TOLL BAR PRIMARY SCHOOL

POLICY FOR TEACHING WRITTEN CALCULATION

The **aim** is that:-

- by the end of year six, all children know, understand and can apply **one standard written method for every operation**
- children **always use mental methods as a first resort** and
- children **choose an efficient method** - mental, written, calculator or a combination - that is appropriate for the task.

The standard written method for each operation will be:

- addition - based on partitioning each number into the value of each digit and recombining
- subtraction - decomposition
- multiplication - based on partitioning each number into the value of each digit and recombining
- division - 'long' division progressing to short division for single digit divisors for more able children - expanded method.

Children will progress through four stages in the process of learning one standard written method for each operation. These stages are:

1. informal written methods - pencil and paper methods which are structured annotations of calculations
2. an expanded standard written method - a vertical layout that shows clearly the place value of the numbers involved and the procedure for the standard method
3. a standard written method, and
4. a standard written method extended to more difficult numbers and decimals. (Children may need to be reminded of the expanded method when first tackling more difficult numbers and decimals)

At every stage, **children will progress to working with numbers which challenge them.** Gradings of difficulty on AS1-11, 2-8 and 2-9 in *guide for your professional development: Book 3, chapters 1 and 2* will be used.

At every stage, **children will be able to explain orally how their method works** referring to the value of the digits involved.

At every stage, **children will find the approximate size of the answer** and use it to check their answer after the written method has been applied - Visualisation.

At any stage, **children who persistently make errors, will return to the stage they understood** until they are ready to move on.

Teaching written calculation will build on children's mental calculation strategies and will be delayed until children generally meet the criteria listed in *Teaching written calculation: guidance for teachers at key stages 1 and 2,QCA (TWC)on pages 16 and 17.*

Prior to teaching written calculation the teaching of mental calculation strategies will involve written work. Children will use pictures, jottings, number lines, etc, where necessary, to help them to perform a mental strategy, and all children will, at times, produce a complete and correct written record of their mental method. See *TWC page 11.*

Parents will be encouraged to help their children to learn written calculation methods and informed of the school's approach.

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WRITTEN CALCULATION: ADDITION

NB   When any method is explained, the value of the digits will be used, eg forty (four tens) not the name. Column headings will be used where appropriate to aid understanding.

1. Informal written methods
- Children will use one or more of the methods illustrated in the *Framework section 5, page 43 and section 6, pages 48 and 49, and in TWC pages 26, 27 and 28.* Any other mathematically correct method that children devise will be used, eg

$$86 + 57 = 143 \quad \text{(answer written after doing calculation)}$$
$$80 + 50 = 130$$
$$6 + 7 = 13$$
$$130 + 13 = 143$$

86 + 57 = 80 + 50 + 6 + 7 = 130 + 13 = 143

Not the procedure used for the standard written method………..

$$86 + 57 = 143 \quad \text{(answer written after doing calculation)}$$
$$86 + 50 = 136$$
$$136 + 7 = 143$$

```
        +4              +50                     +3       Number lines are
-------86-----------90-----------------------------140-------143      a useful tool.
```

- Vertical recording of informal written methods will be taught in years four, five and six where more digits are involved and a system that lines up the digits becomes helpful. See the *Framework, section 6, pages 48 and 49* and *TWC pages 27 and 28.*

2. Expanded standard written method

- **With reference to one of the informal written records** of the method based on partitioning each number into the value of each digit and recombining, which is the basis of the standard written method, the children will be taught to record vertically, eg

  (80 + 50)   Do this method first as it comes
  (6 + 7)   from the mental method.

  See the *Framework, section 5 page 43 and section 6, pages 48 and 49* and *TWC page 28.*

- Children will be taught to add the units or least significant digit first, eg

  (6 + 7)   Show this method and can then decide which way

(80 + 50)   is easiest. Units are done first when do standard method.

NB This stage is not illustrated in the *Framework* for years five and six.

3. <u>Standard written method</u>

- The 'carrying' figures will always be written below the answer box,eg

```
    86
  +257
   343
    11
```

Remember language - carry tens, hundreds.

- A suggested way of explaining the procedure is:

Six add seven equals thirteen, which equals three units and one ten. Write down three in the answer box and ten (one ten) under the answer box in the tens column.

```
    86
  +257
     3
   1
```

Eighty add fifty add ten equals one hundred and forty. Write down forty (four tens) in the answer box and one hundred under the answer box in the hundreds column.

```
    86
  +257
    43
   11
```

Two hundred add one hundred equals three hundred. Write down three hundred in the answer box.

```
    86
  +257
   343
    11
```

The total is three hundred and forty three.

