

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



Progression in Mental Calculations

A guide for Year 5 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 5

| Skills | Examples | | | | | | | | |
|--|--|----------------------|---------------------|----------------------|--|---------------|--------------|----------------|---------------|
| Counting | | | | | | | | | |
| Count forwards or backwards in steps of powers of 10 for any given number up to 1 000 000. | Count on from 34 642 in hundreds. What four numbers would come next in this counting sequence? 422 734, 412 734... | | | | | | | | |
| Count forwards or backwards in decimal steps. | Continue this count: 4.4, 3.8, 3.2,... What four numbers would come next in this counting sequence? 2.16, 2.27, 3.38... | | | | | | | | |
| Find 0.01, 0.1, 1, 10, 100, 1000 and other powers of 10 more or less than a given number. | <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">$154\ 041 - 100$</td> <td style="width: 25%;">$474\ 985 + 1\ 000$</td> <td style="width: 25%;">$202\ 883 - 10\ 000$</td> <td style="width: 25%;"></td> </tr> <tr> <td>$23.47 + 0.1$</td> <td>$6.07 - 0.1$</td> <td>$31.09 + 0.01$</td> <td>$12.3 - 0.01$</td> </tr> </table> | $154\ 041 - 100$ | $474\ 985 + 1\ 000$ | $202\ 883 - 10\ 000$ | | $23.47 + 0.1$ | $6.07 - 0.1$ | $31.09 + 0.01$ | $12.3 - 0.01$ |
| $154\ 041 - 100$ | $474\ 985 + 1\ 000$ | $202\ 883 - 10\ 000$ | | | | | | | |
| $23.47 + 0.1$ | $6.07 - 0.1$ | $31.09 + 0.01$ | $12.3 - 0.01$ | | | | | | |
| Number Facts | | | | | | | | | |
| Recall addition and subtraction facts for 1 and 10 (with numbers to one decimal place). | $0.6 + 0.4 = \underline{\quad}$ $0.2 + \underline{\quad} = 1$ $1 = \underline{\quad} + 0.5$ $1 - 0.3 = \underline{\quad}$ $1 - \underline{\quad} = 0.1$ $0.7 = 1 - \underline{\quad}$ $1.3 + 8.7 = \underline{\quad}$ $2.5 + \underline{\quad} = 10$ $10 = \underline{\quad} + 4.6$ $10 - 5.2 = \underline{\quad}$ $10 - \underline{\quad} = 6.3$ $1.9 = 10 - \underline{\quad}$ | | | | | | | | |
| Recall related tables facts for multiples of 10 | 70×6 8×40 90×6 | | | | | | | | |
| Recall prime numbers up to 19 | Instantly know the prime numbers 2, 3, 5, 7, 11, 13, 17 and 19 | | | | | | | | |
| Recall square (²) numbers up to 12 x 12 | Instantly know the square of all numbers to 12: $1^2 = 1, 2^2 = 4, 3^2 = 9, 4^2 = 16, 5^2 = 25, 6^2 = 36, 7^2 = 49, 8^2 = 64, 9^2 = 81, 10^2 = 100,$ $11^2 = 121$ and $12^2 = 144$ | | | | | | | | |
| Mental Calculation Strategies – Addition and Subtraction | | | | | | | | | |
| Derive and use addition and subtraction facts for 1 (with decimal numbers to two decimal places) <i>Concrete – (if necessary) place value counters</i> <i>Pictorial – number line</i> | $0.45 + \underline{\quad} = 1$ $\underline{\quad} + 0.27 = 1$ $1 = 0.39 + \underline{\quad}$ $1 = \underline{\quad} + 0.78$ $1 - 0.08 = \underline{\quad}$ $1 - \underline{\quad} = 0.61$ $0.54 = 1 - \underline{\quad}$ $\underline{\quad} = 1 - 0.89$ | | | | | | | | |

