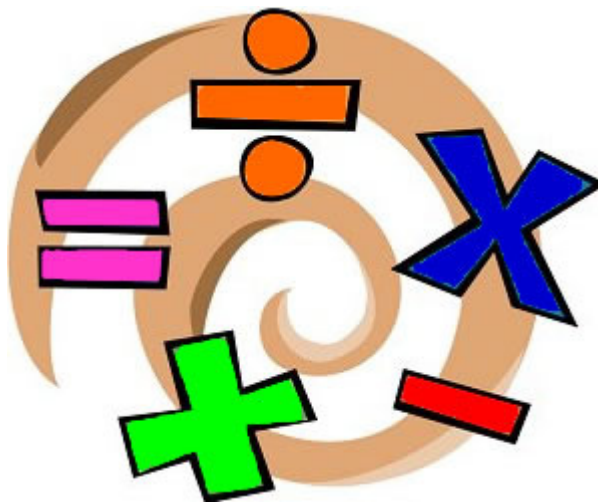# Progression in Written Calculations

Laughton Community Primary School

A useful document for staff and parents.

"They didn't do it like that in my day!"

Do your children ask for help with their maths homework and start talking in a foreign language, using words like 'partitioning', 'chunking', 'grid multiplication'…..?

If so, you may feel the need for some translation. This booklet is designed to explain some of the methods used to teach calculation in schools following the introduction of the National Numeracy Strategy (NNS) in 1999 and the Primary National Strategy (PNS) in 2003.
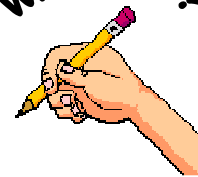
Which is more important?

mental calculation?   **or**   **written?**
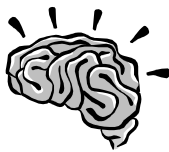
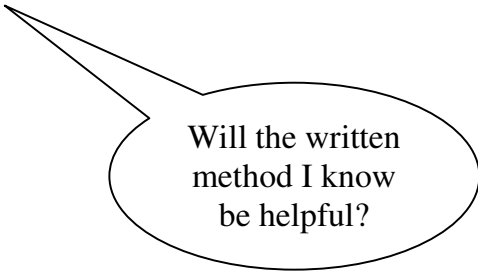This will depend on the numbers involved and the individual child.

When faced with a calculation, no matter how large or difficult the numbers may appear to be, all children should ask themselves:

> Can I do this in my head?

> Do I know the approximate size of the answer?

> If I can't do it wholly in my head, what do I need to write down in order to help me calculate the answer?

When do children need to start recording?

The following table shows how some sort of recording is relevant throughout the primary years with mental strategies playing an important role throughout.

EYFS + Level 1	Level 2 and 3	Level 4 and 5
←————————— Making a record of a calculation —————————→		
←———— Jotting to support a mental strategy ————→		
←—— Explaining a mental strategy ——→		
←—— Developing written methods ——→		

It is important to encourage children to look first at the problem and then get them to decide which is the best method to choose – pictures, mental calculation with or without jottings, structured recording or calculator.

Children attempting to use formal written methods without a secure understanding will try to remember rules, which may result in unnecessary and mistaken applications of a standard method.

$$
\begin{array}{r}
24 \\
+39 \\
\hline
513 \\
\hline
\end{array}
$$

Some of the methods explained in this booklet involve 'partitioning' and a set of place value cards are attached which can be pasted onto card and cut out (your child will show you how to use them). Partitioning is splitting numbers into hundreds, tens and units to help with mental and written calculations. This is also extended

beyond hundreds and into decimal numbers. If you are still unsure about these cards, please ask your child's teacher.

CALCULATIONS IN CONTEXT

All the methods in this booklet support children in using their mental and written skills to solve calculations. Children need to be encouraged to use the method that they understand and can use confidently.

It is important that children are able to choose the most appropriate method for the calculation. For example:

4003 − 3998

These numbers are very close together and so counting up on a number line (actual or imagined) would be the most efficient method.