WRITTEN CALCULATION: **MULTIPLICATION**

NB When any method is explained the value of the digits will be used,eg

forty (four tens) not the name. Column headings will be used where appropriate to aid understanding.

1. Informal written methods

- We will not teach grid multiplication
- Children will use one of the methods illustrated in the *Framework section 6, pages 66 and 67,* and *TWC pages 46 to 48.* Any other mathematically correct method that the children devise will be used, eg

```
Method    {  23  x  8  =  184   ( answer written after doing calculation)
to be     {  20  x  8  =  160
taught    {   3  x  8  =   24
          { 160  + 24  =  184
```

23 x 8 = (20 x 8) + (3 x 8) = 160 + 24 = 184

Not the procedure used for the standard written method........
The children may come up with this but not what we would teach.

```
23  x  10  =  230
23  x   2  =   46
23  x   8  =  230 - 46  = 184
```

```
23  x   8  =   23 x 2 x 2 x 2  =  46 x 2 x 2  =  92 x 2  =  184
```

```
23  x   8  =   46 x 4 = 92 x 2 = 184
```

2. Expanded standard written method

- **With reference to one of the informal written records** of the method based on partitioning each number into the value of each digit and recombining, which is the basis of the standard written method, the children will be taught to record vertically, eg

```
    23
  x  8
   160    (20 x 8)        }    use brackets until they feel confident
    24    ( 3 x 8)        }____
   184
```

Make sure children are reminded to line up the digits.

See the *Framework, section 6, pages 66 and 67* and *TWC page 50*.

- Children will be taught to begin with the least significant digit, eg

```
    23
  x  8
    24
```

```
     160
     184
```

NB This stage is not illustrated in the *Framework*.

3. <u>Standard written method</u>

The 'carrying' digit will be written below the answer box in the correct column, eg

```
    123
    x  8
    984
     12
```

- Suggested way of explaining the procedure is:

Three multiplied by eight is twenty four. Write down four in the answer box and twenty (two tens) under the answer box in the tens column.

```
    123
    x  8
       4
     2
```

Twenty multiplied by eight equals one hundred and sixty. Add twenty from the twenty four, which equals one hundred and eighty. Write down eighty (eight tens) in the answer box and one hundred under the answer box in the hundreds column.

```
    123
    x  8
      84
     12
```

One hundred multiplied by eight is eight hundred. Add one hundred from the one hundred and eighty, which equals nine hundred. Write down nine hundred in the answer box.

```
    123
    x  8
    984
     12
```

The product is nine hundred and eighty four.

- Children will be taught to begin with the least significant digit when doing long multiplication and where 'carrying' figures are necessary to write them below the 'line', eg

```
  72                    72                 352             } show both
 x 38                  x 38               x 27            } tens first____
2160(72 x 30)          576 (72 x 8)      2464 (352 x 7)   } and units
```

576 (72 x 8)   2160 (72 x 30)   7040 (352 x 20)   }   first
2736   2736   9504   }_____
  1   1   1

NB   In the *Framework* the examples shown begin with the most significant digit.

WRITTEN CALCULATION - DIVISION

NB When any method is explained, the value of the digits will be used, eg forty (four tens) not the name. Column headings will be used where appropriate to aid understanding.
By Year 6 - Division is about sharing or grouping
1. Informal written methods

- Children will use one or more of the methods illustrated in the *Framework, section 6, pages 68 and 69* and *TWC pages 41, 42, 44, 45, 47 and 48.* Any other mathematically correct method that children devise will be used , eg for 65 - 3

This may be appropriate with younger children.

65	30 = 3 x 10		(Children imagine a basket containing sixty five objects and remove groups of three)
35	30 = 3 X 10		
5	3 = 3 x 1		
2			

Answer   21 r2

2. Expanded standard written method

- **With reference to one of the informal written records** of the method based on subtracting multiples of the divisor, children will be taught to record vertically and to use this /   division sign. They will be taught to begin by subtracting the highest multiple of ten times the divisor for 2-digit numbers (the highest multiple of one hundred times the divisor for 3-digit numbers), which is the basis of the standard written method.
   See the *Framework, section 6 pages 68 and 69,* and *TWC page 48* where the procedure is well explained.

