Year 4 - Arithmetic Expectations

This series of documents 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.

For each strategy, the concrete and pictorial representations have been suggested. However, to keep the document to a more manageable size, the imagery has not been shown explicitly as this should be found in your school's agreed mental calculations policies.

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.

See www.lancsngfl.ac.uk/curriculum/primarymaths for the full policies.

Each strategy will require specific modelling (teaching) and sufficient practice for children to develop confidence, accuracy and fluency in performing them.

Children should also be taught when it is appropriate to use each strategy, by looking at the numbers involved and making effective decisions. Again, this is a sign of a child's fluency in mathematics; being able to recognise which strategy best suits a given calculation, rather than always using the same method regardless of the numbers involved.

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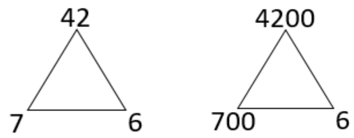
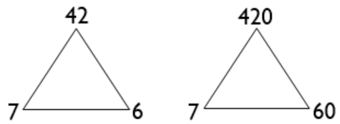
Arithmetic Expectations – Year 4

Skills	Examples
Counting	
Count in multiples of 6, 7, 9, 25 and 100	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 = ___ 24 + ___ = 100 100 = ___ + 71 100 – 49 = ___ 100 – ___ = 19 68 = 100 – ___
Recall and use addition and subtraction facts for multiples of 100 totalling 1000	1000 – 400 = ____ 200 + ____ = 1000 1000 = ____ + 100 300 = 1000 – ____ 100 = _00 + _00 find different ways to complete
Recall multiplication and division facts for multiplication tables up to 12 x 12	7 x 6 = ____ 48 = 12 x ___ 3 x ___ = 27 ___ x ___ = 35 45 ÷ 9 = ___ ____ ÷ 8 = 11 12 = 108 ÷ ___
Multiplying by 0 and 1	354 x 1 = ____ 803 x ___ = 803 1734 = 1 x ______ 354 x 0 = ____ 803 x ___ = 0 0 = 0 x ______
Dividing by 1	542 ÷ 1 = ____ 607 = 607 ÷ ___ 38 = ____ ÷ 1
Recognise and use factor pairs and commutativity in mental calculations.	60 x 3 = 6 x 10 x 3 reordered to give 6 x 3 x 10 = 180 14 x 4 = 7 x 2 x 4 with order of calculations being 7 x (2 x 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 + ___ = 1 2.3 + ___ = 10 ___ + 0.7 = 1 ___ + 8.2 = 10 1 = 0.3 + ___ 10 = 5.6 + ___ 1 = ___ + 0.8 10 = ___ + 2.2 1 – 0.8 = ___ 10 – 6.1 = ___ 1 – ___ = 0.6 10 – ___ = 4.9 0.4 = 1 – ___ 2.8 = 10 – ___ ___ = 1 – 0.9 ___ = 10 – 6.7
Partition and combine multiples of hundreds, tens and ones. *Concrete – Diennes equipment, place value counters*	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

Pictorial – number line	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)
Reorder numbers in a calculation. *Concrete – Diennes equipment, place value counters, beadstring*	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
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*	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
Find differences by counting up through the next multiple of 10 or 100 *Concrete – Diennes equipment, beadstring* *Pictorial – number line*	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**
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*	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
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*	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
Mental Calculation Strategies – Multiplication and Division	
Multiply a one- or two-digit number by 10 and 100 *Concrete – Diennes equipment, place value counters* *Pictorial – place value chart*	7 x 10 9 x 100 71 x 10 63 x 100

