# Numeracy Handbook

## Questions that can help to extend children's thinking

### Ask children who are stuck:

- Ø  Can you describe the problem in your own words?
- Ø  Can you talk me through what you have done so far?
- Ø  What did you do last time?  What is different this time?
- Ø  Is there something that you already know that might help?
- Ø  Could you try it with simpler numbers / fewer numbers / using a number line?
- Ø  What about putting things in order?
- Ø  Would a table / picture / diagram / graph help?
- Ø  Why not make a guess and check if it works?

### After you have done some work:

- ∨  How did you get your answer?
- ∨  Can you explain why it works?
- ∨  What could you try next?
- ∨  Would it work with different numbers?
- ∨  What if you had started with … rather than … ?
- ∨  What if you could only use …?
- ∨  Is it a reasonable answer / result?  What makes you say so?  How did you check it?
- ∨  Did you use any new words today?  What do they mean?  How do you spell them?

## Useful equipment for Maths at home:

- §  Counters / cubes / small objects which do not roll (in at least 2 different colours)
- §  Dice – make your own or buy them from a toy shop (they are available with 6, 8, 10, 12 and 20 faces and a variety of numbers)
- §  A simple calculator or scientific calculator for older children
- §  100 square
- §  Tables Square
- §  Digit cards (0 to 9) – it is easy to make your own!
- §  Number line – you can use a rule for numbers up to 30 (or 300 if you use the millimetres side)

# Do!

- :) Make maths fun.
- :) Encourage children to have a go.
- :) Praise achievements, however small.
- :) Encourage children to talk about how they work things out.
- :) Remember that asking questions is as important as finding answers.
- :) Work together for short sessions (little and often).
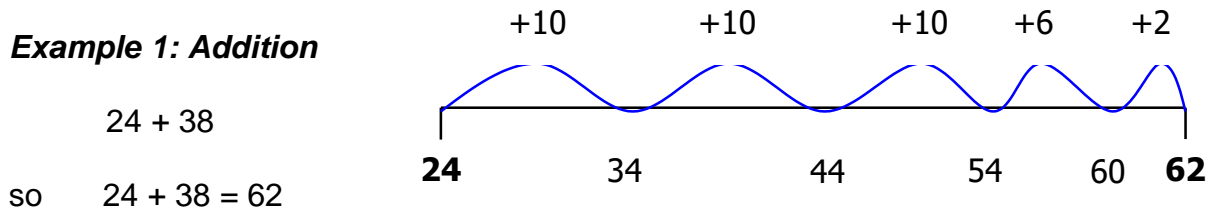- :) Stop as soon as either of you has had enough!

# Don't!

- :) Put children under too much pressure.
- :) Pass on negative feelings you may have about maths.
- :) Rush your child's learning.
- :) Worry about mistakes; we learn by taking risks and getting things wrong sometimes.
- :) Jump in too quickly with the answer. Encourage your child to solve problems for themselves.
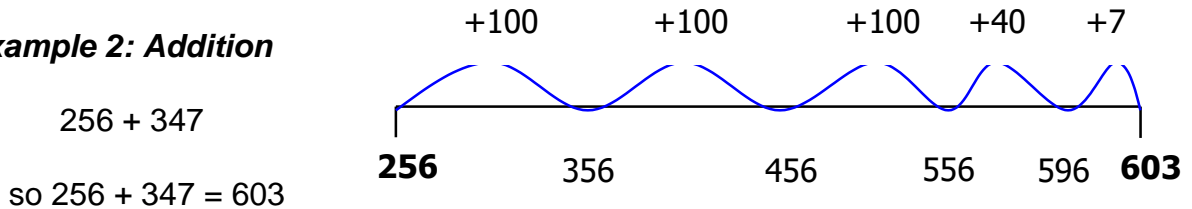- :) Continue if your child is finding the activity too hard.