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200 ÷ 4

> Dividing by 4 is the same as halving and halving again. As it is easy to halve 200 and easy to halve 100, this would be the most efficient method.

Using and applying appropriate skills is very important, when calculations are needed to solve a problem.

> **4 C.DS at £2.99 each – how much altogether?** £2.99 is almost £3.00 and so round up, multiply, then adjust:
>
> 4 x £3.00 = £12.00
>
> £12.00 – 4p = £11.96

Written Calculations

In order to calculate the written methods, pupils need to utilise their mental maths skills. Over their time at school, it is likely they will work through all the written methods for each of the four functions and ideally year 6 will leave us using the most compact method as when these are understood, they are the most efficient. As long as they have a written method for each function, however, they will be able to access the secondary curriculum.

In the classroom, the relevant written methods will be displayed so that pupils are reminded of the methods. If a child is unsure of a new method, staff can refer them back to the old method to check their understanding and to help them move on.

ADDITION

Addition on a blank number line

$$56 + 98 = 154$$

+50

+54

+6

+2

98   100   148   154
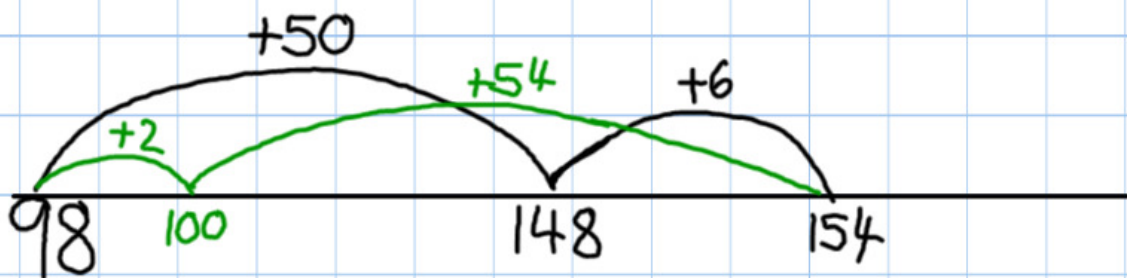
Addition with partitioning

$$294 + 138 = 432$$

$$
\begin{array}{r}
200 + 90 + 4 \\
+\ 100 + 30 + 8 \\
\hline
300 + 120 + 12 \\
\hline
\end{array}
$$

Compact Addition (no carrying)

$$523 + 364 = 887$$

$$
\begin{array}{r}
523 \\
+\,364 \\
\hline
887 \\
\hline
\end{array}
$$

Remember that in the tens column you are adding tens - its really 20 + 60. In the hundreds column it is 500 + 300.

Always start with the units column first.

Compact Addition (with carrying)

$$517 + 364 = 881$$

$$
\begin{array}{r}
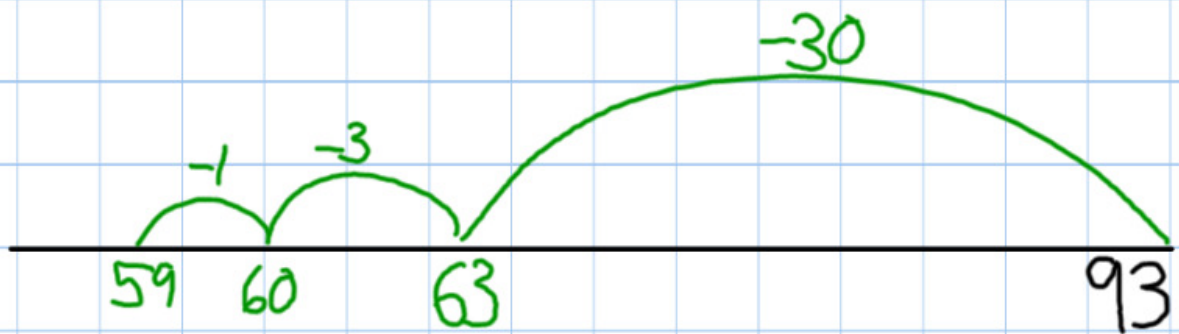517 \\
+\,364 \\
\hline
881 \\
\hline
1 \\
\end{array}
$$

Remember that in the tens column you are adding tens - its really 10 + 60. In the hundreds column it is 500 + 300.

