

Ruislip Gardens Primary School



Enjoying Learning

Calculation Policy
November 2015

Progression towards a standard written method of calculation

This policy outlines the calculation methods that will be used for all four number operations in all year groups at Ruislip Gardens Primary School.

Rationale

This policy is required to ensure:

- Consistency and continuity in methods taught throughout the school.
- Progression from informal/practical methods of recording to written methods for each of the four operations.

This Calculation Policy is also an aid to parents' understanding in their child's stages of learning.

There is considerable emphasis on teaching mental calculation strategies alongside times table knowledge, as written methods of calculations are based on mental strategies. Each of the four operations builds on mental skills which provide the foundation for jottings and informal written methods of recording. Skills need to be taught, practised and reviewed constantly. These skills then lead on to more formal written methods of calculation.

Strategies for calculation need to be supported by familiar models and images to reinforce understanding. When teaching a new strategy it is important to start with numbers the child can easily manipulate so that they can easily understand the concept.

The transition between stages should not be hurried as not all children will be ready to move on to the next stage at the same time, therefore the progression in this document is outlined in stages. Previous stages may need to be revisited to consolidate understanding when introducing a new strategy.

A sound understanding of the number system is essential for children to carry out calculations efficiently and accurately.

This policy outlines the different stages that children should progress through in order to calculate using the standard written methods.

Mental methods required for completing written calculations

The aim is that children use mental methods when appropriate, but for calculations that they cannot do in their heads they use an efficient written method accurately and with confidence. Children are entitled to be taught and to acquire:

- secure mental methods of calculation,
- one efficient written method of calculation for each of the four operations which they know they can rely on when mental methods are not appropriate.

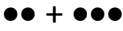
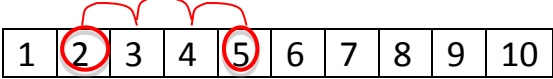
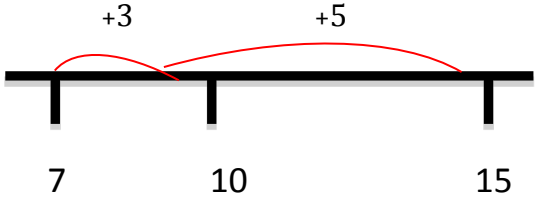
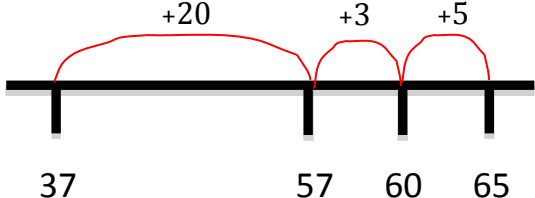
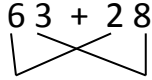
Note: It is important that children's mental methods of calculation are practised and secured alongside their learning and use of an efficient written method for the four operations.

At Ruislip Gardens, the Maths Passport is used to ensure children are progressing through the Mental Maths skills at an appropriate rate for them. It helps to ensure each individual child is working on the skills that they are weaker on and to inform their targets.

See appendix 1 for suggested progression in mental calculation.

Calculation methods

Addition

The different stages	Examples
Stage 1 Counting sets of objects.	
Stage 2 Combining two sets of objects into one group and counting practically.	For $5 + 3$ the children may get 5 objects, and then 3 more and count how many altogether
Stage 3 Drawing dots – informal jottings and counting how many altogether.	$2 + 3 = 5$ 
Stage 4 Counting on using a number line.	$2 + 3 = 5$ 
Stage 5 Steps in addition can be recorded on a number line. The steps often bridge through a multiple of 10. <ol style="list-style-type: none"> 1) Partition the smaller numbers in to tens and units. 2) Add on the tens. 3) Add on the units. 	$7 + 8 = 15$  $37 + 28 = 65$ 
Stage 6 Partitioning step 1	$63 + 28$  $60 + 20 = 80$ $3 + 8 = 11$ $80 + 11 = 91$