# Using a Blank Number Line to Add and Subtract

Blank number lines are an important and effective tool for children. They can be used to help as children move from using prepared number lines with markings to more standard written forms of calculation. Children find them useful developing a feeling for the size of a number and how different numbers relate to each other.
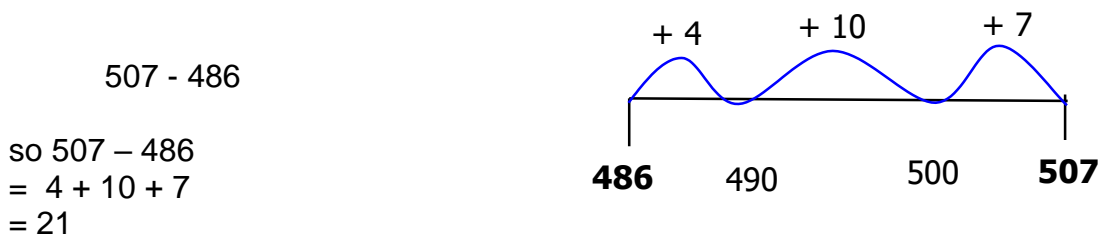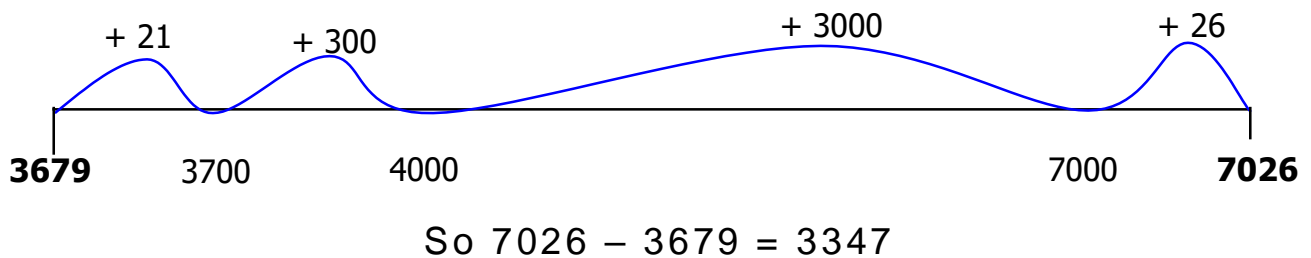
**Example 1: Addition**

24 + 38

so     24 + 38 = 62

$$+10 \quad +10 \quad +10 \quad +6 \quad +2$$

**24**   34   44   54   60 **62**

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**Example 2: Addition**

256 + 347

so 256 + 347 = 603

$$+100 \quad +100 \quad +100 \quad +40 \quad +7$$

**256**   356   456   556   596 **603**

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**Example 3: Subtraction (through counting on)**

507 - 486

so 507 – 486
=  4 + 10 + 7
= 21

$$+ 4 \quad + 10 \quad + 7$$

**486**   490   500 **507**

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*The same method works with larger numbers such as 7026 – 3679:*

$$+ 21 \quad + 300 \quad + 3000 \quad + 26$$

**3679**   3700   4000   7000 **7026**

So 7026 – 3679 = 3347

# Addition – Written methods of Calculation (A)

1. *Partitioning – link with mental methods (Years 3 and 4)*

$$47 + 56 = 40 + 7 + 50 + 6 = (40 + 50) + (7 + 6) = 90 + 13 = 103$$

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2. *Starting to lay out the numbers vertically. There are different ways of doing this. Here are some methods, which they will be taught and encouraged to use. Children will be taught to choose the methods that they understand and which seem best for the calculation that they have to do (also for Years 3 and 4).*

```
    67
 +  56
   110   (60 + 50)
    13   ( 7 +  6)
   123
```

This method links closely to mental calculations. When calculating in their heads, children are taught to add the tens first, as it gives a clue to the size of the answer.

```
   437
 + 586
   900    (400 + 500)
   110    ( 30 +  80)
    13    (  7 +   6)
  1023
```

Here the same method is used for adding hundreds.

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3. *This method, with numbers partitioned into hundreds, tens and ones (units) is a good bridge to the compact method, which will be taught later. Children need to understand this method before using the very compact method on the next page.*

```
 437 + 586 =    400 +  30 +  7
             +  500+  80 +  6
                900 + 110 + 13   = 1000 + 23 = 1023
```

# Addition – Written methods of Calculation (B)

*The Compact method is the last to be introduced.  If introduced too early it tends to slow children's mathematical understanding.  This is because children learn a set of rules and use them without really understanding.  It is very important that children are allowed to use the methods that they find most suitable.  This method will be used a little in Year 4, and will be the main one used in Years 5 and 6.  Children will still be allowed to use other methods in Years 5 and 6 if they choose.*

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**The Compact Method**

$$\begin{array}{r} 437 \\ + \underline{386} \\ \underline{823} \\ {\scriptstyle 1\ 1} \end{array}$$

\* 7 add 6 equals 13.  Write down 3 and carry the ten.  Write down the tens digit in the tens column.

