Great Park Academy

Calculation Policy

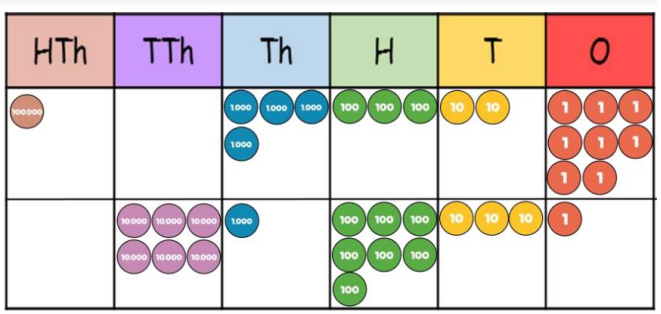
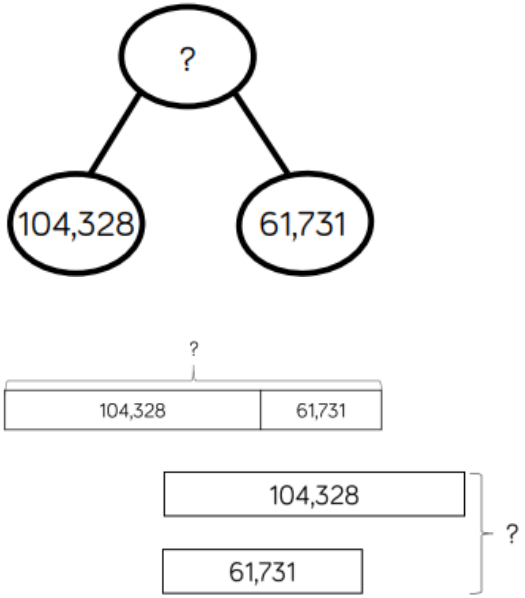
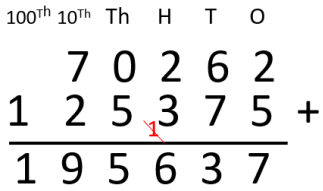
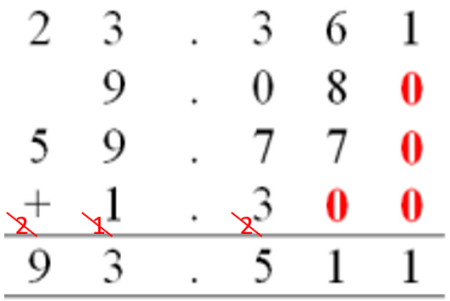
Maths Mastery

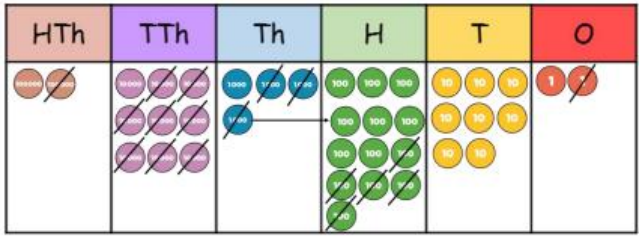
At the centre of the mastery approach to the teaching of mathematics at Great Park Academy is the belief that all children have the potential to succeed. They should have access to the same curriculum content and, rather than being extended with new learning, they should deepen their conceptual understanding by tackling challenging and varied problems. Similarly, with calculation strategies, children must not simply rote learn procedures but demonstrate their understanding of these procedures through the use of concrete materials and pictorial representations. This policy outlines the different calculation strategies that should be taught and used in Year 5 and 6 that are in line with the requirements of the 2014 Primary National Curriculum.