<p>Step 2 - Partitioned numbers are then written under one another.</p>	$63 + 28$ $\begin{array}{r} 60 + 3 \\ 20 + 8 \\ \hline 80 + 11 = 91 \end{array}$
<p>Stage 7 Write the numbers in columns. Add the units first.</p>	$\begin{array}{r} 63 \\ + 28 \\ \hline 11 \\ \hline 80 \\ \hline 91 \end{array}$
<p>Stage 8 This then becomes the shorter method where numbers get carried into the next column. Carried tens are crossed through to ensure they have been counted.</p>	$\begin{array}{r} 63 \\ + 28 \\ \hline 91 \\ \cancel{1} \end{array}$
<p>Stage 9 This then moves on to adding two three digit numbers, three two digit numbers, numbers with more digits and adding decimals.</p>	$\begin{array}{r} 163 \\ + 398 \\ \hline 561 \\ \cancel{11} \end{array}$ $\begin{array}{r} 34 \\ + 72 \\ \hline 26 \\ \hline 132 \\ \cancel{1} \end{array}$ $\begin{array}{r} 16.3 \\ + 39.8 \\ \hline 56.1 \\ \cancel{11} \end{array}$

Stage 6

Decomposition

(Replace with 2 digit numbers)
These show the two steps that lead to the shortened version of the column subtraction method. Always start with the units number.

$$73 - 26 =$$

$$\begin{array}{r} 70 + 3 \\ - 20 + 6 \\ \hline \end{array} \quad \rightarrow \quad \begin{array}{r} 60 \quad 13 \\ \cancel{70} + \cancel{3} \\ - 20 + 6 \\ \hline 40 + 7 \end{array} \quad \rightarrow \quad \begin{array}{r} 6 \\ \cancel{7} \quad 3 \\ - 2 \quad 6 \\ \hline 4 \quad 7 \end{array}$$

Stage 7

(replace with 3 digit numbers)
These show the two steps that lead to the shortened version of the column subtraction method. Always start with the units number.

$$652 - 475 =$$

$$\begin{array}{r} 600 + 50 + 2 \\ 400 + 70 + 5 \\ \hline \end{array} \quad \begin{array}{r} 500 \quad 140 \\ \cancel{600} + \cancel{50} + 2 \\ 400 + 70 + 5 \\ \hline 100 + 70 + 7 \end{array}$$

$$\begin{array}{r} 5 \quad 14 \quad 12 \\ \cancel{6} \quad \cancel{5} \quad \cancel{2} \\ - 4 \quad 7 \quad 5 \\ \hline 1 \quad 7 \quad 7 \end{array}$$

Stage 8

(Replace with 4 digit numbers including 0)

$$6009 - 2123 =$$

$$\begin{array}{r} 5000 \quad 900 \quad 100 \\ 6000 + 000 + 00 + 9 \\ - 2000 + 100 + 20 + 3 \\ \hline 300 + 800 + 80 + 6 \end{array} \quad \rightarrow \quad \begin{array}{r} 5 \quad 9 \\ \cancel{6} \quad \cancel{0} \quad 0 \quad 9 \\ - 2 \quad 1 \quad 2 \quad 3 \\ \hline 3 \quad 8 \quad 8 \quad 6 \end{array}$$



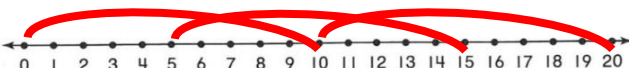
Stage 9

Formal column method. No borrowing first (ensure digits are lined up) moving onto borrowing.

$$\begin{array}{r} 679 \\ - 325 \\ \hline 354 \end{array}$$

$$\begin{array}{r} 4 \quad 11 \\ \cancel{6} \quad \cancel{7} \quad 1 \\ - 2 \quad 8 \quad 6 \\ \hline 2 \quad 3 \quad 5 \end{array}$$

