

Scotforth St. Paul's Church of England Primary and Nursery School



Progression in Mental Calculations

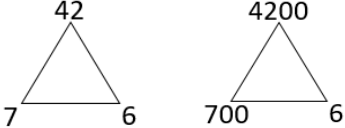
A guide for Year 4 parents

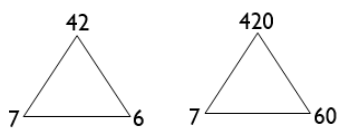
This policy aims to summarise the number facts, mental calculation strategies and the stage(s) of the progression towards the written methods for each of the four operations. The strategies used within this document are taken from the Lancashire Mathematics Team Progression in Mental Calculation Strategies Policies and the Progression Towards Written Methods Policies.

Arithmetic Expectations – Year 4

Skills	Examples
Counting	
Count in multiples of 6, 7, 9, 11, 12, 25 and 100 (By the end of Y4, children should know all tables facts up to 12 x 12)	Count from 0 in sixes What number would come next in this counting sequence? 0, 7, 14, 21, 28, ___ What number is missing from this counting sequence? 0, 25, 50, 100, 125
Count backwards through zero to include negative numbers.	What number would come next in this counting sequence? 5, 0, -5, -10,
Count up and down in hundredths.	Count from 0 in hundredths Count back from $\frac{34}{100}$ to $\frac{15}{100}$ Continue this sequence: 0.06, 0.07, 0.08...
Find 0.1, 1, 10, 100 or 1000 more or less than a given number.	What is 1000 more than 2345? 10 less than 709 is ____. What is one tenth more than 5.9? What is 100 less than 1176? What is 100 less than 1076?
Number Facts	
Recall and use addition and subtraction facts for 100	$100 - 33 = \underline{\quad}$ $24 + \underline{\quad} = 100$ $100 = \underline{\quad} + 71$ $100 - 49 = \underline{\quad}$ $100 - \underline{\quad} = 19$ $68 = 100 - \underline{\quad}$
Recall and use addition and subtraction facts for multiples of 100 totalling 1000	$1000 - 400 = \underline{\quad}$ $200 + \underline{\quad} = 1000$ $1000 = \underline{\quad} + 100$ $300 = 1000 - \underline{\quad}$ $100 = \underline{\quad}00 + \underline{\quad}00$ find different ways to complete
Recall multiplication and division facts for multiplication tables up to 12 x 12	$7 \times 6 = \underline{\quad}$ $48 = 12 \times \underline{\quad}$ $3 \times \underline{\quad} = 27$ $\underline{\quad} \times \underline{\quad} = 35$ $45 \div 9 = \underline{\quad}$ $\underline{\quad} \div 8 = 11$ $12 = 108 \div \underline{\quad}$
Multiplying by 0 and 1	$354 \times 1 = \underline{\quad}$ $803 \times \underline{\quad} = 803$ $1734 = 1 \times \underline{\quad}$ $354 \times 0 = \underline{\quad}$ $803 \times \underline{\quad} = 0$ $0 = 0 \times \underline{\quad}$
Dividing by 1	$542 \div 1 = \underline{\quad}$ $607 = 607 \div \underline{\quad}$ $38 = \underline{\quad} \div 1$
Recognise and use factor pairs and commutativity in mental calculations.	$60 \times 3 = 6 \times 10 \times 3$ reordered to give $6 \times 3 \times 10 = 180$ $14 \times 4 = 7 \times 2 \times 4$ with order of calculations being $7 \times (2 \times 4) = 56$
Mental Calculation Strategies – Addition and Subtraction	
Derive and use addition and subtraction facts for 1 and 10 (with decimal numbers to one decimal place)	$0.5 + \underline{\quad} = 1$ $2.3 + \underline{\quad} = 10$ $\underline{\quad} + 0.7 = 1$ $\underline{\quad} + 8.2 = 10$ $1 = 0.3 + \underline{\quad}$ $10 = 5.6 + \underline{\quad}$ $1 = \underline{\quad} + 0.8$ $10 = \underline{\quad} + 2.2$ $1 - 0.8 = \underline{\quad}$ $10 - 6.1 = \underline{\quad}$ $1 - \underline{\quad} = 0.6$ $10 - \underline{\quad} = 4.9$ $0.4 = 1 - \underline{\quad}$ $2.8 = 10 - \underline{\quad}$ $\underline{\quad} = 1 - 0.9$ $\underline{\quad} = 10 - 6.7$