How to use the Policy

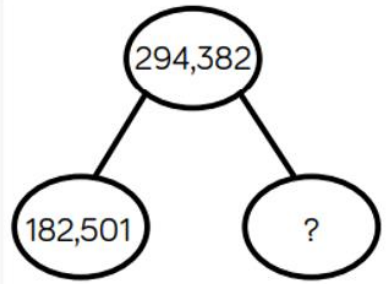
The mathematics policy is a guide for all staff at Great Park Academy. It is expected that teachers will use their professional judgment as to when consolidation of existing skills is required or if to move onto the next concept. However, the focus must always remain on breadth and depth rather than accelerating through concepts. Children should not be extended with new learning before they are ready, they should deepen their conceptual understanding by tackling challenging and varied problems. All teachers have been given the schemes of work and are required to base their planning around their year group's modules and not to move onto a higher year group's scheme of work.

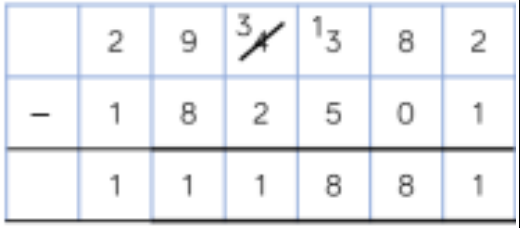
Teachers can use any teaching resources that they wish to use and the policy does not recommend on set of resources over another, rather than, a variety of resources are used. For each of the four rules of number, different strategies are laid out, together with examples of what concrete materials can be used and how, along with suggested pictorial representations. The principle of the concrete- pictorial-abstract (CPA) approach [Make it. Draw it. Write it] is for children to have a true understanding of mathematical concept, they need to master all three phases within a year group's scheme of work

Objective and Strategies	Concrete	Pictorial	Abstract
Addition			
Adding numbers with more than 4 people	Make both numbers on a place value grid. Add up the unites and exchange 10 ones for one ten. Add up the rest of the columns, exchanging the 10 counters from one column for the next place value column until every column has been added.  This can also be done with Base 10 to help children clearly see those 10 ones equal 1 ten and 10 tens equal 100.	Part-whole models, bar-models  	Column Method to add larger numbers efficiently. 
Adding numbers with up to 3 decimal places	Place value counters on a place value grid are effective manipulatives when adding decimals with 1,2 and 3 decimal places	Children to draw place value counters and show their exchange by crossing the counters out as well as clearly showing the exchange made	Ensure children have experience of adding decimals with a variety of decimal places. This includes putting this into context when adding money and other measures. 

<table>
<tr><th colspan="4">Subtraction</th></tr>
<tr>
<td>Subtracting numbers with more than 4 digits</td>
<td>Place value counters . Model process of exchange using Numicon, base ten and place value charts counters.
 
</td>
<td>Draw the counters onto a place value grid and show what you have taken away by crossing the counters out as well as clearly showing the exchanges you make.

Children to draw place value counters and show their exchange

Part-whole model
 

Bar model</td>
<td>Column Subtraction
 
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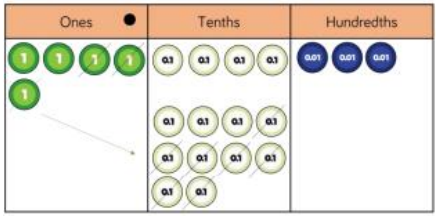
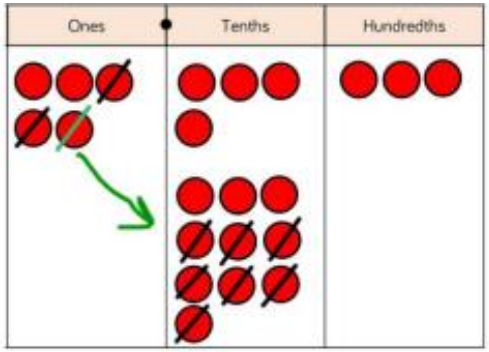
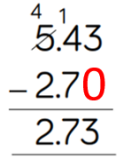
</tr>
<tr>
<td>Subtracting numbers with up to 3 decimal places</td>
<td>Place value counters.
 
