St John Fisher Catholic Primary School

Written Calculation Strategies

A Guide for Parents

INTRODUCTION

This booklet explains how children are taught to carry out written calculations for each of the four number operations (add/subtract/multiply/divide). The methods may look different to those that you are familiar with but your child will be using them to learn to calculate at school.

So as to help support and develop your child's mathematical understanding, each operation is taught according to a clear progression of stages. Generally, children begin by learning how written methods can be used to support mental calculations. They then move on to learn how to carry out and present calculations horizontally. After this, they start to use vertical methods, first in long form and then in compact form.

Research has shown that two things make a big difference when children are learning to calculate. First, it is important to use the correct words when talking about the numbers in calculations. The numbers should be said using the value of the number, for example;

45
+13
50 add the tens first by saying **forty** add **ten** is **fifty**

Second, children find it much easier to grasp new methods when given pictures to look at or concrete apparatus to use. Drawings, counters, objects all help – and, don't forget, fingers are one of the best maths resources at any age!

ADDITION

(1) Mental Methods with Jottings

A method of adding is to partition the numbers into parts, add the parts and then recombine to find the total.

12 + 26 =

Partition the numbers into tens and units (or ones):

10 + 2 + 20 + 6

Add the tens together and add the units together:

10 + 20 = 30 2 + 6 = 8

Recombine the numbers to give the total:

30 + 8 = 38

A clearer way for your child to write this is as follows:-

10 + 20 = 30
↑ ↑ ↓
12 + 26 = 38
↓ ↓ ↑
2 + 6 = 8

(2) Informal Written Method ('Horizontal')

This knowledge of partitioning can then be used in an informal calculation where the largest parts of the numbers are added first and the smallest parts of the numbers are added last. This method will start to be used when the numbers being added together get larger.

e.g. 148 + 286

100	40	8	
200	80	6	
300			add the hundreds first by saying **one hundred** plus **two hundred** is **three hundred**
100	40	8	
200	80	6	
300	120		add the tens next by saying **forty** plus **eighty** is **one hundred and twenty**
100	40	8	
200	80	6	
300	120	14	add the units next by saying **eight** plus **six** is **fourteen**
100	40	8	
200	80	6	
300	120	14	= 434 (total the numbers)

(3) Expanded Written Method ('Vertical')

The same method can be used in a vertical calculation with the smallest parts of the numbers being added first and the largest parts of the numbers added last. It is now vital that children keep digits in the correct columns.

e.g. 148 + 286

```
 148
 286
  14   add the units first by saying eight plus six

 148
 286
  14
 120   add the tens by saying forty plus eighty is one
       hundred and twenty

 148
 286
  14
 120
 300   add the hundreds by saying one hundred plus
       two hundred is three hundred

 148
 286,
  14
 120
 300   total the numbers – 14 + 120 + 300
 434
```

(4) Standard Compact Written Method ('Vertical & Compact')

This can then lead to a more compact method involving carrying between columns where necessary:

e.g. 148 + 286

```
 148   add the units
 286   eight plus six is fourteen
  4    put one ten under the tens column and 4 in
 1     the units column

 148   add the tens; forty plus eighty is one hundred
 286   and twenty plus ten underneath, is one
  34   hundred and thirty; put thirty in the tens
1      column and one hundred under the hundreds
       column

 148   add the hundreds; one hundred plus two
 286   hundred is three hundred, plus one hundred
 434   underneath is four hundred; put the four
       hundreds in the hundreds column
```

SUBTRACTION

There are two ways of understanding subtraction:

- finding the difference ('mind the gap')
- taking away ('stealing')

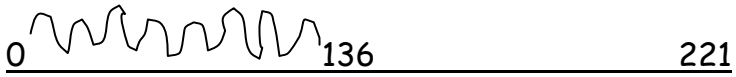
Children will be taught both ways and will be asked to choose the way that they find easiest to use.

I. Finding the difference

(1) Mental Methods with Jottings/Informal Written Method

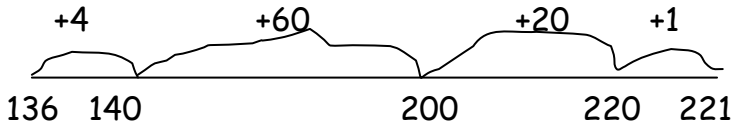
A number line can be used when finding the difference to subtract, e.g: 221 – 136

Start by marking zero and the two numbers on a number line.



We want to take away 136 so we scribble away 136. We can then count up from 136 to 221 to find what is left. Counting to the nearest multiple of 10 or 100 makes it easier.

Children can, of course, simply mark the two numbers on the number line and count up to find the answer:



Add the size of each jump, starting with the largest, to find the total and the answer: 60 + 20 + 4 + 1 = 85

This method works equally well with larger and smaller numbers.

