 432 chocolates, how many full trays will I have and how many chocolates will be left over?*<br>432 ÷ 15 becomes<br>2 8 r 12<br>1 5 \| 4 3 2<br>3 0 0<br>1 3 2<br>1 2 0<br>1 2<br>*Answer: there will be 28 trays of chocolates and 12 chocolates left.* |
| **Developing conceptual understanding**<br>Concrete to pictorial using year group expected language<br><br>(may include these examples and further concrete methods) | **Concrete**<br>6 ÷2 = 3 by sharing into 2 groups and by grabbing groups of 2<br><br><br><br><br>**Pictorial**<br>How many 2s?<br> | **Concrete**<br>15 ÷ 3 = 5 in each group (sharing)<br><br>Link to fractions<br><br>15 ÷ 3 = 5 groups of 3 (grouping)<br><br>10 ÷2 = 5<br>(see numicon for sharing and grouping)<br><br>**Pictorial**<br>How many 2s?<br> | **Concrete**<br>Link division to multiplication by creating an array and thinking about the number sentences that can be created.<br>Eg 15 ÷ 3 = 5 5 x 3 = 15<br>15 ÷ 5 = 3 3 x 5 = 15<br><br>Use place value counters to divide using the short division method alongside.<br>96 ÷ 3<br><br>**Pictorial**<br>56÷7=8<br><br>How many 3s?<br> | **Concrete**<br>42 ÷ 3<br>Start with the biggest place value. We are sharing 40 into three groups. We can put 1 ten in each group and we have 1 ten left over.<br>We exchange this ten for 10 ones and then share the ones equally among the groups.<br>We look at how many are in each group.<br><br>**Pictorial**<br>As above but with drawings within the exercise book.<br>Students can continue to use drawn diagrams with dots or circles to help them divide numbers into equal groups.<br><br>Encourage them to move towards counting in multiples to divide more efficiently. | **Concrete**<br>192 ÷ 6 using place value counters to support written method<br><br>Exchange one 100 for ten 10s<br><br>19 tens into groups of 6<br><br>3 groups so that is 30 x 6, exchange remaining 10 for ten 1s<br><br><br>**Pictorial**<br>So 192 ÷ 6 = 32<br> | **Abstract**<br>Pupils progress to expressing their remainders as a fraction,<br>e.g. *432 litres of water are stored in 15 litre drums. How many full drums of water will there be and what fraction of the final drum will be filled?*<br>432 ÷ 15 becomes<br>2 8<br>1 5 \| 4 3 2<br>3 0 0 15×20<br>1 3 2<br>1 2 0 15×8<br>1 2<br>12/15 = 4/5<br>Answer: 28 4/5<br>*Answer: there will be 28 full drums and the 29th drum will be 4/5 full.*<br><br>Progressing to expressing the remainder as a decimal, e.g.<br>*£432 was raised at the school fair and is to be shared equally between 15 classes. How much will each class receive?* |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Children use pictures or shapes to share quantities.<br><br>8 ÷ 2 = 4 | <br><br>10 ÷ 5 = ?<br>5 x ? = 10 | | **Abstract**<br>.<br>Begin with divisions that divide equally with no remainder.<br><br> | **Abstract**<br>Move onto divisions with a remainder. Once children understand remainders, begin to express as a fraction or decimal according to the context.<br><br><br>Divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context | |
| **With jottings**<br><br>**… or in your head** | **Abstract**<br>Solve one-step problems involving division, by calculating the answer with the support of the teacher | **Abstract**<br>Solve problems involving division using facts, including problems in contexts | **Abstract**<br>Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental methods | **Abstract**<br>Use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers<br>Recognise and use factor pairs and commutativity in mental calculations | **Abstract**<br>Divide numbers mentally drawing upon known facts<br>Divide whole numbers and those involving decimals by 10, 100 and 1000. | **Abstract**<br>Perform mental calculations, including with mixed operations and large numbers |
| **Just know it!** | Count in multiples of twos, fives and tens | Recall and use x and ÷ facts for the 2, 5 and 10 x tables, including recognising odd and even numbers. | Recall and use x and ÷ facts for the 3, 4 and 8 times tables | Recall x and ÷ facts for x tables up to 12 x 12. | Recall prime numbers up to 19. To know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers. Recognise and use square numbers and cube numbers, and the notation for squared (²) and cubed (³) | Apply known facts |
| **Skills and knowledge to ensure fluency**<br>(To be used on a regular basis)<br><br>**Based on Maths Passport objectives** | • Know and use numbers bonds (and related subtraction facts) to 20.<br>• Recall and can use the halves and doubles of numbers to at least 20. | • Recall addition and subtraction facts to 20.<br>• Find related addition and subtraction facts to 100.<br>• Recall multiplication and division facts for the 2 multiplication table.<br>• Recall multiplication and division facts for the 5 multiplication table.<br>• Recall multiplication and division facts for the 2 multiplication table | • Recall and use multiplication and division facts for the 3 multiplication table.<br>• Recall and use multiplication and division facts for the 4 multiplication table.<br>• Recall and use multiplication and division facts for the 8 multiplication table.<br>• Calculate10 times smaller | • Recall and use multiplication and division facts for multiplication tables up to 12 × 12.<br>• Recognise and the factor pairs of multiplication tables us to 12 x 12. | • Count in any multiples of multiplication tables up to 12.<br>• Identify all factor pairs of a number, and common factors of two numbers.<br>• Count in multiples of 25 and 50.<br>• Recall square numbers and the notation for them.<br>• Recall cube numbers and the notation for them.<br>• Recall prime numbers up to 19.<br>• Find out whether a number up to 100 is prime and use the vocabulary of prime factors. | • Knowledge of multiples and factors, including all factor pairs of a number, for multiplication tables up to 12 x 12 and beyond.<br>• Identify common factors and common multiples of two numbers.<br>• Knowledge of square numbers and cube numbers and the notation for them.<br>• Identify prime numbers greater than 100 and use the vocabulary of prime factors and composite (non-prime) numbers.<br>• Knowledge of multiples and factors, including all factor pairs of a number, for multiplication tables up to 12 x 12 and beyond.<br>• Identify common factors and common multiples of two numbers |

