

Four Lanes Community Junior School Progression of Written Calculation Strategies Policy

The National curriculum for mathematics provides a structured and systematic approach to teaching number. There is a considerable emphasis on teaching mental calculation strategies. More formal written methods should follow when the child is able to use a wide range of mental calculation strategies. Most children by the end of Year 6 will have a range of calculation methods both mental and written. Selection will depend upon the numbers involved. Children should not be made to move onto the next stage if they are not ready or if they are not confident. Children should be encouraged to approximate their answers before calculating. Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.

When are children ready for written calculations?

Addition and subtraction

- Do they know addition and subtraction facts to 20?
- Do they understand place value and can they partition numbers?
- Can they add three single digit numbers mentally?
- Can they add and subtract any pair of two digit numbers mentally?
- Can they explain their mental strategies orally and record them using informal jottings?
- Can they count on and back?

Multiplication and Division

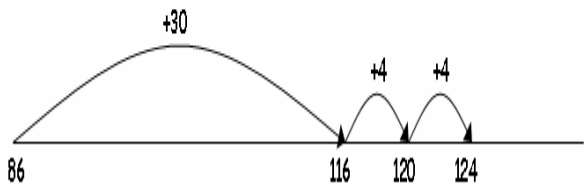
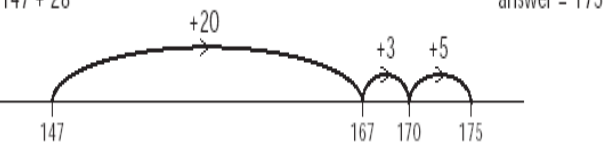
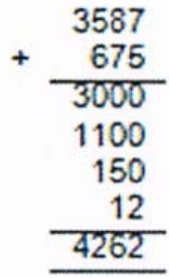
- Do they know the 2, 3, 4, 5 and 10 time table
- Do they know the result of multiplying by 0 and 1?
- Do they understand 0 as a placeholder?
- Can they multiply two and three digit numbers by 10 and 100?
- Can they double and halve two digit numbers mentally?
- Can they use multiplication facts they know to derive mentally other multiplication facts that they do not know?
- Can they explain their mental strategies orally and record them using informal jottings?

The above lists are not exhaustive but are a guide for the teacher to judge when a child is ready to move from informal to formal methods of calculation.

Aims and objectives

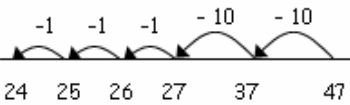
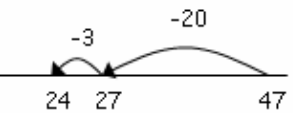
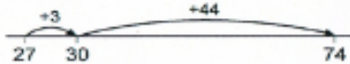
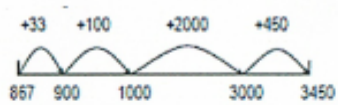
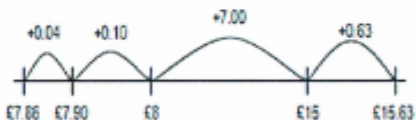
This policy aims to standardise which strategies will be taught and how children will record their calculation

Addition

Stage 1 Number line	Stage 2 Partitioning (link with mental strategies)	Stage 3 Expanded Method	Stage 4 Column Method
<p>Use of empty (unstructured) number lines</p> <p>Count on from the largest number irrespective of the order of the calculation.</p> <p>$38 + 86 = 124$</p>  <p>$147 + 28$ answer = 175</p> 	<p>Continued use of number lines</p> <p>Partitioning one number initially</p> <p>$47 + 76$</p> <p>$76 + 40 = 116$ $116 + 7 = 123$</p> <p>Leading to:</p> <ul style="list-style-type: none"> • HTU + HTU • Adding numbers with different numbers of digits • Moving across the hundreds barrier • Use decimals involving money and measures 	<p>Write the numbers in columns but using partitioning to support</p>  <p>Leading to:</p> <ul style="list-style-type: none"> • adding the least significant digits first <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> $\begin{array}{r} 67 \\ + 24 \\ \hline 11 \text{ (7 + 4)} \\ \hline 80 \text{ (60 + 20)} \\ \hline 91 \end{array}$ </div> <div style="text-align: center;"> $\begin{array}{r} 267 \\ + 85 \\ \hline 12 \text{ (7 + 5)} \\ \hline 140 \text{ (60 + 80)} \\ \hline 200 \\ \hline 352 \end{array}$ </div> </div> <ul style="list-style-type: none"> • Decimals in context 	<p>Carry below the line.</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> $\begin{array}{r} 587 \\ + 475 \\ \hline 1062 \\ 11 \end{array}$ </div> <div style="text-align: center;"> $\begin{array}{r} 3587 \\ + 675 \\ \hline 4262 \\ 111 \end{array}$ </div> </div> <div style="text-align: center; margin-top: 20px;"> $\begin{array}{r} 12786 \\ + 2568 \\ \hline 15354 \\ 111 \end{array}$ </div> <p>Children should extend the carrying method to numbers with any number of digits.</p> <div style="text-align: center; margin-top: 20px;"> $\begin{array}{r} 42 \\ 6432 \\ 786 \\ 3 \\ + 4681 \\ \hline 11944 \\ 121 \end{array}$ </div>