(2) Expanded Written Method

This method of counting up to find the difference when subtracting can also be recorded vertically:

```
  221
-136
    4   to make 140
   60   to make 200
   20   to make 220
    1   to make 221
   85
```

(3) Compact Written Method

As children become more proficient, they will be able to take fewer, larger jumps leading to a more compact calculation:

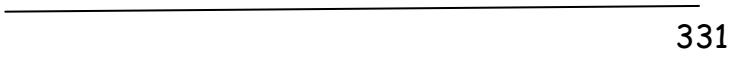
221
-136
64 to make 200
21 to make 221
85

II. Taking Away

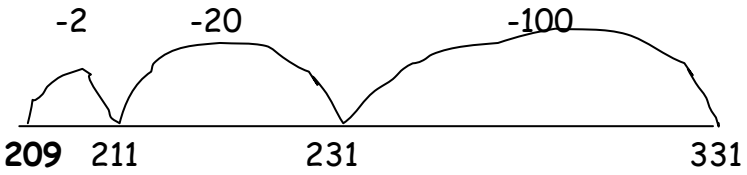
(1) Mental Methods with Jottings/Informal Written Method

A number line can again be used but this time you begin by only marking the largest number on the line:

331 – 122



You then jump back the amount you are taking away and where you finish gives the answer. Again, it makes it easier if multiples of 10 or 100 are used:



331 – 122 = 209

(2) Expanded Written Method

We can also use ideas of partitioning to take away when subtracting. This method partitions each number and takes each part of one number away from each part of the other number.

e.g. 331 – 122

Each number is partitioned into hundreds, tens and units and set out in this way:

300 30 1
-100 20 2

Starting with the units, take 2 away from 1. There isn't enough, so we need to exchange one ten for ten units. The tens column becomes ten less and the units column becomes ten more:

300 **20** **11**
-100 20 2

We can now take 2 away from 11:

300 20 **11**
-100 20 **2**
9

Move to the tens column; can we take twenty from twenty? Yes.

300	**20**	11
-100	**20**	2
	0	9

Move to the hundreds column; can we take one hundred from three hundreds? Yes.

300	20	11
-100	20	2
200	0	9

The numbers are put back together (recombined) to give the answer.

331 – 122 = 209

(3) Standard Compact Written Method

This expanded written method then leads to a more compact method:

331– 122 =

3 3 1
- 1 2 2

3 2 ^{1}1 **exchange one ten**
-1 2 2
2 0 9

MULTIPLICATION

Early multiplication skills begin in reception with counting in different steps.
Learning and recalling multiplication tables begins in year 2. Children in year 2 are still encouraged to count in twos, fives and tens, and also in threes and fours.

A strategy to help children learn multiplication tables facts from counting is to show a multiplication fact such as:

6 x 2 =

and then ask the child to put up six fingers and count across the six fingers in twos: six lots of 2 are 12.

This applies generally. Thus:

7 x 10 =

ask the child to put up seven fingers and count across the fingers in tens: seven lots of 10 are 70.

It is also important for children to know that 10 x 7 will give the same answer as 7 x 10. You can let them show this with their fingers.

Helping your child learn their multiplication table facts is one of the best things you can do to help them, not only with multiplication but in virtually all areas of maths.

Little and often is the best way - 5 minutes practice on the way to the shops is ideal!

(1) Mental Methods with Jottings

Children can use partitioning when multiplying larger numbers.

38 x 7 =

30 x 7 + 8 x 7

Multiply the tens:

30 x 7 = 210 3 x 10 x 7 = (3 x 7) x 10 = 21 x 10

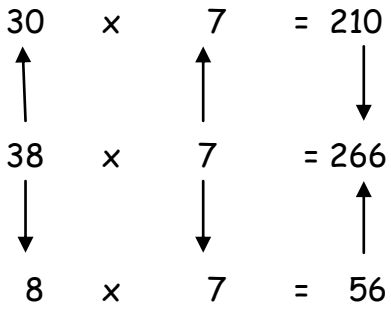
Multiply the units:

8 x 7 = 56 (table knowledge)

Add the totals together:

210 + 56 = 266

This can be recorded as:-



(2) Informal Written Method

The next step is to use partitioning and organise the calculation as a grid, e.g.: 32 x 17

First, thirty two is partitioned into tens and units and put into a grid:

x	30	2

Next, seventeen is partitioned into tens and units and added to the grid:

x	30	2
10		
7		

Then, multiply by the tens and write the answers in the boxes underneath:-

X	30	2
10	300	20
7		

Then, multiply by the units and write the answers in the boxes underneath:-

x	30	2
10	300	20
7	210	14

Last, add up the total of each row and then add up these totals to get the answer:

x	30	2	
10	300	20	320
7	210	14	224
			544

32 x 17 = 544

This method can be used to multiply combinations of numbers of any size. All that happens is that the size of the grid changes, you multiply across each row, total each row, and add all the row totals together,

e.g. 324 x 178

x	300	20	4	
100	30,000	2,000	400	32,400
70	21,000	1,400	280	22,680
8	2,400	160	32	2,592
				57,672

The grid method provides an extremely clear and flexible approach to multiplication which is much easier for children to understand and apply than any vertical methods.

For this reason, vertical methods for multiplying will not be taught, except in one instance in Years 5 and 6 when multiplying by a single digit.

It should be noted, though, that the grid method can still be used in this instance.