Multiplication

<p>Year 2 2 times table 5 times table 10 times table</p> <p>Year 3 3 times table 4 times table 8 times table</p> <p>Year 4 Derive and recall multiplication facts for all tables up to 12 x 12</p>	<p>Within this teach how to know facts i.e. 6 x 3 is = 5 x 3 and then 1 x 3 9 x 3 is = 10 x 3 and then take away 1 x 3</p>								
The different stages	Examples								
<p>Stage 1 Counting practically in repeated groups/ patterns</p>									
<p>Stage 2 Grouping</p>	<p>$3 \times 2 = 6$</p> 								
<p>Stage 3 Arrays</p>	<p>$4 \times 2 = 8$ or $2 \times 4 = 8$</p> 								
<p>Stage 4 Repeated addition</p> <p>Repeated addition can be shown easily on a number line</p>	<p>5×3 is $5 + 5 + 5 = 15$ or 3 lots of 5</p> 								
<p>Stage 5 Partitioning</p>	<p>$14 \times 6 =$ $10 \times 6 = 60$ $4 \times 6 = 24$ $60 + 24 = 84$</p>								
<p>Stage 6 The grid method Place the number with the most digits in the left-hand column so that it is easier to add the answers of each part of the multiplication together.</p>	<p>$37 \times 8 =$</p> <table border="1" data-bbox="671 1704 1107 1872"> <tr> <td>X</td> <td>8</td> </tr> <tr> <td>30</td> <td>240</td> </tr> <tr> <td>7</td> <td>56</td> </tr> <tr> <td></td> <td>296</td> </tr> </table>	X	8	30	240	7	56		296
X	8								
30	240								
7	56								
	296								

<p>Stage 7 TU x U ladder method The next step is to show the method of recording in a column format, but showing the working. This links to the grid method above. Children should describe what they do by saying the actual values of the digits in the column. e.g. the first step in 37×8 is 'eight multiplied by seven. The second step is thirty multiplied by eight not 'three times eight'.</p>	$\begin{array}{r} 37 \\ \times 8 \\ \hline 56 \\ 240 \\ \hline 296 \end{array}$ <p>($7 \times 8 = 56$) ($30 \times 8 = 240$)</p>																
<p>Stage 8 Short multiplication The next step involves adding 240 and 56 mentally with only the 5 in 56 recorded.</p>	$\begin{array}{r} 37 \\ \times 8 \\ \hline 296 \\ \hline \end{array}$																
<p>Stage 9 The grid method TU x TU Multiplying two, two digit numbers. This follows the same steps as the first grid method but for 2 digit numbers</p>	<p>47 x 23</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tbody> <tr> <td>X</td> <td>20</td> <td>3</td> <td></td> </tr> <tr> <td>40</td> <td>800</td> <td>120</td> <td>920</td> </tr> <tr> <td>7</td> <td>140</td> <td>21</td> <td>161</td> </tr> <tr> <td></td> <td></td> <td></td> <td>1081</td> </tr> </tbody> </table>	X	20	3		40	800	120	920	7	140	21	161				1081
X	20	3															
40	800	120	920														
7	140	21	161														
			1081														
<p>Stage 10 TU x TU ladder method The amount of recording is reduced but children still need to follow each step of the grip method.</p>	<p>47 x 23 is approximately 50 x 20 is 1000</p> $\begin{array}{r} 47 \\ \times 23 \\ \hline 21 \\ 140 \\ 120 \\ \hline 800 \\ \hline 1081 \end{array}$ <p>($7 \times 3 = 21$) ($7 \times 20 = 140$) ($40 \times 3 = 120$) ($40 \times 20 = 800$)</p>																

Stage 11**Long multiplication**

The amount of recording is reduced more.

