Spring Common Academy Written Methods For Calculation

Guidance for parents and professionals

This booklet outlines the main strategies we use when teaching our pupils mathematics. These methods have been chosen because they:

- Enable pupils to build on their existing understanding.
- Promote the use of mental strategies.
- link well with functional ('hands on') maths opportunities.

Our main aim of this booklet is to ensure that our pupils are taught mathematics consistently throughout the school. We promote the use of what are commonly known as 'standard' written methods—methods that are efficient and work for any calculations, including those that involve whole numbers or decimals.

The fundamentals of understanding each of the four operations (subtraction, addition, multiplication and division) are taught throughout the whole school. When a child is competent to add or subtract two digit numbers in their head (possibly with the age of a jotting), then they are ready to move onto written methods. The methods exemplified here can be used with any number—pupils start with two digit numbers before moving to three and four digit numbers and decimals. Where there is a number line / grid and a written method alongside, the choice is up to the child— the maths is the same!
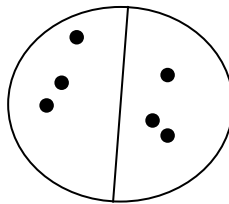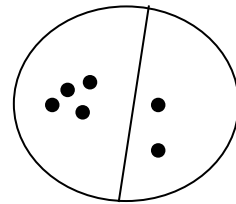
Addition

Stage 1 — Foundations

Pupils are encouraged to develop a mental image of the number system in their heads. This is fundamental to the development of mental mathematics. Pupils are encouraged to develop ways of recording calculations using pictures etc.
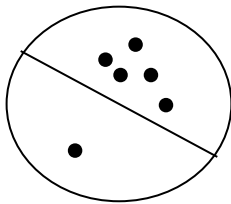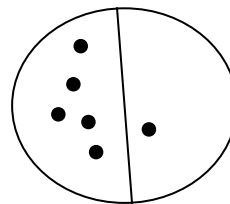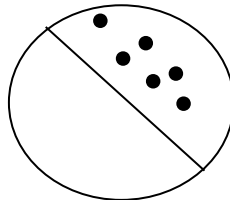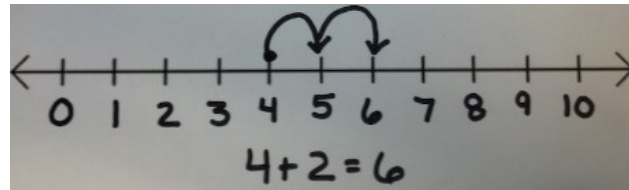
3 and 3

4 and 2

2 + 4
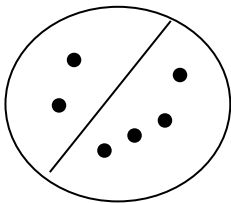
1 and 5

5 and 1
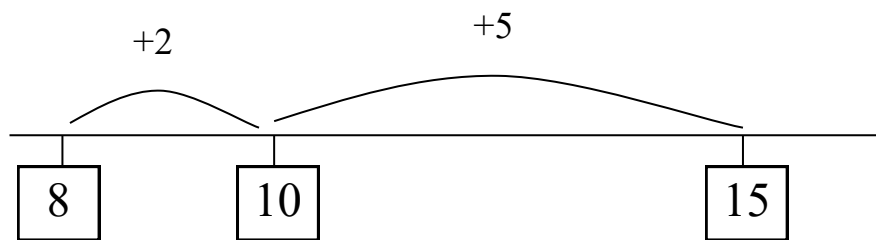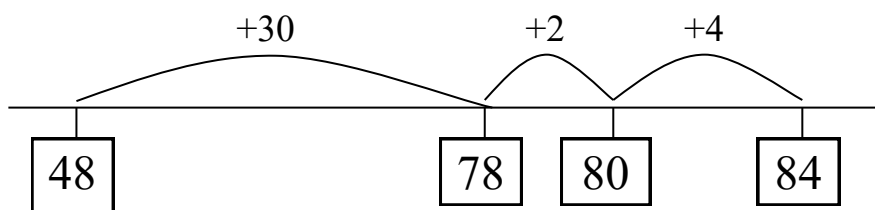
0 and 6