# Calculation with fractions (Years 5 and 6)

## Use common factors to simplify fractions.

1) Find a number that both the numerator and the denominator can be divided by (in this case, 3)
2) Divide both the numerator and denominator by that number.



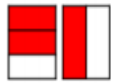
÷ 3

$\frac{9}{15} = \frac{3}{5}$

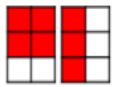
÷ 3

## Use multiples to express fractions in the same denominator

1) Find a number that is a common multiple of both denominators (in this case, 6)
2) Multiply both fractions by the relevant multiple to reach the new denominator



$\frac{2}{3}$ x 2 = 3 x 2 $\frac{1}{2}$ x 3 = 2 x 3



$\frac{4}{6}$ $\frac{3}{6}$

## Convert mixed numbers to improper fractions

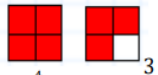
1) Multiply the denominator by the whole number.
2) Add the numerator
3) Write the answer as a numerator over the existing denominator

add

$1\frac{3}{4}$

multiply

$1\frac{3}{4} = \frac{7}{4}$



1 whole $\frac{4}{4}$ $\frac{3}{4}$

## Convert improper fractions to mixed numbers

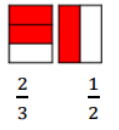
1) See how many times the denominator will go into the numerator (once, with a remainder of 3)
2) Write the answer (1) as the whole number
3) Write the remainder (3) as the numerator over the existing denominator.

$\frac{7}{4} = 1\frac{3}{4}$

1 whole $\frac{4}{4}$ $\frac{3}{4}$

## Compare fractions

1) Decide on a common multiple of the two denominators to become the new denominator
2) Convert both fractions to have the same denominator.
3) Decide which symbol to use– which fraction is larger?