\* 30 plus 80 equals 110.  Add the extra ten and that equals 120.  Write down the twenty (2 digit in the tens column) and carry 100.  Write the hundreds digit under the hundreds column.

\* 400 plus 300 equals 700.  Add the extra 100 and that equals 800.

\* The total is eight hundred and twenty three.

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It can of course be used with larger numbers and for adding more than two numbers at a time:

$$\begin{array}{r} 45689 \\ 35698 \\ 2356 \\ 48 \\ \underline{203686} \\ \underline{287477} \\ {\scriptstyle 1\ 2\ 3\ 3} \end{array}$$

# Subtraction – Written methods of Calculation

*1.*      *Partitioning – link with mental methods*

$$86 - 53 = 80 + 6 - 50 - 3 = (80 - 50) + (6 - 3) = 30 + 3 = 33$$

*2.*      *Starting to lay out the numbers vertically.  This is an introduction to decomposition (see right hand column), which will be used mainly from Year 5 onwards.  The expanded methods will be used mainly in Years 3 and 4.*

**Example 1**     **563 − 241 :**

```
     500 +      60 +   3                         563
   -  200+      40+   1                       -  241
     300 +      20 +   2   = 322                  322
```

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**Example 2**     **563 − 258 :**

```
     500 +      60 +   3                         563
   -  200+          50+   8                    -  258
```

Partition 63 into 50 + 13

```
                50                               5 ₁
     500 +      60 +  13                          5̶6̶3
   -  200+          50+   8                     -  258
                        5                            5
```

Now subtract the tens and hundreds

```
                50                               5 ₁
     500 +      60 +  13                          5̶6̶3
   -  200+          50+   8                     -  258
     300 +       0  +   5   = 305                 305
```

*Sometimes the number being subtracted is more awkward. This example shows how to tackle a 3 digit number which has to have both tens and hundreds partitioned.*

*It is important to allow children to understand the expanded method before using the compact method of decomposition.*

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**Example 3** **563 – 278 :**

```
  500 +    60 +   3        Partition 63 into
- 200 +    70 +   8        50 + 13
```

```
               50
  500 +    6̶0̶ +  13                              5
- 200 +    70 +   8                            1
               5                             5 6̶ 3
                                           -  2 7 8
                                                 5
```

Now partition 550 into 400 + 150

```
  400        150
  5̶0̶0̶ +    6̶0̶ +  13                        4  15
- 200 +    70 +    8                             1
  200 +    80 +    5   = 285              5̶ 6̶ 3
                                        -  2 7 8
                                           2 8 5
```

And here is a calculation
involving larger numbers:

```
            6  14  12  13  17
                              1
          7̶  5̶  3̶  4  8̶  3
        -      2 6 8 4 8 5
          4  8  4  9  9  8
```

# Multiplication – Written methods of Calculation (A)

*As with addition and subtraction, there is a need to understand the early stages properly before starting the more compact methods. Children really need to know their tables (2x, 3x, 4x, 5x and 10x before using any of these methods).*

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## 1.  Mental method (partitioning) written down:

e.g.  32 x 5   = (30 x 5) = (2 x 5) = 150 + 10 = 160

257 x 8   = (200 x 8) + (50 x 8) + (7 x 8)

=  1600  +  400  +  56

= 2056

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

## 2.  Grid method:

*Smaller numbers*

38 x 7

| x | 30 | 8 | Total |
|---|-----|----|-------|
| 7 | 210 | 56 | 266 |

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*Larger numbers*

156 x 27

| x | 20 | 7 | |
|-------|------|------|------|
| 100 | 2000 | 700 | |
| 50 | 1000 | 350 | |
| 6 | 120 | 42 | |
| **Total** | **3120** | **1092** | *4212* |