3) Expanded Written Method

When multiplying by a single digit number, another way of setting out multiplication is as a vertical calculation,
e.g: 23 x 7:

	23	
	x7	
3 x 7	21	multiply the units
20 x 7	140	multiply the tens saying **twenty** times 7
	161	total the columns

(4) Compact Written Method

When multiplying by a single digit number, a more compact method can also be used:-

23 x 7

23	seven times 3 is twenty one
x**7**	put the **twenty** under the tens column
1	and the one in the units column
2	

23	seven times **twenty** is one hundred
x**7**	and forty plus the **twenty** underneath
161	makes **one hundred and sixty**
2	put the **sixty** in the tens column and the one **hundred** in the hundreds column.

DIVISION

Early division begins with sharing in practical activities.
It is important, however, that children go on to recognise that division has another meaning besides sharing. For example, 15 ÷ 3:

can mean 15 **shared** between 3 (3 lots of 5)

but

it can also mean 15 **grouped** into 3's (5 lots of 3)

For written calculations, it is the idea of division as grouping which is used.

To find out how many groups of three are in fifteen, we can use a number line and count forwards or backwards in threes:-

1 2 3 4 5

0 3 6 9 12 15

15 ÷ 3 = 5

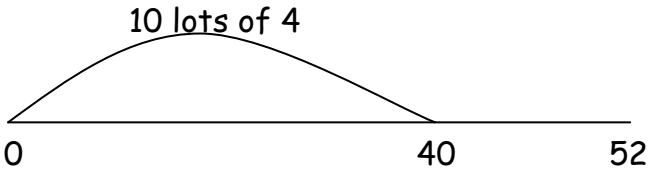
As children become more competent and the numbers they work with get larger, this basic method is refined in certain ways.

(1) Mental Methods with Jottings ('Chunking')

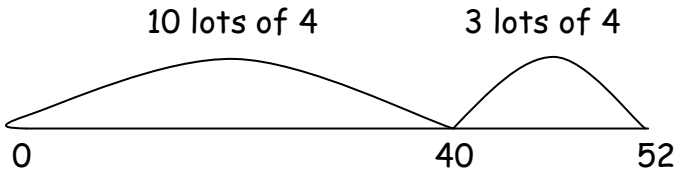
A method known as 'chunking' is introduced when the numbers to be divided start to get larger:

52 ÷ 4

Draw a number line and using table knowledge, start to count up from zero in chunks of 4. Again, it is most useful to use 'chunks' that are multiples of 10 wherever possible:-



Work out how many are left and, using table knowledge, work out how many lots of 4 this is equal to:



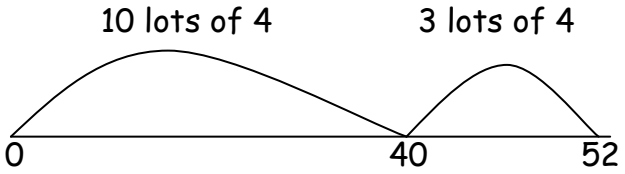
Count up the lots of 4: 10 + 3

52 ÷ 4 = 13

(2) Expanded Written Method - 'Simple chunking'

The method can be written down in a vertical format, though children may continue to need to use a number line, at least initially:-

52 ÷ 4

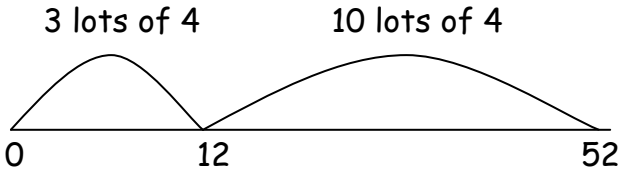


40 **10** lots of 4
1 2 **3** lots of 4
52

Count up the lots of 4: 10 + 3 = 13

The answer can also be obtained by counting backwards rather than forwards and, again, a number line may need to be used at the same time:-

52 ÷ 4



When written vertically, this becomes:

52
-40 **10** lots of 4
12
-12 **3** lots of 4
0

Count up the lots of 4: 10 + 3 = 13

(3) Expanded Written Method - 'Efficient chunking'

As the number to be divided gets even larger, the method needs to be made more efficient by working with larger 'chunks', e.g. 256 ÷ 7

If 10 lots of 7 are 70, what's the biggest chunk (lot) of 7 I can get from 256?

30 lots of 7 = 210, so I can take off 30 lots of 7

256
- 210 **30** x 7
46

How many sevens are there in 46?

6 x 7 = 42, take off 6 lots of 7

256
- 210 **30** x 7
46,
- 42 **6** x 7
4

Count up the chunks of 7: 30 + 6 = 36

The answer is 36 remainder 4

256 ÷ 7 = 36 r 4

Or, as another example, with even larger numbers:-

972 ÷ 36

How many thirty sixes are there in 972?
What is the biggest 'chunk' (lot) of 36 I can get from 972?

36) 972
720 **20** x 36 (10 x 36 = 360,
252 double 360=720)

How many thirty sixes in 252?

36) 972
720 **20** x 36
252
180 **5** x 36(10 x 36 = 360, halve 360=180)
72
72 **2** x 36

27 count up the 'chunks' or multiples of 36