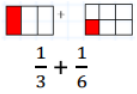


$\frac{2}{3}$ $\frac{1}{2}$

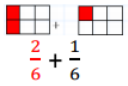
$\frac{4}{6}$ > $\frac{3}{6}$

## Add proper fractions

1) Convert both fractions to have the same denominator
2) Add the numerators, but not the denominators.
3) Simplify the answer if you can



$\frac{1}{3} + \frac{1}{6}$



$\frac{2}{6} + \frac{1}{6}$



$\frac{2}{6} + \frac{1}{6} = \frac{3}{6}$

$\frac{3}{6} = \frac{1}{2}$

## Add mixed numbers (method 1)

$1\frac{3}{4} + 1\frac{3}{8}$

1) Change any mixed numbers to improper fractions.
2) Convert both fractions to have the same denominator
3) Add the numerators together.
4) Change any improper fractions back to mixed numbers
5) Simplify the answer if you can.

$\frac{7}{4} + \frac{11}{8}$

$\frac{14}{8} + \frac{11}{8}$

$\frac{14}{8} + \frac{11}{8} = \frac{25}{8}$

$\frac{25}{8} = 3\frac{1}{8}$

## Add mixed numbers (method 2)

$1\frac{3}{4} + 1\frac{3}{8}$

1) Add the two whole numbers together.
2) Convert both fractions to have the same denominator.
3) Add the numerators together.
4) Change any improper fractions back to mixed numbers
5) Add together your two answers.
6) Simplify the answer if you can.

1 + 1=2

$\frac{6}{8} + \frac{3}{8}$

$\frac{6}{8} + \frac{3}{8} = \frac{9}{8}$

$\frac{9}{8} = 1\frac{1}{8}$

$2 + 1\frac{1}{8} = 3\frac{1}{8}$

## Subtract proper fractions

1) Convert both fractions to have the same denominator
2) Subtract the numerators, but not the denominators.
3) Simplify the answer if you can



$\frac{2}{3} - \frac{1}{6}$



$\frac{4}{6} - \frac{1}{6}$



$\frac{4}{6} - \frac{1}{6} = \frac{3}{6}$

$\frac{3}{6} = \frac{1}{2}$

## Subtract mixed numbers

$2\frac{3}{4} - 1\frac{1}{8}$

1) Change any mixed numbers to improper fractions.
2) Convert both fractions to have the same denominator.
3) Subtract the second numerator from the first.
4) Change any improper fractions back to mixed numbers.
5) Simplify the answer if you can.

$\frac{11}{4} - \frac{9}{8}$

$\frac{22}{8} - \frac{9}{8}$

$\frac{22}{8} - \frac{9}{8} = \frac{13}{8}$

$\frac{13}{8} = 1\frac{5}{8}$

## Multiply pairs of proper fractions

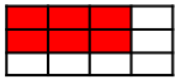
$\frac{3}{4} \times \frac{2}{3}$

1) Multiply the numerators
2) Multiply the denominators
3) Simplify the answer if you can.

$\frac{3}{4} \times \frac{2}{3} = \frac{6}{12}$

$\frac{6}{12} = \frac{1}{2}$

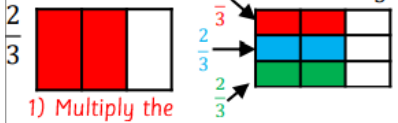
$\frac{3}{4}$



$\frac{2}{3}$ $= \frac{6}{12}$

## Divide fractions by whole numbers

$\frac{2}{3} \div 3$



1) Multiply the denominator by the whole number and write the answer as the new denominator.
2) Simplify the answer if you can.