</td>
<td>Children to draw place value counters and show their exchange. Draw the counters onto a place value grid and show what you have taken away by crossing the counters out as well as clearly showing the exchanges you make.
 
</td>
<td>Column Subtraction. Use zeros for place-holders
 
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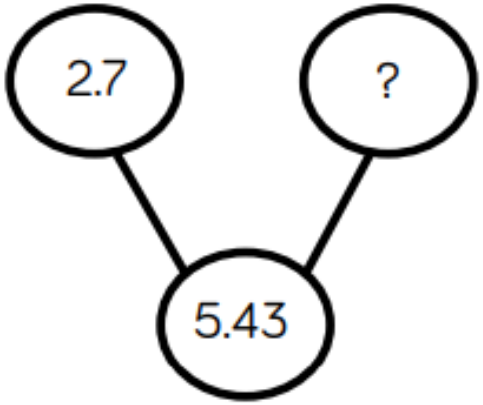
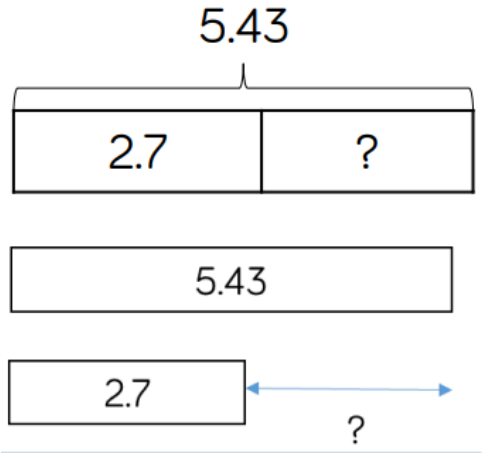
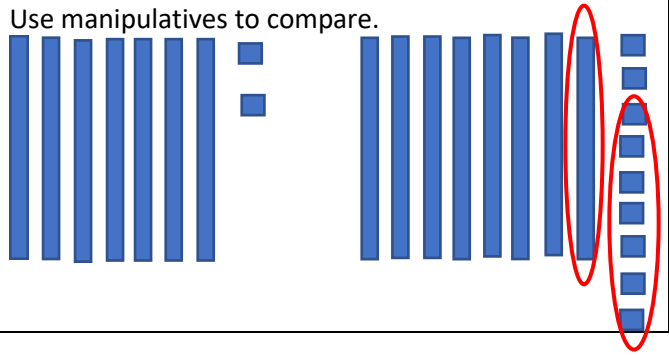
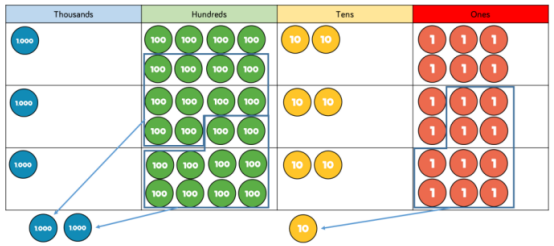
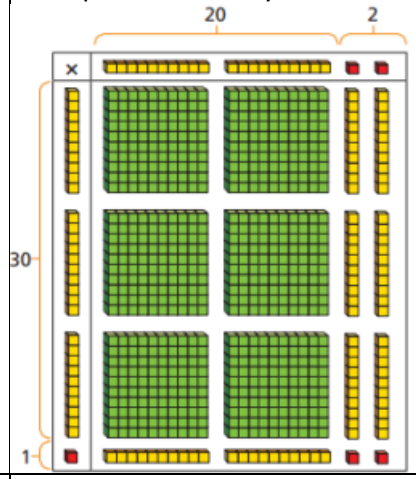
		Part-whole model  Bar model  	
Effective strategies.	Use manipulatives to compare. 	Using knowlegde of number bonds to create a number line to count on. What is the difference between 89 and 72?  	Mental maths… From 72 to 90 it is 18. Therefore, one less is 17.