Always start with the units column first.

SUBTRACTION

Subtraction on a blank number line

$$93 - 34 = 59$$

Subtraction on a blank number line (counting on)

$$97 - 46 = 51$$
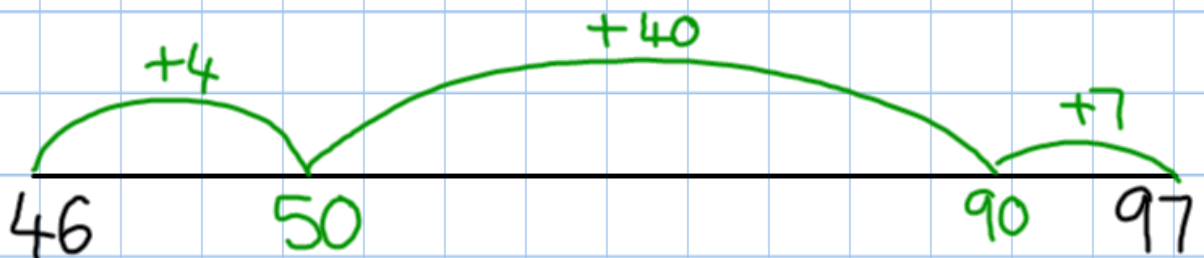
Subtraction with partitioning (no exchange)

$$796 - 432 = 364$$

$$
\begin{array}{r}
700 + 90 + 6 \\
-\quad 400 + 30 + 2 \\
\hline
300 + 60 + 4
\end{array}
$$

Subtraction with partitioning (with exchange)

$$753 - 438 = 315$$

$$
\begin{array}{r}
700 + \overset{40}{\cancel{50}} + 13 \\
-\quad 400 + 30 + 8 \\
\hline
300 + 10 + 5
\end{array}
$$

Compact Subtraction (no exchange)

$$547 - 235 = 312$$

```
   547
 - 235
 _____
   312
 _____
```

Remember you are subtracting tens and hundreds in those columns. It is 40 - 30 in the tens for example.

You must always start with the units column first.

Compact Subtraction (with exchange)

$$617 - 382 = 235$$

```
  5⁶¹17
 - 382
 _____
   235
 _____
```

Remember that in the tens column you are subtracting tens - its really 10 - 80 in the tens. In the hundreds column it is 600 - 300.

Always start with the units column first.

MULTIPLICATION

Children will need to know their times tables (up to 10 x 10) before applying a written method.

Multiplication on a blank number line

$$13 \times 6 = 78$$

10×6

$3 \times 6 = 18$

0   60   78

Grid Method of Multiplication (single digit)

$$47 \times 8 = 376$$

X	40	7		
8	320	56	=	376

Grid Method of Multiplication (double digit)

48 × 53 = 2544

×	40	8
50	2000	400
3	120	24

```
   2 0 0 0
     1 2 0
     4 0 0
 +     2 4
   2 5 4 4
```

Compact Method of Multiplication (single digit)

154 × 7 = 1078

```
    1 5 4
 ×      7
  1 0 7 8
    3 2
```

Compact Method of Multiplication (double digit)

$$398 \times 27 = 10746$$

```
      3 9 8
  X     2 7
  2 7 8 6
  7 9 6 0
1 0 7 4 6
    1 1
```

DIVISION

Multiplication skills are also key fro division – we are asking "How many groups of x in y?"

Division on a blank number line (single digit, no remainder)

$$112 \div 8 = 14$$

How many lots of 8 in 112?