$\frac{2}{3} \div 3 = \frac{2}{9}$

## Multiply fractions by whole numbers



$\frac{3}{4} \times 5$

1) Write the whole number as a fraction over 1.
2) Multiply the numerators
3) Multiply the denominators
4) Change any improper fractions back to mixed numbers
5) Simplify the answer if you can

$\frac{3}{4} \times \frac{5}{1}$

$\frac{3}{4} \times \frac{5}{1} = \frac{15}{4}$

$\frac{15}{4} = 3\frac{3}{4}$



## Multiply mixed numbers by whole numbers (method 1)

$3\frac{3}{4} \times 5$

1) Change any mixed numbers to improper fractions
2) Write the whole number as a fraction over 1.
3) Multiply the numerators
4) Multiply the denominators
5) Change any improper fractions back to mixed numbers.
6) Simplify the answer if you can.

$\frac{15}{4} \times 5$

$\frac{15}{4} \times \frac{5}{1}$

$\frac{15}{4} \times \frac{5}{1} = \frac{75}{4}$

$\frac{75}{4} = 18\frac{3}{4}$

## Multiply mixed numbers by whole numbers (method 2)

$3\frac{3}{4} \times 5$

1) Multiply the two whole numbers together.
2) Multiply the fraction by the whole number.
3) Change any improper fractions back to mixed numbers.
4) Add your two answers together.
5) Simplify the answer if you can.

$3 \times 5 = 15$

$\frac{3}{4} \times \frac{5}{1} = \frac{15}{4}$

$\frac{15}{4} = 3\frac{3}{4}$

$15 + 3\frac{3}{4} = 18\frac{3}{4}$

# Glossary of Terms

**2-digit number**– a number with 2 digits like 23, 45, 12 or 60

**3-digit number** – a number with 3 digits like 123, 542, 903 or 561

**Addition facts** – this is knowing that 1+1 = 2 and 1+3 = 4 and 2+5 = 7. Normally we only talk about number facts with totals of 20 and under.

**Array** - An array is an arrangement of a set of numbers or objects in rows and columns –it is mostly used to show how you can group objects for repeated addition or subtraction.

**Bead String/Bar** – a string with (usually 100) beads on, grouped by colour in tens. The bead string is a good bridge between a number track and a number line as it maintains the cardinality of the numbers whilst beginning to develop the concepts of counting 'spaces' rather than objects.

**Bridging** – when a calculation causes you to cross a 'ten boundary' or a 'hundred boundary' e.g. 85 + 18 will bridge 100.

**Compact vertical** – the name of the recommended written method for addition whereby the numbers are added in columns, 1s first then 10s and so on. Where the total exceeds 10, the ten 1s are exchanged for a 10 and written below the answer line. This is sometimes referred to as 'carrying'.

**Concrete apparatus** – objects to help children count and calculate– these are most often cubes (multilink) but can be anything they can hold and move including Cuisenaire rods, Dienes rods (hundreds, tens and units blocks), straws, Numicon, Place Value counters and much more.

**Count all** – when you add by counting all the items/objects e.g. to add 11 and 5 you would count out 11, then count out 5, then put them together and count them all to get **16**.

**Count on** – when you add (or sometimes subtract) by counting onwards from a given number. E.g. to add 11 and 5 you would count on 5 from 11 i.e. 12, 13, 14, 15, **16**

**Decimal number** – a number with a decimal point e.g. 2.34 (said as two point three four)

**Decomposition** – the name of the recommended written method for subtraction whereby the smaller number is subtracted from the larger, 1s first then 10s and so on. Where the subtraction cannot be completed as the second number is larger than the first, a 10 is exchanged for ten 1s to facilitate this. This is the traditional 'borrowing' form of column method, which is different to the 'payback' method.

**Dienes Rods (or Base 10)** – this is a set of practical equipment that represents the numbers to help children with place value and calculation. The Dienes rods show 1s, 10s, 100s and 1000s as blocks of cubes that children can then combine. Dienes rods do not break up so the child has to 'exchange' them for smaller or larger blocks where necessary.