<p>Partition and combine multiples of hundreds, tens and ones. Concrete – Diennes equipment, place value counters Pictorial – number line</p>	<p>320 + 150 320 add 100 = 420 then add 50 = 470 243 + 230 243 add 200 = 443 then add 30 = 473 460 – 140 460 subtract 100 = 360 then subtract 40 = 320 562 – 320 562 subtract 300 = 262 then subtract 20 = 242 234 + 125 234 add 100 = 334 then add 20 = 354 then add 5 = 359 (not crossing any boundaries) 765 – 241 765 subtract 200 = 565 then subtract 40 = 515 then subtract 1 = 514 (not crossing any boundaries) 85 + 47 85 add 40 = 125 then add 7 = 132 (crossing hundreds and tens boundaries) 122 – 35 122 subtract 30 = 92 then subtract 5 = 87 (crossing hundreds and tens boundaries)</p>
<p>Reorder numbers in a calculation. Concrete – Diennes equipment, place value counters, beadstring</p>	<p>7 + 12 + 3 + 5 reordered as 7 + 3 + 12 + 5 to make use of the bond to 10 18 + 6 – 8 reordered as 18 – 8 + 6 to make use of the place value of 18 27 + 75 reordered as 75 + 27 to make use of 75 + 25 seeing 27 as 25 + 2</p>
<p>Identify and use knowledge of number bonds within a calculation and identify related facts, e.g. 150 + 270 from 15 + 27 Concrete – Diennes equipment, place value counters Pictorial – Diennes jottings</p>	<p>120 + 80 using knowledge of 12 + 8 = 20 250 + 130 using knowledge of 25 + 13 = 38 200 – 70 using knowledge of 20 – 7 = 13 460 – 150 using knowledge of 46 – 15 = 31</p>
<p>Find differences by counting up through the next multiple of 10 or 100 Concrete – Diennes equipment, beadstring Pictorial – number line</p>	<p>80 – 43 43 + 7 = 50 + 30 = 80 so the difference is 37 92 – 35 35 + 5 = 40 + 50 = 90 + 2 = 92 so the difference is 57 203 – 96 96 + 4 = 100 + 100 = 200 + 3 = 203 so the difference is 107 504 – 180 180 + 20 = 200 + 300 = 500 + 4 = 504 so the difference is 324</p>
<p>Bridge through 10 when adding or subtracting a single digit number (partitioning, e.g. 58 + 5 = 58 + 2 + 3 or 76 – 8 = 76 – 6 – 2) Concrete – Diennes equipment, beadstring Pictorial – number line</p>	<p>48 + 35 as 48 + 2 + 33 = 50 + 33 = 83 97 + 64 as 97 + 3 + 61 = 100 + 61 = 161 103 – 25 as 103 – 3 – 22 = 100 – 22 (using number bonds to 100) 230 – 72 as 230 – 30 – 40 – 2 = 200 – 40 – 2</p>
<p>Add or subtract a multiple of 10 and adjust (for those numbers close to multiples of 10) Concrete – Diennes equipment, place value counters Pictorial – number line</p>	<p>84 + 28 as 84 + 30 – 2 = 114 – 2 = 112 167 + 48 as 167 + 50 – 2 = 217 – 2 = 215 96 – 38 as 96 – 40 + 2 = 56 + 2 = 58 213 – 58 as 213 – 60 + 2 = 153 + 2 = 155</p>
<p>Mental Calculation Strategies – Multiplication and Division</p>	
<p>Multiply a one- or two-digit number by 10 and 100 Concrete – Diennes equipment, place value counters Pictorial – place value chart</p>	<p>7 × 10 9 × 100 71 × 10 63 × 100</p>