2×8=16   2×8=16   5×8=40   5×8=40

0   16   32   72   112
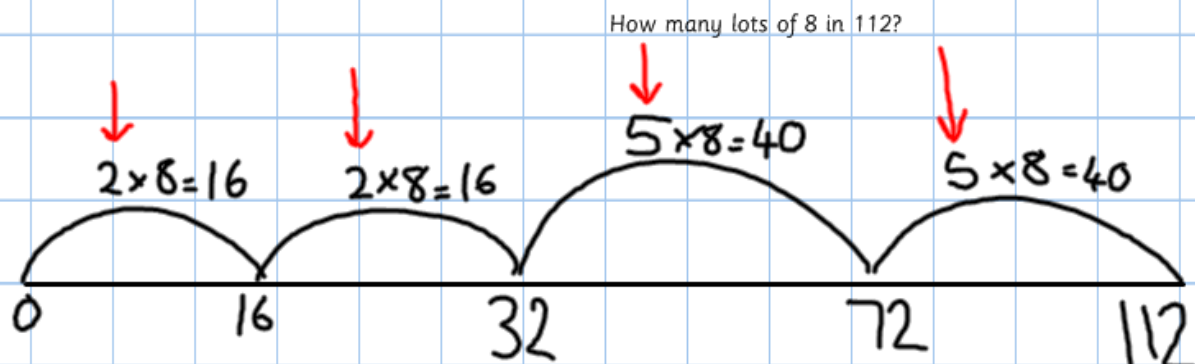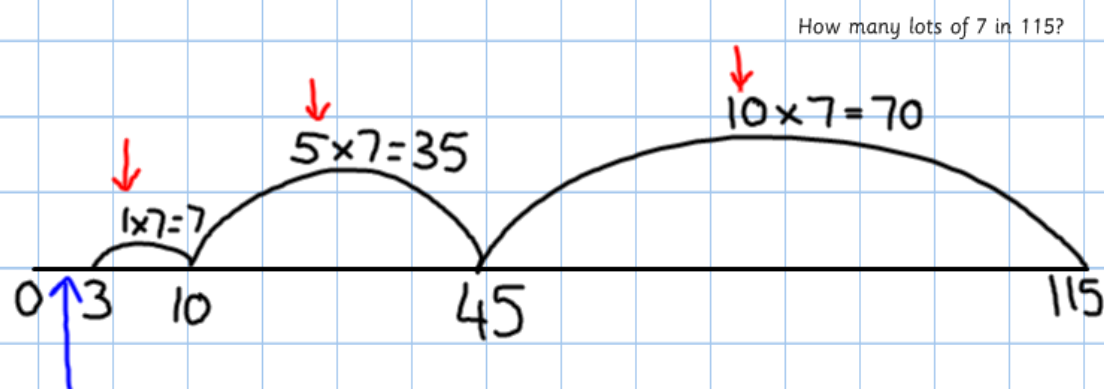
Take away the biggest group of that number you know - often 5 or 10 lots of.

Division on a blank number line (single digit, remainder)

$$115 \div 7 = 16 \, r \, 3$$

How many lots of 7 in 115?

1×7=7   5×7=35   10×7=70

0 3   10   45   115

You cannot take another 7 away therefore this is your remainder.

Chunking Method Division (single digit, with or without remainder)

$$543 \div 3 = 181$$

```
              3 | 5 4 3
100 × 3 =      - 3 0 0
              ─────────
                2 4 3
 50 × 3 =       1 5 0
              ─────────
                0 9 3
 31 × 3 =         9 3
              ─────────
                    0
```

Take away the biggest group of that number you know - often 5 or 10 lots of.

Chunking Method Division (double digit, with or without remainder)

$$7953 \div 14 = 568 \; r \; 1$$

```
              14 | 7 9 5 3
100×14 =          1 4 0 0
                  6 5 5 3
400×14=           5 6 0 0
                    9 5 3
50×14=              7 0 0
                    2 5 3
10×14=              1 4 0
                    1 1 3
8×14=               1 1 2
                          1
```

Pupils would be likely to try this method with a 3 digit number before a 4 digit number.