**Difference** – the gap between numbers that is found by subtraction e.g. 7-5 can be read as '7 take away 5' or as the 'difference between 7 and 5'

**Dividend** – the number being divided in a calculation

**Divisor** – the smaller number in a division calculation.

**Double** – multiply a number by 2

**Efficient Methods** – the method(s) that will solve the calculation most rapidly and easily

**Equals** - is worth the same as (be careful not to emphasise the use of = to show the answer)

**Exchanging** – Swapping a '10' for ten '1s' or a '100' for ten '10s' or vice versa (used in addition and subtraction when 'moving' 'ten' or a 'hundred' from its column into the next column and splitting it up). This is heavily relied upon for addition and subtraction of larger numbers. Skills in this can be built up practically with objects, then Dienes rods/base 10, then place value counters before relying on a solely written method.

**Expanded Multiplication** – a method for multiplication where each stage is written down and then added up at the end in a column

**Factor** – a number that divides exactly into another number, without remainder

**Grid method** – a method for multiplying two numbers together involving partitioning and multiplying each piece separately.

**Grouping** – an approach to division where the dividend is split into groups of the size of the divisor and the number of groups created are then counted.

**Half** - a number, shape or quantity divided into 2 equal parts

**Halve** – divide a number by 2

**Integer** - a whole number (i.e. one with no decimal point)

**Inverse** – the opposite operation. For example, addition is the inverse of subtraction and multiplication is the inverse of division.

**Known Multiplication Facts** – times tables and other number facts that can be recalled quickly to support with larger or related calculations e.g. if you know 4x7 then you also know 40 x 70, 4 x 0.7 etc.

**Long Division** – formal written of division where the remainders are calculated in writing each time (extended version of short division)

**Long Multiplication** – formal written method of column multiplication

**Multiple** - a number which is an exact product of another number i.e. a number which is in the times table of another number

**Number bonds** – 2 numbers that add together to make a given total, e.g. 8 and 2 bond to 10 or 73 and 27 bond to 100

**Number line** – this is a line either with numbers or without (a blank number-line). The number line emphasises the continuous nature of numbers and the existence of 'in-between' numbers that are not whole. It is based around the gaps between numbers. Children use this tool to help them count on or count back for addition of subtraction. As they get older, children will count in 'jumps' on a number line e.g. to add 142 to a number they may 'jump' 100 and then 40 and then 2. The number line is sometimes used in multiplication and division but can be time consuming.

**Number track** – a sequence of numbers, each inside its own square. It is a simplified version of the number line that emphasises the whole numbers.

**Numicon** – practical maths equipment that teaches children the names and values of numbers 1-10 initially but them helps them with early addition, subtraction, multiplication and division. Numicon is useful for showing the real value of a number practically.

**One-Step Calculation –** a calculation involving only one operation e.g. addition. Usually the child must decide what that operation is.

**Partition** – split up a larger number into parts, such as the hundreds, tens and units e.g. 342 can be partitioned into 300 and 40 and 2

**Place Value** – the value of a digit created by its position in a number e.g. 3 represents thirty in 234 but three thousand in 3567

**Recombine** – for addition, once you have partitioned numbers into hundreds, tens and units then you have to add then hundreds together, then add the tens to that total, then add the units to that total

**Remainder** – a whole number left over after a division calculation

**Repeated addition** – repeatedly adding groups of the same size for multiplication

**Scaling –** an approach to multiplication whereby the number is 'scaled up' by a factor of the multiplier e.g. 4 x 3 means 4 scaled up by a factor of 3.

**Sharing –** an approach to division whereby the dividend is shared out into a given number of groups (like dealing cards)

**Short Division** – this is a traditional method for division with a single digit divisor (this is a compact version of long division, sometimes called 'bus stop')

**Significant digit** – the digit in a number with the largest value e.g. in 34 the most significant digit is the 3, as it has a value of '30' and the '4' only has a value of '4'

**Single digit** – this is a number with only one digit. These are always less than 10.

**Sum** – the total of two or more numbers (it implies addition). Sum should not be used as a synonym for calculation.

**Two-step calculation** - a calculation where two different operations must be applied e.g. to find change in a shop you will usually have to add the individual prices and then subtract from the total amount. Usually the child has to decide what these two operations are and the order in which they should be applied.