| | | |
|--|---|--|
| <p>Partition and combine multiples of thousands hundreds, tens and ones. Concrete (if necessary) – place value counters Pictorial – number line</p> | <p>4300 + 1400 364 + 250 3600 – 1200 432 – 240 5124 + 1352 7584 – 2351</p> | <p>4300 add 1000 = 5300 then add 400 = 5700 364 add 200 = 564 then add 50 = 614 3600 subtract 1000 = 2600 then subtract 200 = 2400 432 subtract 200 = 232 then subtract 40 = 192 5124 add 1000 = 6124 then add 300 = 6424 then add 50 = 6474 then add 2 = 6476 (not crossing any boundaries) 7584 subtract 2000 = 5584 then subtract 300 = 5284 then subtract 50 = 5234 then subtract 1 = 5233 (not crossing any boundaries)</p> |
| <p>Partition and combine multiples of ones and tenths. Concrete (if necessary) – place value counters Pictorial – number line</p> | <p>5.4 + 3.2 4.7 – 2.5</p> | <p>5.4 add 3 = 7.4 then add 0.2 = 7.6 4.7 subtract 2 = 2.7 then subtract 0.5 = 2.2</p> |
| <p>Identify and use knowledge of number bonds within a calculation and identify related facts, e.g. 1.5 + 2.7 from 15 + 27 Concrete (if necessary) – place value counters</p> | <p>1.2 + 0.8 2.5 + 1.3 3.8 + 4.5 2 – 0.7 4.6 – 1.5 8.3 – 5.4</p> | <p>using knowledge of 12 + 8 = 20 using knowledge of 25 + 13 = 38 using knowledge of 38 + 45 = 83 using knowledge of 20 – 7 = 13 using knowledge of 46 – 15 = 31 using knowledge of 83 – 54 = 29</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 (if necessary) – Diennes equipment, place value counters Pictorial – number line</p> | <p>594 + 170 1995 + 278 703 – 128 3002 – 87</p> | <p>as 594 + 6 + 164 = 600 + 164 as 1995 + 5 + 273 = 2000 + 273 as 703 – 3 – 125 = 700 – 125 as 3002 – 2 – 85 = 3000 – 85</p> |
| <p>Find differences by counting up through the next multiple of 1, 10, 100 or 1000 Concrete (if necessary) – place value counters Pictorial – number line</p> | <p>604 – 289 523 – 160 1200 – 785 5003 – 1960 7.3 – 2.8 20.1 – 6.7</p> | <p>289 + 11 = 300 + 300 = 600 + 4 = 604 so the difference is 315 160 + 40 = 200 + 300 = 500 + 23 = 523 so the difference is 363 785 + 15 = 800 + 400 = 1200 so the difference is 415 1960 + 40 = 2000 + 3003 = 5003 so the difference is 3043 2.8 + 0.2 = 3 + 4 = 7 + 0.3 = 7.3 so the difference is 4.5 6.7 + 3.3 = 10 + 10.1 = 20.1 so the difference is 13.4</p> |
| <p>Add or subtract a multiple of 10 and adjust (for those numbers close to multiples of 10) Concrete (if necessary) – Diennes equipment, place value counters Pictorial – number line</p> | <p>257 + 68 325 + 298 764 – 88 876 – 397</p> | <p>as 257 + 70 – 2 = 327 – 2 as 325 + 300 – 2 = 625 – 2 as 764 – 90 + 2 = 674 + 2 as 876 – 400 + 3 = 476 + 3</p> |
| Mental Calculation Strategies – Multiplication and Division | | |
| <p>Multiply/divide whole numbers and decimals by 10, 100 and 1000 Concrete (if necessary) – Diennes equipment, place value counters Pictorial – place value chart</p> | <p>75.91 × 10 5.07 × 10 670.4 × 100 360 × 1000 0.76 × 1000</p> | <p>874 ÷ 10 60.1 ÷ 10 7043 ÷ 100 48 750 ÷ 1000</p> |

Use related facts to multiply a multiple of 100 by a one-digit number and divide a multiple of 100 by a one-digit number

Pictorial – place value chart for multiplying/dividing by 1000, related facts multiplication trio and related facts division trio



3000×3 related to $3 \times 3 = 9$

This should be understood as 'three thousand threes'.

As the number of 3s is 1000x greater than three threes, so the product is 1000x greater.