Use related facts to multiply H00 by a one-digit number *Concrete – Diennes equipment, place value counters* *Pictorial – place value chart, related facts multiplication trio e.g. 7 x 6 = 42* *then 700 x 6 = 4200* 	600 x 7 related to 6 x 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.* 500 x 8 related to 5 x 8 = 40 900 x 6 related to 9 x 6 = 54
Use factor pairs to multiply H00 by a one-digit number. *Pictorial – place value chart for multiplying by 100*	600 x 7 becomes 6 x 100 x 7 reordered as 6 x 7 x 100 500 x 8 becomes 5 x 100 x 8 reordered as 5 x 8 x 100 900 x 6 becomes 9 x 100 x 6 reordered as 9 x 6 x 100
Use compensation to multiply T9 by a one-digit number. NB T9 represents a two-digit number with 9 ones *Pictorial – rectangular array or a rectangle with given dimensions*	49 x 3 considered as 50 x 3 – 1 x 3 (read as '*fifty threes subtract one three*') 29 x 7 considered as 30 x 7 – 1 x 7 (read as '*thirty sevens subtract one seven*') 89 x 6 considered as 90 x 6 – 1 x 6 (read as '*ninety sixes subtract one six*')
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*	28 x 5 becomes 28 x 10 = 280 then 280 ÷ 2 = 140 81 x 5 becomes 81 x 10 = 810 then 810 ÷ 2 = 405 54 x 5 becomes 54 x 10 = 540 then 540 ÷ 2 = 270
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*	34 x 20 becomes 34 x 10 = 320 then 320 x 2 = 640 47 x 20 becomes 47 x 10 = 470 then 470 x 2 = 940 68 x 20 becomes 68 x 10 = 680 then 680 x 2 = 1360
Use partitioning to multiply TU by a one-digit number. *Pictorial – partitioning diagram using grid method strategy*	57 x 4 becomes 50 x 4 + 7 x 4 (read as '*fifty fours add seven fours*') 36 x 7 becomes 30 x 7 + 6 x 7 (read as '*thirty sevens add six sevens*') 93 x 6 becomes 90 x 6 + 3 x 6 (read as '*ninety sixes add three sixes*')
Multiply together three numbers. *Concrete – rectangular arrays created with counters or cubes* *Pictorial – rectangular arrays on squared paper*	3 x 4 x 6 (read as '*three lots of four sixes*') 7 x 3 x 9 (read as '*seven lots of three nines*') 5 x 6 x 8 (read as '*five lots of six eights*')
Use place value, known and derived facts to divide mentally. *Concrete – Diennes equipment, place value counters* *Pictorial – place value chart*	120 ÷ 10 600 ÷ 100 850 ÷ 10

Use related facts to divide HT0 by a one-digit number. *Pictorial – place value chart, related facts division trio e.g. 42 ÷ 6 = 7* *then 420 ÷ 60 = 7* 	480 ÷ 8 related to 48 ÷ 8 630 ÷ 9 related to 63 ÷ 9 300 ÷ 6 related to 30 ÷ 5
Use partitioning to divide TU by a one-digit number. *Concrete – Diennes equipment, place value counters* *Pictorial – part-part-whole diagram*	68 ÷ 4 by partitioning into 40 and 28 (both multiples of 4) 95 ÷ 5 by partitioning into 50 and 45 (both multiples of 5) 84 ÷ 6 by partitioning into 60 and 24 (both multiples of 6)
Use partitioning to double or halve any number, including decimals to one decimal place. *Concrete – place value counters* *Pictorial – partitioning diagram*	Double 374 Halve 468 Double 4524 Find half of 7602 Double 7.6 What is half of 8.2?

Progression Towards Written Calculation Strategies – Addition

This is the final stage of the method, and should be continued to be used for all written addition calculations.
The first example would be explained as follows:
5 + 8 = 13, put 3 down and carry the 10 *(written as a 1 in the tens column)*
20 + 40 + 10 that was carried over = 70 *(7 written in the tens column)*
600 + 0 = 600 *(6 written in the hundreds column)*
Children will be expected to use this method for adding numbers with more than 3 digits, numbers involving decimals and adding any number of amounts together.