For the multiplying, the numbers are carried at the top and crossed out when used. For any adding, the numbers are carried at the bottom

47 x 23 is approximately

50 x 20 which is 1000

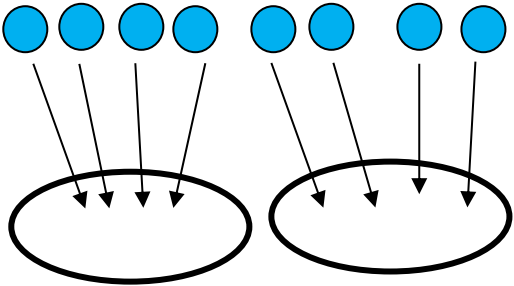
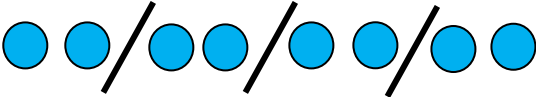
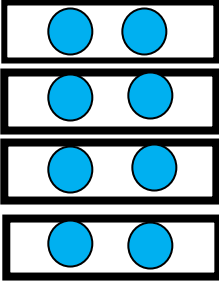
$$\begin{array}{r} \cancel{1} \cancel{2} \\ 47 \\ \times 23 \\ \hline 141 \\ + \cancel{9} \cancel{4} \cancel{0} \\ \hline 1081 \end{array}$$

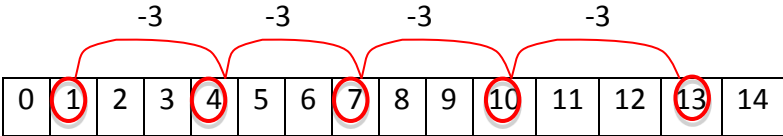
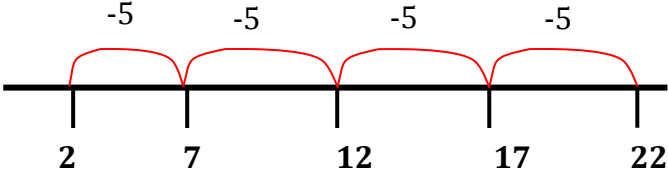
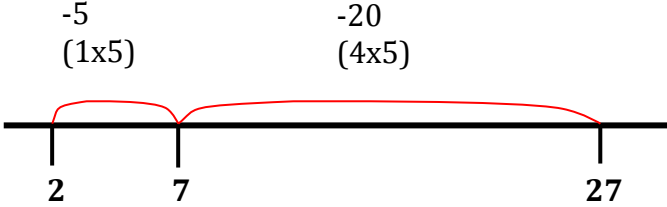
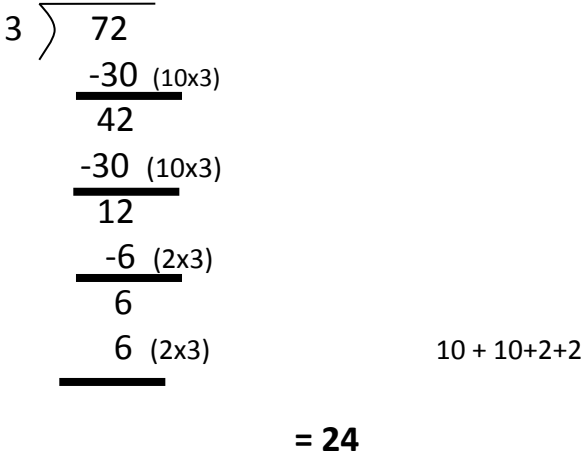
$$\begin{array}{r} \cancel{1} \cancel{4} \\ 8.9 \\ \times 8.5 \\ \hline 4.45 \\ + 71.20 \\ \hline 75.65 \end{array}$$

$$\begin{array}{r} \cancel{3} \cancel{2} \\ 39 \\ \times 43 \\ \hline 117 \\ + 1560 \\ \hline 1677 \\ \cancel{1} \end{array}$$

Division

Deriving and recalling division facts		
Year 2	Year 3	Year 4
2 times table 5 times table 10 times table	3 times table 4 times table 8 times table	Derive and recall all division facts for all tables up to 12 x 12

The Different Stages	Examples
<p>Stage 1 Step 1 Children will develop their understanding of division and use jottings to support calculation</p> <p>Step 2 Grouping</p> <p>Step 3 Arrays</p> <p>Step 4 Repeated addition</p> <p>Repeated addition can be shown easily on a number line</p>	<p>$8 \div 2$</p> <p>Sharing equally 8 sweets shared between 2 people, how many do they each get?</p>  <p>Grouping or repeated addition There are 8 sweets, how many people can have 2 sweets each?</p>  <p>Arrays can also be used</p> 