Stage 2— Number Lines

Pupils use a number line to support addition, starting with a numbered number line before progressing to an empty number line.
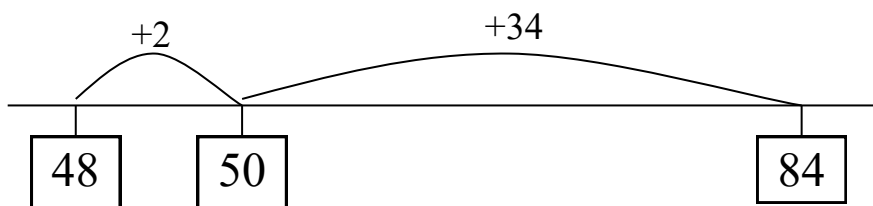

$4 + 2 = 6$
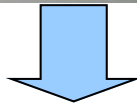
$8 + 7 = 15$

$48 + 36 = 84$

or:

Stage 3— Partitioning

A pupil's ability to partition numbers into hundreds, tens and units is a crucial to development of an ability to work out calculations mentally. Pupils are encouraged to record their calculations using partitioning as it helps them to visualise the method.

For example, pupils add the tens and then the units to form partial sums and then add these partial sums.

Record steps in addition using partitioning:

47 + 26 =

40 + 20 = 60
 7 + 6 = 13

60 + 13 = 73

Stage 5— Expanded Column Method

The next step is to apply knowledge of partitioning in order to organise the number sentence so that it can be solved more easily, separating the hundreds, tens and ones:

The logical way in which this method breaks down and sets out the calculation encourages pupils to think about solving it mentally.

Stage 5— Short Column Method

With this method, recording is reduced further. 'Carry' digits are recorded below the line and are referred to as 'carried hundreds' or 'carried tens'.

$$
\begin{array}{r}
47 \\
+76 \\
\hline
123 \\
\end{array}
\qquad
\begin{array}{r}
258 \\
+\ 87 \\
\hline
345 \\
\end{array}
$$

11   11

Column addition remains efficient when used with larg- er whole num- bers and decimals. Once learned, the method is quick and reliable.
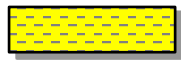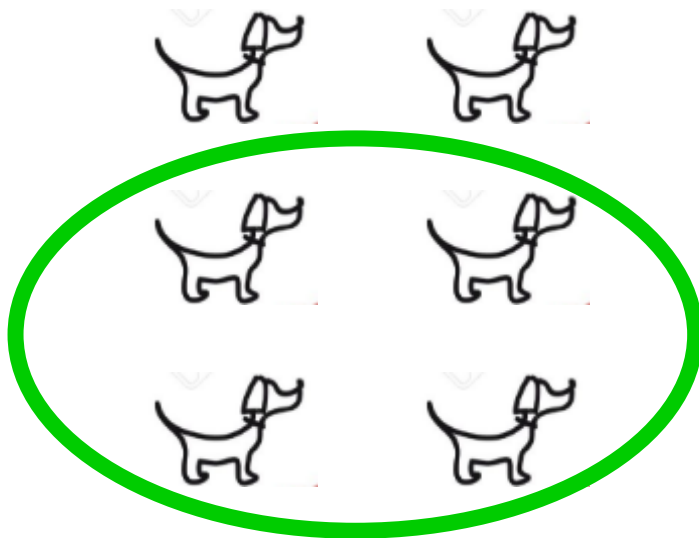
Subtraction

Stage 1—Foundations

Pupils are encouraged to develop a mental picture of the number system in their heads to use for calculations. They develop ways of recording calculations using picture etc.

The man took 6 dogs for a walk. He lost 2 dogs. How many are left?