# Multiplication – Written methods of Calculation (B)

## 3.    Vertical format with expanded working (Years 4 and 5)

Smaller numbers    | 38 x 7 |                 Larger numbers    | 56 x 27 |

```
      38                                          56
   x  7                                        x  27
     210    (30 x 7)                            1000    (50 x 20)
      56    ( 7 x 8)                             120     ( 6 x 20)
     266                                         350     (50 x  7)
                                                  42     ( 6 x  7)
                                                1512
                                                   1
```

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## 4.    Vertical layout with compact working (Years 5 and 6)

Smaller numbers    | 38 x 7 |                 Larger numbers    | 56 x 27 |

```
      38                                          56
   x  7                                        x  27
     266                                        1120    (56 x 20)
       5                                        ¹392    (56 x  7)
                                                   4
                                                1512
                                                   1
```

# Division – Written methods of Calculation (A)

*There is a clear progression in written forms of division. The children need first to have learnt at least some of their tables (2x, 5x and 10x) and know that multiplication and division are "inverses" (opposites).*

*They will then be able to use their tables knowledge to work out division facts (e.g. 3 x 4 = 12 so 12 ÷ 4 = 3).*

*They will be familiar with division as sharing (12 shared between 4 people is 3 each) and division as grouping (12 divided into groups of 4 is 3 groups altogether).*

*They also need to be able to understand division as repeated subtraction so 12 ÷ 4 = 12 – 4 – 4 – 4 (take away four 3 times) = 3.*

*Multiplication is repeated addition. Division is the opposite – repeated subtraction. This is essential for understanding the main written methods.*

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## 1.    *Division as sharing (Years 3 and 4):*

20 cakes need to be divided fairly between 5 people.
How many cakes will each person get?

Give each person one cake each. Keep on sharing until there are no cakes left. Count how many cakes each person has.

$$20 \div 5 = 4$$

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## 2.    *Division as Grouping (Years 3 and 4):*

24 eggs are packed in boxes of 6.
How many boxes are needed?

Pack the boxes one by one. When all the eggs have gone, count the number of boxes used.

$$24 \div 6 = 4$$

# Division – Written methods of Calculation (B)

## 3.    *Division as repeated subtraction (Year 4 onwards):*

a)   A £200 prize is to be shared between 6 people.
How much will each person get?

How many lots of £6 make £200?

It is possible to count up from 6, or count back from 200.
Using repeated subtraction, here is the method.

```
    200
 -    6
    194
 -    6
    188
 -    6
    182
 -    6
    176
etc
```

---------------------------------------------

This would clearly take a long time and there would be
many opportunities for mistakes before finding the answer

200 ÷ 6 = 33 remainder 2

```
     14
 -    6
      8
 -    6
      2
```

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b)   To make the calculation quicker and reduce the
chance of mistakes, it is possible to subtract
multiples of 6.  The easiest ones are 10x, 100x or
1000x the divisor (6).

```
    200
 -   60  (10 x 6)
    140
 -   60  (10 x 6)
     80
 -   60  (10 x 6)
     20
 -   18  (3 x 6)
      2
```

So we have (10 + 10 + 10 + 3) x 6
and 2 left over.

thus 200 ÷ 6 = 33 remainder 2

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| **Useful words:** | **divisor** | – The number used to divide another |
|---|---|---|
| | **quotient** | – The answer to a division calculation |

# Division – Written methods of Calculation (B)

## 4. Division as repeated subtraction (continued) (Year 4 onwards):

As skills develop, children can take away larger multiples at one time.  Here is an example:

$8672 \div 7$

```
  8672
- 7000     (1000 x 7)
  1672
- 1400     (200 x 7)
   272
-  210     (30 x 7)
    62
-   56     (8 x 7)
     6
```

so $8672 \div 7 = 1238$ remainder 6

This method can also be used to divide by 2 and 3 digit numbers (Long Division).

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## 5. The very short method (Guzinter) (Years 5 and 6):

After children have mastered division by repeated subtraction, they are allowed to use the "Guzinter" method – familiar to many parents.

It gets its name from the language used: "7 goesinto 62 eight times remainder 6".

This can be a quicker method to use, especially for decimals.  It is a difficult method to understand mathematically, and will not be taught until children are familiar with the repeated subtraction model.

$8672 \div 7$

```
    1 2 3 8 . 8 5 7 r 1
  7 | 8 ¹6 ²7 ⁶2 . ⁶0 ⁴0 ⁵0
```