Short Division (single digit, with or without remainder)

$$856 \div 8 = 107$$

```
      1 0 7
  8 | 8 5 6
```

Multiplication Square

This can be helpful for pupils who are unsure of their tables as a handy reference when they are trying to work out tricky multiplication calculations. Each classroom has a large multiplication square displayed and smaller ones that pupils can access.
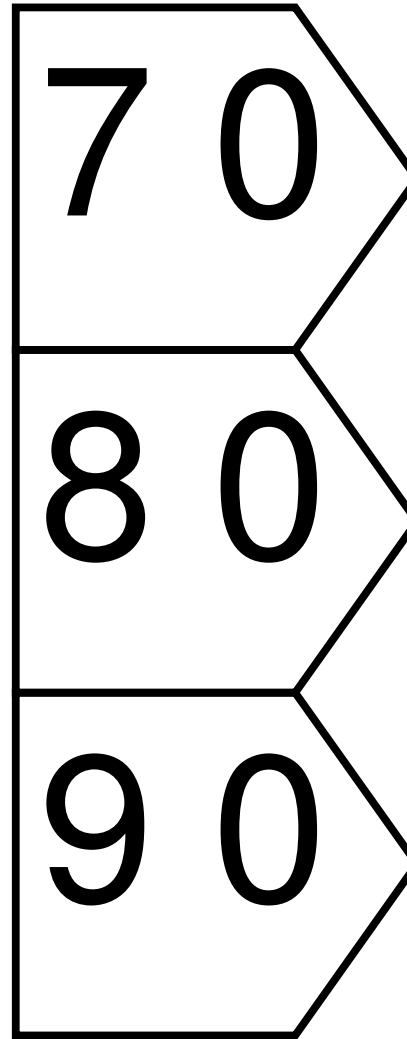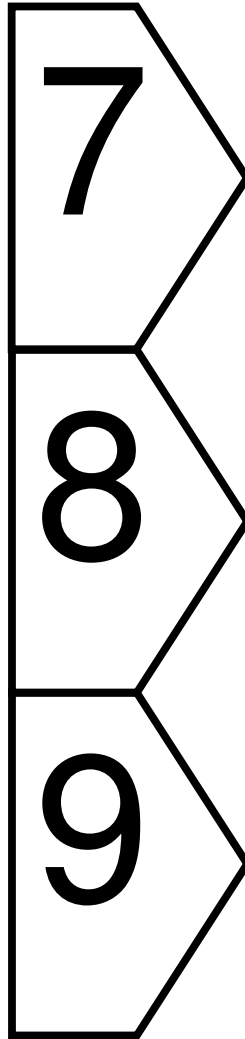
x	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

Hundred Square

These are used across the school and are particularly useful for simple addition and subtraction. You can also find patterns in multiples of numbers (answers in the times tables). Each classroom has a large hundred square displayed and smaller ones that pupils can access.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Place Value Cards

4	7	70
5	8	80
6	9	90
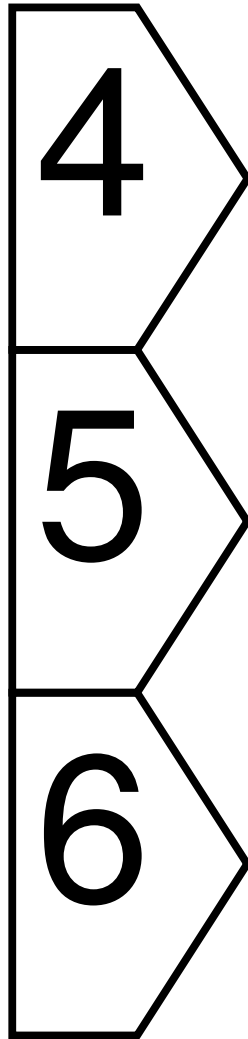
1 0 0 0

2 0 0 0

3 0 0 0

4 0 0 0

1 0 0

2 0 0

3 0 0

4 0 0

21

5 0 0 0	5 0 0
6 0 0 0	6 0 0
7 0 0 0	7 0 0
8 0 0 0	8 0 0

9 0 0 0

1 0   1

2 0   2

3 0   3

9 0 0

4 0

5 0

6 0