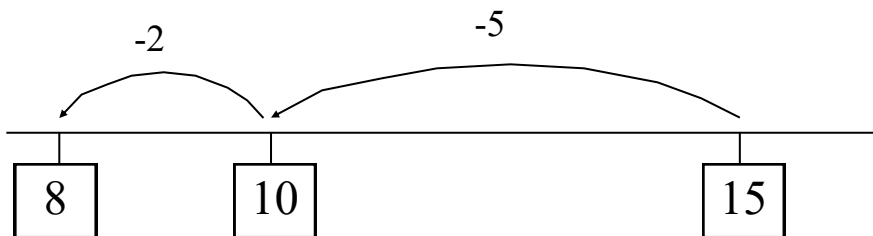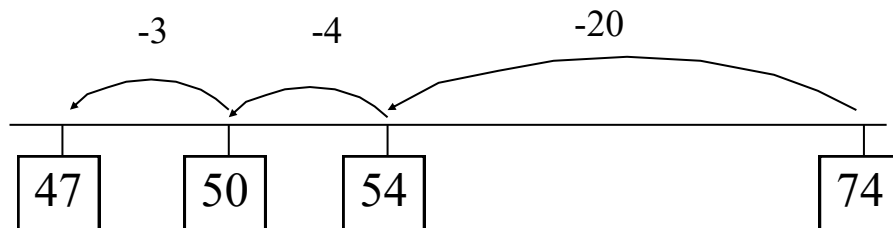## Stage 2– Finding the difference on a blank numberline

Similar to addition, steps in subtraction can also be recorded on a number line. The steps often bridge through a multiple of ten.

$15 - 7 = 8$

-2   -5

8   10   15

$74 - 27 = 47$ worked out by counting back

-3   -4   -20

47   50   54   74

Mental Calculations in Addition and Subtraction

Number bonds to ten are extremely important to the development of a pupil's mental maths ability and pupils should work towards knowing them all off by heart from an early age.

Number bonds to 10

$$0 + 10 = 10$$
$$1 + 9 = 10$$
$$2 + 8 = 10$$
$$3 + 7 = 10$$
$$4 + 6 = 10$$
$$5 + 5 = 10$$
$$6 + 4 = 10$$
$$7 + 3 = 10$$
$$8 + 2 = 10$$
$$9 + 1 = 10$$
$$10 + 0 = 10$$

Pupils are encouraged to practise number bonds by finding the missing number on their fingers.

E.g.

7 + ? = 10

Start at 7 and count on to 10 to find the difference of 3.

Pupils should also learn to find the missing number in a number sentence and 'triangle bonds' are a good way of developing a pupil's understanding of the relationship between numbers in a number sentence.
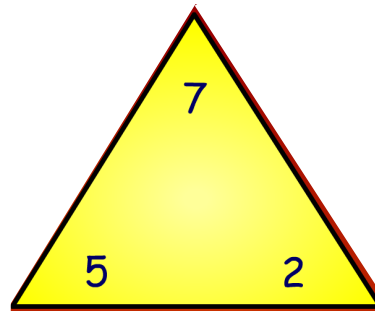
When pupils are presented with the triangle they learn to show all relationships between the three numbers:
5 + 2 = 7
2 + 5 = 7
7—2 = 5
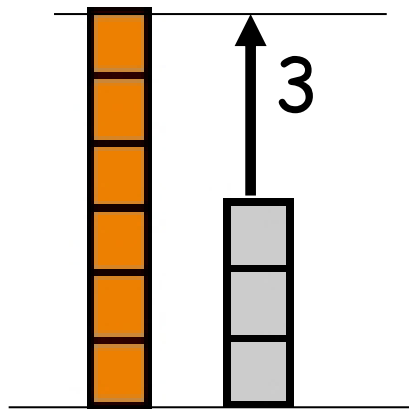7—5 = 2

When learning to subtract mentally, pupils are taught to 'find the difference' between two numbers. This means that instead of counting back they count on, as illustrated below:

6—3 can be thought of as two cube towers of 6 and 3. When next to each other the difference can be found by counting the difference between the smallest tower and the largest.
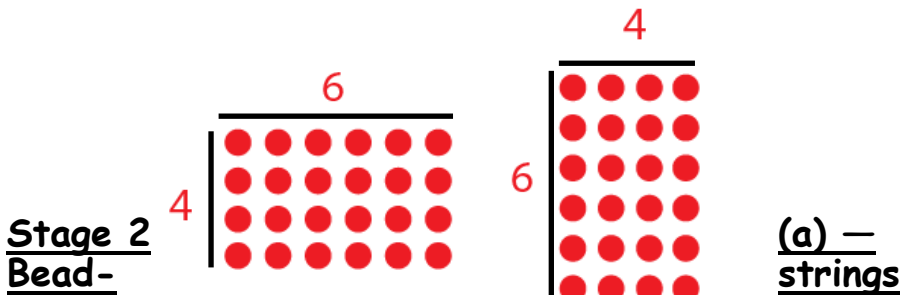
$$6—3 = 3$$

✕ Multiplication

Stage 1 — Arrays

Pupils are encouraged to visualise multiplication through arrays. Arrays encourage the pupils to think about multiplication in terms of adding groups together Repeatedly. For example, 6 groups of 4 or 4 groups of 6.

Stage 2 Bead-

(a) — strings
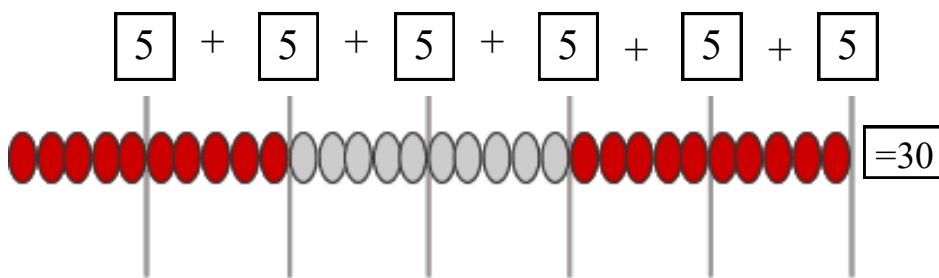
4 × 6 = 24   6 × 4 = 24

The next pupils to confident beadstring to reinforce jumping in equal amounts. For example, 6 x 5 = 30 (6 groups of 5 equals 30).

stage is for become using a

| 5 | + | 5 | + | 5 | + | 5 | + | 5 | + | 5 |

=30

Stage 2(b) - Blank Numberline

Pupils progress to the blank numberline method. This approach is similar to the beadstring method but it is less structured and requires the pupil to visualise the size of each group in their head:

Stage 3 - Grid Method

Five jumps, each jump is two steps.

$5 \times 2 = 10$.
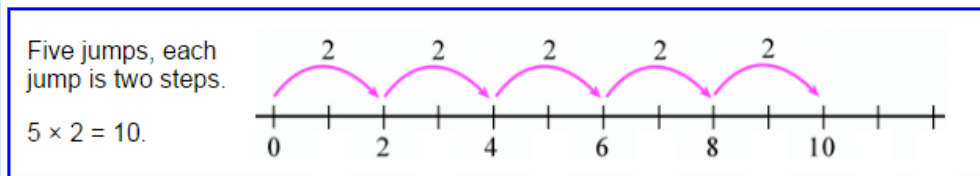
The grid method is for more advanced multiplication and it encourages pupils to break down more complicated multiplication number sentences into manageable problems by making use of their knowledge of tens and units. Below is the solution to 35 x 26, using the grid method: 35 x 26 = 910

20 x 30 = 600
20 x 5 = 100

6 x 30 = 180
6 x 5 = 30

×	30	5
20	600	100
6	180	30

600 + 100 = 700
180 + 30 = 210
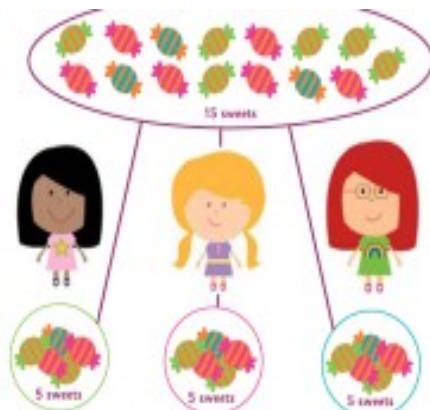
700 + 210 = 910
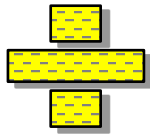
## Stage 1 — Sharing Equally Between Pupils

At this stage division is

referred to as sharing equally. For example a pupil may be asked to physically share 15 sweets equally between 3 children, checking that each pupil has the same number of sweets.