- Children will be taught to write the answer on the division sign at the top of the sum, eg

```
            23   r 2
    4     94
          -80          4 x 20
          14
          -12          4 x 3
           2
```

NB Writing the answer at the top is only illustrated in the *Framework* where zeros are omitted
- A suggested way of explaining the procedure is:

 Thirty sixes equal one hundred and eighty. Write down thirty (three tens) on the answer line. Write down one hundred and eighty under one hundred and ninety six. Put a subtraction sign and the top line of the answer box. One hundred and ninety six subtract one hundred and eighty equals sixteen. Write down sixteen in the subtraction answer box.

```
            3
    6     196
```

```
        -180
          16
```

Two sixes equal twelve. Write down two on the answer line. Write down twelve under sixteen. Put a subtraction sign on the top line of the answer box. Sixteen subtract twelve equals four. Write down four in the subtraction answer box. Four is fewer than six so there is a remainder of four. Write down remainder four in the answer box.

```
        32   r4
   6     196
        -180
          16
         -12
           4
```

The quotient answer is thirty two remainder four.

3. <u>Standard written method</u>

- <u>The standard written method for short division will be taught to more able pupils</u> to improve efficiency so long as accuracy and understanding are maintained, eg

```
       32   r4                6 into 190  = 30       } Explanation
  6    196                    6 into  16  =  2  r4   }
                                          = 32  r4   }
```

NB Short division is not illustrated in the *Framework* but it is discussed in *TWC pages 52 and 53.*

- The standard written method for long division where zeros are omitted when recording the subtractions , will **not** be taught, eg

```
          27
   36    972
         -72
         252
        -252
           0
```


NB   Long division where zeros are omitted when recording the subtractions is illustrated in the *Framework* for Years 5 and 6 but NOT for Years 7, 8 and 9.

WRITTEN CALCULATION: **SUBTRACTION**

NB   When any method is explained the value of the digits will be used, eg forty (four tens) not the name. Column headings will be used where appropriate to aid understanding.
Examples A + B of the framework (section 6, p50-51) on counting up and compensating are <u>not</u> taught in this school.

1. <u>Informal written methods</u>

- Children will use one or more of the methods illustrated in the *Framework, section 5, page 45 and section 6, pages 50 and 51* and *TWC pages 26 and*

27. Any other mathematically correct method that children devise will be used, eg

53 - 26 = 53 - 20 - 6 = 33 - 6 = 27 -   this is the method we should
                                        encourage children to use.
We could encourage this method with larger no's to reinforce.

53 - 26 = 53 - 23 - 3 = 30 - 3 = 27   }   possibilities children may come up
53 - 26 = 53 - 30 + 4 = 23 +4 = 27   }   with

- Vertical recording of informal written methods will be taught in years four, five and six where more digits are involved and a system that lines up the digits becomes helpful. See the *Framework, section 6, pages 50 and 51* and *TWC pages 29 and 30.*

2. Expanded standard written method
- None of the formal written methods are written records of decomposition. Initially the procedure will be modelled with base ten or money.
- Children will first be taught the expanded written method for decomposition based on partitioning and rewriting the sum to show how the larger number is changed to avoid negative answers, eg for 563 - 238

(A) 500 + 60 + 3   3 units   563 - bigger than 238
    -200 + 30 + 8   8 units
    Exchange 1 ten for ten units could use Deans at this point
    See the *Framework, section 5, page 45 and section 6, pages 50 and 51.*

- Instead of rewriting the sum to show how the larger number is changed, the second stage will be to teach the children to show it on the partitioned number, eg

              50   13
(B) 500 + 60 + 3
    -200 + 30 + 8
     300 + 20 + 5   = 325

NB This process is illustrated in *TWC pages 30 and 31* but not in the *Framework*

3. Standard written method
- Children will understand that changing the form of the larger number does not change its value. In the example below, children will understand that four hundred, one hundred and fifty and thirteen is five hundred and sixty three:

       4   15   13
       5   6   3   exchange ten - clear explanation
      -2   7   8
       2   8   5

- A suggested way of explaining the procedure is:

Three units is not enough units to subtract eight. Exchange one of the tens from the sixty for tens units. Now there is fifty (five tens) and thirteen units. Cross out six for sixty and write five for fifty. Cross out three and write thirteen. Thirteen subtract eight is five. Write down five in the answer box.

```
        5   13
  5  6  3
 -2  7  8
           5
```

Fifty is not enough tens to subtract seventy. Exchange one of the hundreds from the five hundred for ten tens. Now there is four hundred and one hundred and fifty (fifteen tens). Cross out five for five hundred and write four for four hundred. Write one next to five tens for one hundred and fifty (fifteen tens). One hundred and fifty subtract seventy equals eighty. Write down eighty (eight tens) in the answer box.

```
   4   15  13
  5  6  3
 -2  7  8
     8  5
```

Four hundred subtract two hundred equals two hundred. Write down two hundred in the answer box.

```
   4   15  13
  5  6  3
 -2  7  8
  2  8  5
```

The difference is two hundred and eighty five.