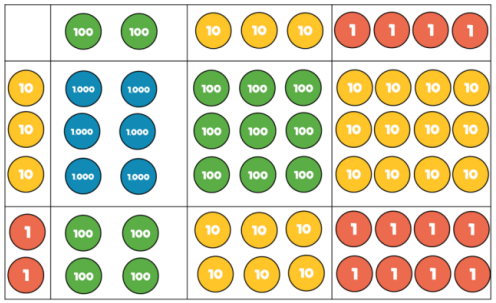
<table>
<tr><th colspan="4">Multiplication and Division</th></tr>
<tr>
<td>Multiply 4 by 1 digit</td>
<td>Show the link to arrays to first introduce the grid method. This can also be shown using Base 10s. Children then move on to place value counters to show how to find groups of a numbers.

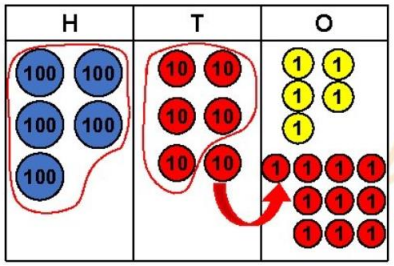
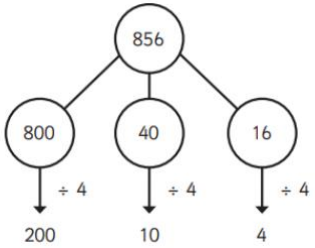
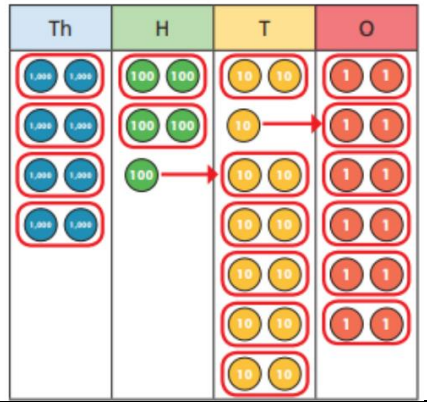
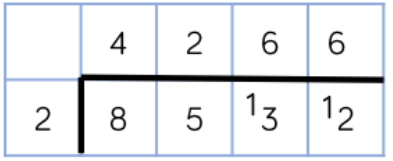
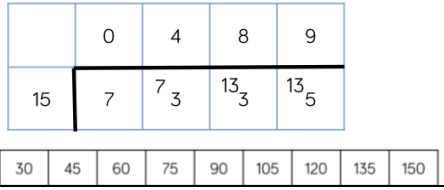
It is important at this stage that they always multiply the ones first and note down their answer followed by the tens which they note below.
 
</td>
<td>Bar modelling and number lines can support learners when solving problems with multiplication alongside the formal written methods. Children need to understand multiplication as repeated addition of equal groups in order to use the bar model for multiplication problem solving.</td>
<td>
<table>
<tr><td></td><td>Th</td><td>H</td><td>T</td><td>O</td></tr>
<tr><td></td><td>1</td><td>8</td><td>2</td><td>6</td></tr>
<tr><td>×</td><td>2</td><td></td><td>1</td><td>3</td></tr>
<tr><td></td><td>5</td><td>4</td><td>7</td><td>8</td></tr>
</table>
</td>
</tr>
<tr>
<td>Multiply two by two digit numbers</td>
<td>Children use the Base 10 area model to help children understand the size of the numbers they are using (this links to finding the area of a rectangle by finding the space covered by the Base 10.
 
</td>
<td>Partition.