By the end of year 6, children will have a range of calculation methods, mental and written. Selection will depend upon the numbers involved. Children should not be made to go onto the next stage if: they are not ready or if they are not confident. Children should be encouraged to approximate their answers before calculating. Children should be encouraged to consider if a mental calculation would be appropriate before using written methods

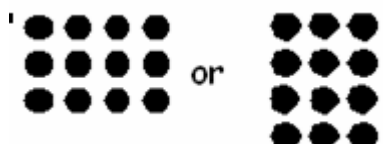
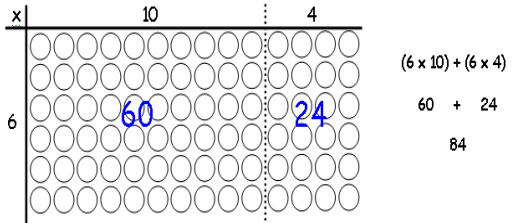
Subtraction

Stage 1 Number line	Stage 2 Partitioning (link with mental strategies)	Stage 3 Expanded Method	Stage 3 Column Method
<p><i>Number line to count back (take away)</i></p> <p>$47 - 23 = 24$</p>  <p>$47 - 23 = 24$</p> 	<p>Subtracting a single or two digit number from a two digit number</p> <p>$74 - 27$</p> <p>$74 - 20 = 54$ or $74 - 20 = 54$ $54 - 7 = 47$ $54 - 4 = 50$ $50 - 3 = 47$</p>	<p>Partitioned numbers are written under one another. Relies on secure mental skills.</p> <p>Start by subtracting Units</p> <p>$374 - 127$</p> <p>$300 + 70 + 4$ $- 100 + 20 + 3$ <hr style="width: 100px; margin-left: 0;"/> $200 + 50 + 1$</p> <p>Leading to exchanging</p> <div style="margin-top: 20px;"> $\begin{array}{r} 8000 + 400 + 20 + 5 \\ - 2000 + 700 + 60 + 0 \\ \hline + 5 \end{array}$ $\begin{array}{r} 7000 + 1300 + 120 + 5 \\ - 2000 + 700 + 60 + 0 \\ \hline 5000 + 600 + 60 + 5 = 5665 \end{array}$ </div>	<p>Children must be secure with place value, partitioning and numbers facts</p> <div style="text-align: center; margin-top: 20px;"> $\begin{array}{r} 374 \\ - 127 \\ \hline 247 \end{array}$ </div> <div style="text-align: center; margin-top: 20px;"> $\begin{array}{r} 3783 \\ - 2684 \\ \hline 1099 \end{array}$ </div> <div style="text-align: center; margin-top: 20px;"> $\begin{array}{r} 16.63 \\ - 7.86 \\ \hline 8.77 \end{array}$ </div> <div style="text-align: center; margin-top: 20px;"> $\begin{array}{r} £ 7.77 \\ - 7.86 \\ \hline \end{array}$ </div>
<p><i>Numberline to count on (find the difference)</i></p> <p>Where the numbers involved in the calculation are close together or near to multiples of 10, 100 etc counting on using a number line should be used.</p>   			

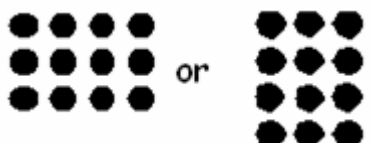
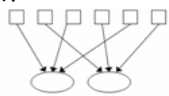