7000×5

8000×9

$7200 \div 9$ related to $72 \div 9$

This should be understood as 'how many nines in 7200? Compared to how many nines in 72?'

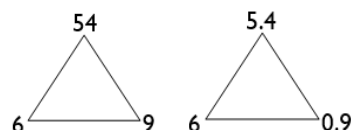
As the dividend is 100x greater, then the number of nines in it will be 100x greater.

$3000 \div 6$

$9600 \div 8$

Use related facts to multiply 0.t by a one-digit number

Pictorial – related facts multiplication trio



0.3×7 related $3 \times 7 = 21$

The number of 7s is 10x less, so the product will be 10x less.

0.6×9

0.5×4

Use factor pairs to multiply a multiple of 10 x a multiple of 10

Pictorial – place value chart for multiplying by 100

30×60 becomes $3 \times 10 \times 6 \times 10$ reordered as $3 \times 6 \times 10 \times 10$

70×80 becomes $7 \times 10 \times 8 \times 10$ reordered as $7 \times 8 \times 10 \times 10$

50×40 becomes $5 \times 10 \times 4 \times 10$ reordered as $5 \times 4 \times 10 \times 10$

Use compensation to multiply a number ending in 99 by a one-digit number

Pictorial – rectangular array or a rectangle with given dimensions

599×4 considered as $600 \times 4 - 1 \times 4$ (read as 'six hundred fours subtract one four')

399×6 considered as $400 \times 6 - 1 \times 6$ (read as 'four hundred sixes subtract one six')

699×9 considered as $700 \times 9 - 1 \times 9$ (read as 'seven hundred nines subtract one nine')

Use partitioning to multiply U.t by a one-digit number

Pictorial – partitioning diagram using grid method strategy

6.7×4 becomes $6 \times 4 + 0.7 \times 4$

3.2×7 becomes $3 \times 7 + 0.2 \times 7$

8.5×6 becomes $8 \times 6 + 0.5 \times 6$

Use partitioning to double or halve numbers including those with two decimal places

Concrete (if necessary) – place value counters

Pictorial – partitioning diagram

Double 56.7

Double 485.6

Double 8.59

Double 36 742

Find half of 4.62

Find half of 18.46

Find half of 8.94

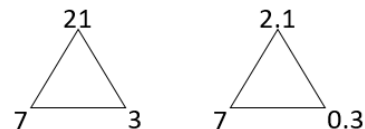
Find half of 17.92

Find half of 32 784

Use related facts to divide U.t by a one-digit number

Pictorial – place value chart, related facts division trio

e.g. $21 \div 7 = 3$ then $2.1 \div 7 = 0.3$



$2.1 \div 7$ related to $21 \div 7 = 3$

This should be understood as 'how many sevens in 2.1? Compared to how many sevens in 21?'

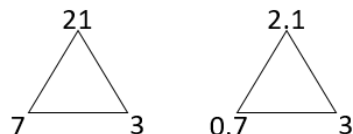
As the dividend is 10x smaller, then the number of sevens in it will be 10x smaller.

$3.6 \div 9$

$4.8 \div 4$

Use related facts to divide U.t by a 0.t

Pictorial – place value chart, related facts division trio
 e.g. $21 \div 7 = 3$ then $2.1 \div 0.7 = 3$



$2.1 \div 0.7$ related to $21 \div 7 = 3$

This should be understood as 'how many 0.7s in 2.1? Compared to how many sevens in 21?'

As the dividend is 10x smaller and the divisor is 10x smaller, then the answer (quotient) will be the same.

$3.6 \div 0.9$

$4.8 \div 0.4$

Use partitioning to divide HTU by a one-digit number

Concrete (if necessary) – Diennes equipment, place value counters

Pictorial – part-part-whole diagram

$756 \div 9$ By partitioning into 720 and 36 (two multiples of 9 totalling 756)

$765 \div 5$ By partitioning into 500 and 250 and 15 (three multiples of 5 totalling 765)

$861 \div 7$ By partitioning into 700 and 140 and 21 (three multiples of 7 totalling 861)

Decision Making

When calculating, children should ask themselves:

- 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?

Concrete → Pictorial → Abstract

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).