Stage 2 — Sharing Equally Into Groups

At this stage the pupils, division is taught by teaching pupils to share an amount equally into groups.

Here the pupil has been asked to share 12 strawberries equally into four groups to work out how many would be in each group:

$$12 \div 4 = 3$$
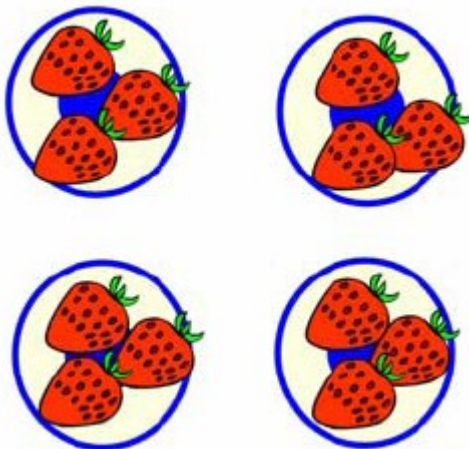
Stage 3(a) — Grouping Using A Beadstring

The next stage is for pupils to use a beadstring to find and amount an divide it into equal groups in order to work out how many beads will be in each equal group:
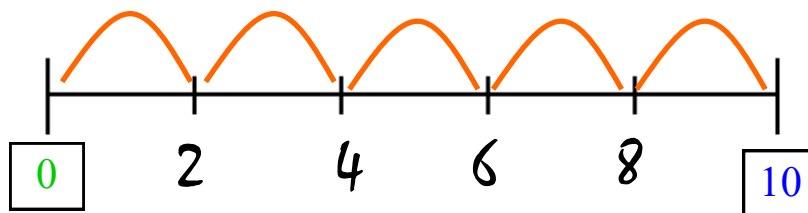
5	5	5	5	5	5

1   2   3   4   5   6
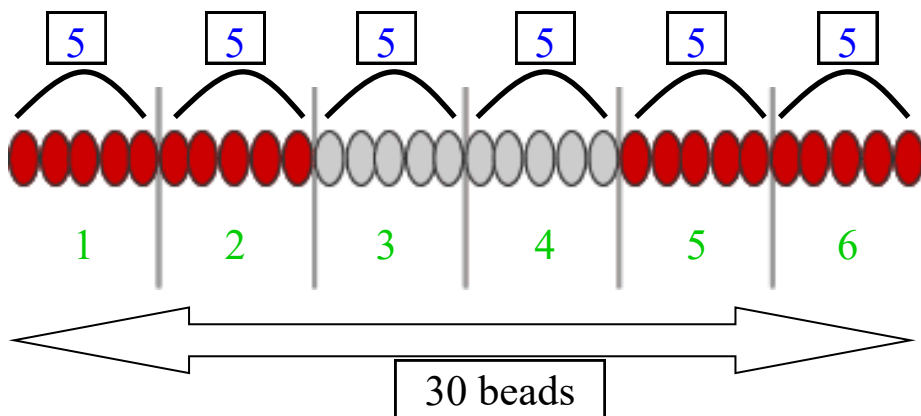
30 beads

30 beads in total divided into 6 equal groups of 5 beads.

$$30 \div 6 = 5$$

Stage 3(b) — Grouping Using A Blank Numberline

In this advanced stage, pupils are expected to mark the largest number on the numberline and then jump from 0 to the largest number to show how many equal groups are needed.

0   2   4   6   8   10

10 is the largest number which divides equally into 5 equal groups of 2.

$$10 \div 2 = 5$$

Mental   **Cal-**

culations in Multiplication & Division

Similarly to addition and subtraction, it is important that pupils learn to work out the relationship between multiplication and division. Triangle bonds can also be used to develop this:

When pupils are presented with the triangle they learn to show all relationships between the three numbers:
2 x 5 = 10
5 x 2 = 10
10 ÷ 5 = 2
10 ÷ 2 = 5

10

2   5