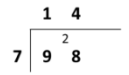
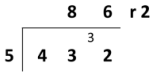
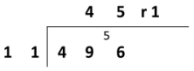
31 x 2 = 62

620 + 62 = 682

31 x 20 = 620
Placeholder carries down.</td>
<td>The grid method matches the area model as an initial written method before moving on to the formal written method.
<table>
<tr><td></td><td>H</td><td>T</td><td>O</td></tr>
<tr><td></td><td></td><td>2</td><td>2</td></tr>
<tr><td>×</td><td></td><td>3</td><td>1</td></tr>
<tr><td></td><td></td><td>2</td><td>2</td></tr>
<tr><td></td><td>6</td><td>6</td><td>0</td></tr>
<tr><td></td><td>6</td><td>8</td><td>2</td></tr>
</table>
</td>
</tr>
<tr>
<td>Multiply a 3 digit by a 2 digit</td>
<td>Children can continue to use the area model when multiplying 3 digit by 2 digits. Once children grasp the size of the numbers, children can use place value counters in their area grid</td>
<td>Partition.</td>
<td>Formal method.</td>
</tr>
</table>

		234 x 2 = 468 7020 + 468 = 7488 234 x 30 = 7020 Placeholder carries down.	234 x 32 = 468 + 7020 = 7488
Multiply 4 digit by 2 digits			When multiplying 4 digits by 2 digits, children should be confident in the written method. Ensure exchange digits are consistent across Great Park. TTh Th H T O 2 7 3 9 x 2 8 2 1 9 1 2 5 4 7 8 0 + 7 6 6 9 2
Division			
Divide 3 digits by 1 digit	When using the show division method, children use grouping, starting with the largest place value, they group by the divisor.	Children can a draw their own counters and group them through a more pictorial method. Bar models 844 ? ? ? ?	4 | 8 5 16 = 2 1 4

	 Children can continue to ujse place value counters to share 3 digit numbers into equal groups	Part Whole Model 	
Divide 4 digits by 1 digit	Place value counters or plan counters can be used on a place value grid to support children to divide 4-digits by 1-digit. 	Children can also draw their own counters and group them through a more pictorial method.	Children should be encouraged to move away from concrete and pictorial when dividing numbers with multiple exchanges 
Divide multi digits by 2 digits (short division)	NA	NA	When children begin to divide up to 4 digits by 2 digits, written methods become the most accurate as concrete and pictorial representations become less effective. Children can write out multiples to support their calculations with larger remainders. 

Divide up to 4-digit numbers by 2 digits (formal short method) and convert to decimals and fractions.			Children write out multiples to support their calculations with larger remainders. When a remainder is left at the end the end of a calculation, children can either leave it as a remainder or convert it to a fraction. **Short division** 98 ÷ 7 becomes  Answer: 14 432 ÷ 5 becomes  Answer: 86 remainder 2 496 ÷ 11 becomes  Answer: $45\frac{1}{11}$
Divide up to 4-digit numbers by 2 digits (formal long method).			Children write out multiples to support their calculations with larger remainders. When a remainder is left at the end the end of a calculation, children can either leave it as a remainder or convert it to a fraction.

Long division

432 ÷ 15 becomes

$$\begin{array}{r} 28\ \text{r}\ 12 \\ 15\overline{)\,432} \\ -\,300 \\ \hline 132 \\ -\,120 \\ \hline 12 \end{array}$$

Answer: 28 remainder 12

432 ÷ 15 becomes

$$\begin{array}{r} 28 \\ 15\overline{)\,432} \\ -\,300 \quad 15\times 20 \\ \hline 132 \\ -\,120 \quad 15\times 8 \\ \hline 12 \end{array}$$

$\frac{\cancel{12}}{\cancel{15}} = \frac{4}{5}$

Answer: $28\frac{4}{5}$

432 ÷ 15 becomes

$$\begin{array}{r} 28.8 \\ 15\overline{)\,432.0} \\ -\,300 \\ \hline 132 \\ -\,120 \\ \hline 120 \\ -\,120 \\ \hline 0 \end{array}$$

Answer: 28·8