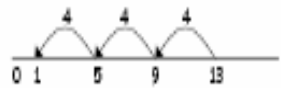
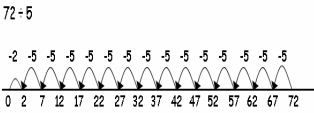
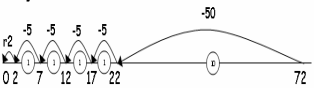
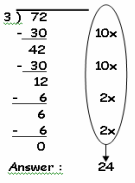
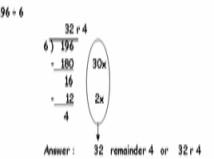
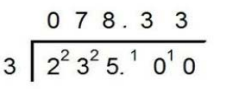
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Multiplication

Stage 1 Arrays	Stage 3 Grid Method	Stage 4 Column Method																																																																																																		
<p>Describing and drawing arrays e.g.</p> <p>$3 \times 4 = 12$ $4 \times 3 = 12$</p>  <p>$14 \times 6 = 84$</p>  <p>Array maker/multiarray itp Array Creator xl</p>	<p>Drawing a grid TU x U 23×8</p> <table border="1" data-bbox="705 319 1086 375"> <tr><td>X</td><td>10</td><td>10</td><td>3</td></tr> <tr><td>8</td><td>80</td><td>80</td><td>24</td></tr> </table> <p>$80+80+24=184$</p> <p>leading to</p> <p>$160+24=184$</p> <p>ThHTU x U 4346×8</p> <table border="1" data-bbox="694 542 1052 590"> <tr><td>x</td><td>4000</td><td>300</td><td>40</td><td>6</td></tr> <tr><td>8</td><td>32000</td><td>2400</td><td>320</td><td>48</td></tr> </table> <p>$32000 + 2400 + 320 + 48 = 34768$</p> <p>TU x TU 35×26</p> <table border="1" data-bbox="739 742 1131 805"> <tr><td>x</td><td>10</td><td>10</td><td>10</td><td>5</td></tr> <tr><td>10</td><td>100</td><td>100</td><td>100</td><td>50</td></tr> <tr><td>10</td><td>100</td><td>100</td><td>100</td><td>50</td></tr> <tr><td>6</td><td>60</td><td>60</td><td>60</td><td>30</td></tr> </table> <p>$100 + 100 + 100 + 50 = 350$ $100 + 100 + 100 + 50 = 350$ $60 + 60 + 60 + 30 = 210$ $350 + 350 + 210 = 910$</p> <p>HTU x TU (Long multiplication - multiplication by more than a single digit) 372×24 Children will approximate first 372×24 is approximately $400 \times 25 = 10000$</p> <table border="1" data-bbox="705 1037 1030 1101"> <tr><td>x</td><td>300</td><td>70</td><td>2</td></tr> <tr><td>20</td><td>6000</td><td>1400</td><td>40</td></tr> <tr><td>4</td><td>1200</td><td>280</td><td>8</td></tr> </table> <p>$6000 + 1400 + 1200 + 280 + 40 + 8 = 8928$</p> <p>4.92 x 3 Children will approximate first 4.92×3 is approximately $5 \times 3 = 15$</p> <table border="1" data-bbox="705 1324 1019 1372"> <tr><td>x</td><td>4</td><td>0.9</td><td>0.02</td></tr> <tr><td>3</td><td>12</td><td>2.7</td><td>0.06</td></tr> </table> <p>$12 + 2.7 + 0.06 = 12.76$</p>	X	10	10	3	8	80	80	24	x	4000	300	40	6	8	32000	2400	320	48	x	10	10	10	5	10	100	100	100	50	10	100	100	100	50	6	60	60	60	30	x	300	70	2	20	6000	1400	40	4	1200	280	8	x	4	0.9	0.02	3	12	2.7	0.06	<p>56×27 is approximately $60 \times 30 = 1800$</p> <table border="0" data-bbox="1724 295 2016 550"> <tr><td>56</td><td></td></tr> <tr><td>x 27</td><td></td></tr> <tr><td>1000</td><td>$50 \times 20 = 1000$</td></tr> <tr><td>120</td><td>$6 \times 20 = 120$</td></tr> <tr><td>350</td><td>$50 \times 7 = 350$</td></tr> <tr><td>42</td><td>$6 \times 7 = 42$</td></tr> <tr><td>1512</td><td></td></tr> <tr><td>1</td><td></td></tr> </table> <p>Leading to:</p> <table border="0" data-bbox="1758 694 1982 869"> <tr><td>56</td><td></td></tr> <tr><td>x 27</td><td></td></tr> <tr><td>1120</td><td>56×20</td></tr> <tr><td>392</td><td>56×7</td></tr> <tr><td>1512</td><td></td></tr> <tr><td>1</td><td></td></tr> </table> <table border="0" data-bbox="1758 965 1982 1157"> <tr><td>286</td><td></td></tr> <tr><td>x 29</td><td></td></tr> <tr><td>5720</td><td>286×20</td></tr> <tr><td>2574</td><td>286×9</td></tr> <tr><td>8294</td><td></td></tr> <tr><td>1</td><td></td></tr> </table> <p>Arrays continue to be used to teach higher level concepts such as algebra and fractions</p>	56		x 27		1000	$50 \times 20 = 1000$	120	$6 \times 20 = 120$	350	$50 \times 7 = 350$	42	$6 \times 7 = 42$	1512		1		56		x 27		1120	56×20	392	56×7	1512		1		286		x 29		5720	286×20	2574	286×9	8294		1	
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<p>Stage 2 Partitioning (link with mental strategies)</p>		<p>Multiplication grid itp</p>																																																																																																		
<p>Two digit by 1 digit</p> <p>12×4</p> <p>$10 \times 4 = 40$ $2 \times 4 = 8$ $40 + 8 = 48$</p>																																																																																																				