Supported (if necessary) by the use of place value counters.

$$\begin{array}{r} \text{HTU} \\ 625 \\ +\ \ 48 \\ \hline 673 \\ {\scriptstyle 1} \end{array} \qquad \begin{array}{r} 367 \\ +\ \ 85 \\ \hline 452 \\ {\scriptstyle 11} \end{array} \qquad \begin{array}{r} 321 \\ +\ \ \ 7 \\ +\ \ 48 \\ \hline 376 \\ {\scriptstyle 1} \end{array} \qquad \begin{array}{r} £3.48 \\ +\ £0.78 \\ \hline £4.26 \\ {\scriptstyle 1\ 1} \end{array}$$

Progression Towards Written Calculation Strategies – Subtraction

This final stage is the compact method of decomposition. The example shows how the same calculation would be carried out using the method from the previous year and the final method.

This is the final stage of the process and will continue to be used with greater numbers and numbers involving decimals.

Supported (if necessary) by the use of place value counters.

$$\begin{array}{r} 754 \\ -\ \ 86 \\ \hline \end{array} \quad \text{expanded} \quad \begin{array}{rcrcr} \overset{600}{\cancel{700}} & \rightarrow & \overset{140}{\cancel{50}} & \rightarrow & {}^{1}4 \\ - & & 80 & \rightarrow & 6 \\ \hline 600 & \rightarrow & 60 & \rightarrow & 8 \end{array} = 668 \quad \text{compact} \quad \begin{array}{r} {\scriptstyle 6\,14\,1} \\ \cancel{7}\cancel{5}4 \\ -\ \ 86 \\ \hline 668 \\ \hline \end{array}$$

The example shown would be explained as follows:
We are subtracting 86 from 754. Start with the least significant place value column.
Are there enough ones to subtract 6?
No – so let's exchange a ten from the tens column for ten ones. 5 tens and 4 ones becomes 4 tens and 14 ones.
14 subtract 6 = 8
Are there enough tens to subtract 80?
No – so let's exchange a hundred from the hundreds column for ten tens. 7 hundreds and 4 tens becomes 6 hundreds and 14 tens.
14 tens (140) subtract 8 tens (80) = 6 tens (60)
600 – 0 = 600
Answer 668

Progression Towards Written Calculation Strategies – Multiplication

In this stage, the array is removed and children use the grid method.
This is an important step in retaining children's understanding of multiplication.

23 x 8

×	20	3
8	160	24

160 + 24 = 184

Progression Towards Written Calculation Strategies – Division

This is the ‘chunking’ method of division in which children use key facts of the multiplication tables of the divisor.
The repeated subtraction is made more efficient by subtracting ‘chunks’ of the divisor and where steps are repeated, children are encouraged to combine these to make the process more efficient.

$$\begin{array}{rl} & 24 \\ 3\,\overline{)\,72} & \\ -\,30 & 10\text{x} \\ \hline 42 & \\ -\,30 & 10\text{x} \\ \hline 12 & \\ -\,12 & 4\text{x} \\ \hline 0 & \end{array}$$

$$\boxed{\begin{array}{l} 1\text{x} = 3 \\ 2\text{x} = 6 \\ 5\text{x} = 15 \\ 10\text{x} = 30 \end{array}}$$

$$\begin{array}{rl} & 24 \\ 3\,\overline{)\,72} & \\ -\,60 & 20\text{x} \\ \hline 12 & \\ -\,12 & 4\text{x} \\ \hline 0 & \end{array}$$

$$\begin{array}{rl} & 32 \text{ r4} \\ 6\,\overline{)\,196} & \\ -\,180 & 30\text{x} \\ \hline 16 & \\ -\,12 & 2\text{x} \\ \hline 4 & \end{array}$$

$$\boxed{\begin{array}{l} 1\text{x} = 6 \\ 2\text{x} = 12 \\ 5\text{x} = 30 \\ 10\text{x} = 60 \\ 20\text{x} = 120 \end{array}}$$

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?

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