<p>Use related facts to multiply a hundreds number by a one-digit number Concrete – Diennes equipment, place value counters Pictorial – place value chart, related facts multiplication trio e.g. $7 \times 6 = 42$ then $700 \times 6 = 4200$</p> 	<p>600×7 related to $6 \times 7 = 42$ This should be understood as ‘six hundred sevens’. As the number of 7s is 100 times greater than six sevens, so the product is 100x greater.</p> <p>500×8 related to $5 \times 8 = 40$ 900×6 related to $9 \times 6 = 54$</p>
<p>Use factor pairs to multiply a hundreds number by a one-digit number. Pictorial – place value chart for multiplying by 100</p>	<p>600×7 becomes $6 \times 100 \times 7$ reordered as $6 \times 7 \times 100$ 500×8 becomes $5 \times 100 \times 8$ reordered as $5 \times 8 \times 100$ 900×6 becomes $9 \times 100 \times 6$ reordered as $9 \times 6 \times 100$</p>
<p>Use compensation to multiply a 2-digit number ending in 9 by a one-digit number. Pictorial – rectangular array or a rectangle with given dimensions</p>	<p>49×3 considered as $50 \times 3 - 1 \times 3$ (read as ‘fifty threes subtract one three’) 29×7 considered as $30 \times 7 - 1 \times 7$ (read as ‘thirty sevens subtract one seven’) 89×6 considered as $90 \times 6 - 1 \times 6$ (read as ‘ninety sixes subtract one six’)</p>
<p>Use related facts to multiply TU x 5 (by multiplying by 10 and halving). Concrete – Diennes equipment, place value counters Pictorial – place value chart and a part-part-whole diagram, rectangular arrays on squared paper</p>	<p>28×5 becomes $28 \times 10 = 280$ then $280 \div 2 = 140$ 81×5 becomes $81 \times 10 = 810$ then $810 \div 2 = 405$ 54×5 becomes $54 \times 10 = 540$ then $540 \div 2 = 270$</p>
<p>Use related facts to multiply TU x 20 (by multiplying by 10 and doubling). Concrete – Diennes equipment, place value counters Pictorial – place value chart and a part-part-whole diagram, rectangular arrays on squared paper</p>	<p>34×20 becomes $34 \times 10 = 320$ then $320 \times 2 = 640$ 47×20 becomes $47 \times 10 = 470$ then $470 \times 2 = 940$ 68×20 becomes $68 \times 10 = 680$ then $680 \times 2 = 1360$</p>
<p>Use partitioning to multiply TU by a one-digit number. Pictorial – partitioning diagram using grid method strategy</p>	<p>57×4 becomes $50 \times 4 + 7 \times 4$ (read as ‘fifty fours add seven fours’) 36×7 becomes $30 \times 7 + 6 \times 7$ (read as ‘thirty sevens add six sevens’) 93×6 becomes $90 \times 6 + 3 \times 6$ (read as ‘ninety sixes add three sixes’)</p>
<p>Multiply together three numbers. Concrete – rectangular arrays created with counters or cubes Pictorial – rectangular arrays on squared paper</p>	<p>$3 \times 4 \times 6$ (read as ‘three lots of four sixes’) $7 \times 3 \times 9$ (read as ‘seven lots of three nines’) $5 \times 6 \times 8$ (read as ‘five lots of six eights’)</p>
<p>Use place value, known and derived facts to divide mentally. Concrete – Diennes equipment, place value counters Pictorial – place value chart</p>	<p>$120 \div 10$ $600 \div 100$ $850 \div 10$</p>

<p>Use related facts to divide multiples of 10 up to a thousand by a one-digit number.</p> <p><i>Pictorial – place value chart, related facts division trio e.g. $42 \div 6 = 7$ then $420 \div 60 = 7$</i></p> <div style="text-align: center;">  </div>	<p>$480 \div 8$ related to $48 \div 8$ $630 \div 9$ related to $63 \div 9$ $300 \div 6$ related to $30 \div 5$</p>
<p>Use partitioning to divide TU by a one-digit number.</p> <p><i>Concrete – Diennes equipment, place value counters Pictorial – part-part-whole diagram</i></p>	<p>$68 \div 4$ by partitioning into 40 and 28 (both multiples of 4) $95 \div 5$ by partitioning into 50 and 45 (both multiples of 5) $84 \div 6$ by partitioning into 60 and 24 (both multiples of 6)</p>
<p>Use partitioning to double or halve any number, including decimals to one decimal place.</p> <p><i>Concrete – place value counters Pictorial – partitioning diagram</i></p>	<p>Double 374 Halve 468 Double 4524 Find half of 7602 Double 7.6 What is half of 8.2?</p>

Decision Making	Concrete → Pictorial → Abstract
<p>When calculating, children should ask themselves:</p> <ul style="list-style-type: none"> - do I know the answer because it is a fact I have learnt? - can I work it out easily in my head? - can I use some equipment or a jotting? - do I need to use the written method? 	<p>All new concepts are introduced using concrete apparatus eg. cubes, counters, bead strings, Diennes (hundreds, tens and ones equipment). When children are ready, we then move on to representing the concept using pictures or jottings eg. numberlines, bar models, arrays, part/whole diagrams. The final stage is using abstract forms (numbers and symbols).</p>