Division

Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
<p>Describing and drawing arrays</p>  <p>See and understand how $12 \div 4 = 3$ and $12 \div 3 = 4$ are related</p> <p>Division as sharing and grouping using concrete apparatus</p> <p><u>Sharing equally</u> 6 cakes shared between 2 children, how many cakes do they each get?</p>  <p><u>Grouping</u> There are 6 cakes how many children can have 2 cakes each?</p>  <p>Using a beadstring There are 12 cakes, how many children can have 3 cakes each?</p>  <p>A beadstring can help the children interpret a division calculation as how many 3s make 12.</p>	<p>Repeated subtraction on a number line</p> <p>Emphasis on grouping</p> <p>Children will use an empty number line to support their calculation.</p>  <p>$24 \div 4 = 6$</p>  <p>$13 \div 4 = 3 \text{ r } 1$</p> <p>Moving on to calculations that can rise to remainders. (Show remainders as whole number r1)</p> <p>Round up or down after division</p> <p>Relate fractions and division e.g. $\frac{1}{2} \times 10$ is same as $10 \div 2$</p>	<p>Repeated subtraction using chunking on a number line</p> <p>Children will develop their use of repeated subtraction to be able to subtract multiples of the divisor.</p> <p>List useful facts to help</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p><u>Useful Facts</u></p> <p>$1 \times 5 =$</p> <p>$2 \times 5 = 10$</p> <p>$10 \times 5 = 50$</p> <p>$5 \times 5 = 25$</p> </div>  <p>$72 \div 5$</p> <p>Moving onto:</p>  <p>Ensure children understand signs for division</p> <p>$\frac{69}{7} = 69 \div 7$</p>	<p>Vertical chunking</p> <p>Short division $TU \div U$</p>  <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p><u>Useful Facts</u></p> <p>$1 \times 3 = 3$</p> <p>$2 \times 3 = 6$</p> <p>$5 \times 3 = 15$</p> <p>$10 \times 3 = 30$</p> </div> <p>HTU \div U Children can start to subtract larger multiples of the divisor, e.g. $30 \times$</p>  <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p><u>Useful Facts</u></p> <p>$1 \times 6 = 6$ $10 \times 6 = 60$</p> <p>$2 \times 6 = 12$ $5 \times 6 = 30$</p> <p>$10 \times 6 = 60$</p> </div> <p>Long division $HTU \div TU$</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p><u>Useful Facts</u></p> <p>$1 \times 36 = 36$</p> <p>$2 \times 36 = 72$</p> <p>$10 \times 36 = 360$</p> </div> <p>Any remainders should be shown as fractions, i.e. if the children were dividing 32 by 10, the answer should be shown as $3 \frac{2}{10}$ which could then be written as $3 \frac{1}{5}$ in its lowest terms.</p> <p><u>Extend to decimals with up to two decimal places.</u> Children should know that decimal points line up under each other</p>	<p>Short division (show remainders to 2dp)</p>  <p>Long division (show remainders to 2dp)</p> <p>Use factors of the divisor (factorising) to split a division into more manageable calculations. For example:</p> <p>$480 \div 15$</p> <p>$= 480 \div 5 \div 3$</p> <p>$= 96 \div 3$</p> <p>$= 32$</p> 