<p>Stage 2</p> <p>Children should also move onto calculations involving remainders through repeated subtraction</p>	<p>$13 \div 3 = 4 \text{ r}1$</p> 
<p>Stage 3</p> <p>Children will develop their use of repeated subtraction to be able to subtract multiples of the divisors.</p> <p>Initially this should be multiples of 10, 5, 2 and 1 – numbers with which the children are more familiar</p>	<p>$22 \div 5 = 4 \text{ r}2$</p> 
<p>Stage 4</p> <p>Moving onto:</p>	<p>$27 \div 5 = 5 \text{ r}2$</p> 
<p>Stage 5</p> <p>The vertical method (also known as chunking)</p> <p>TU \div U And HTU \div U</p>	<p>$72 \div 3 =$</p> 

<p>Stage 6 Short division – dividing by a single digit</p> <p>Underline 2 digits when being read as a whole TU number</p>	<p>$72 \div 3 =$</p> $\begin{array}{r} 24 \\ 3 \overline{) 72} \end{array}$ <p>$52 \div 5 =$</p> $\begin{array}{r} 10 \text{ r}2 \\ 5 \overline{) 52} \end{array}$ <p>$105 \div 5 =$</p> $\begin{array}{r} 021 \\ 5 \overline{) 105} \end{array}$ <p>$305 \div 3 =$</p> $\begin{array}{r} 101 \text{ r}2 \\ 3 \overline{) 305} \end{array}$
<p>Stage 7 Chunking HTU \div U Introduce subtracting larger multiples of ten. This is to be used as a stepping stone to stage 8, using larger numbers. Short division is the most effective method to use for dividing by 1 digit.</p>	<p>$289 \div 8$</p> $\begin{array}{r} 8 \overline{) 289} \\ - 80 \quad \underline{10} \times 8 \\ \hline 209 \\ - 160 \quad \underline{20} \times 8 \\ \hline 49 \\ - 48 \quad \underline{6} \times 8 \\ \hline 1 \end{array}$ <p>Answer = 36 r1</p> <p style="text-align: right;">Answer = 36 r1</p>
<p>Stage 8 Long Division – when dividing by TU number (Chunking) HTU \div TU</p>	<p>How many packs of 36 can we make from 828 biscuits? Start by multiplying 36 by multiples of 10 to get an estimate. As 36×20 is 720 and 36×30 is 1080 so we know it is between 20 and 30 packs. We start by subtracting 720 from 828.</p> $\begin{array}{r} 36 \overline{) 828} \\ - 720 \quad \underline{20} \times 36 \\ \hline 108 \\ - 108 \quad \underline{3} \times 36 \\ \hline 0 \end{array}$ <p>Answer = 23</p>

In effect, the recording above is the long division method, through conventionally the digits of the answer are recorded above the line as shown.

$$\begin{array}{r}
 23 \\
 36 \overline{) 828} \\
 \underline{-720} \\
 108 \\
 \underline{-108} \\
 0
 \end{array}$$

Long division

HTU ÷ TU

2 lots of 15 go into 43, which is 30. Write the 30 underneath and the 2 on top. Subtract the 30 from the 43 and we didn't use the 2, so the 2 is brought down giving us 132. Eight lots of 15 go into 132, which is 120. Write the 120 underneath and the 8 on top. Subtract the 120 from 132 to get 12. We haven't used the .0 so that is brought down. There are no more 15s left in 12 so .8 is our remainder ($12/15 = 4/5 = 0.8$)

$$\begin{array}{r}
 28.8 \\
 15 \overline{) 432.0} \\
 \underline{30} \downarrow \\
 132 \\
 \underline{120} \downarrow \\
 12.0 \\
 \underline{12.0} \\
 0
 \end{array}$$