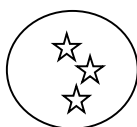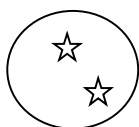# ADDITION

Building foundations for addition:
Combining two sets of objects e.g.
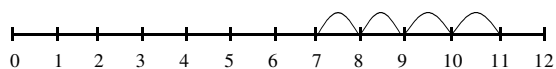
Use of Numicon:

Use of number lines, rulers and hundred squares to count on.

Number lines (numbered)

7 + 4

0   1   2   3   4   5   6   7   8   9   10   11   12

Recording by - drawing jumps on prepared lines

       -     constructing own lines

Bridging

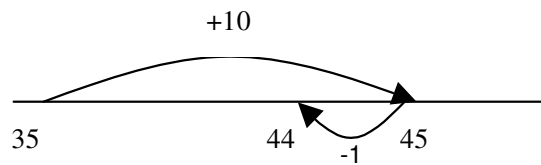24 + 31 = 55

Partition into tens and ones and recombine

12 + 23 = 10 + 2 + 20 + 3
= 30 + 5
= 35

Refine to partitioning the second number only:

23 + 12 = 23 + 10 + 2
         = 33 + 2
         = 35
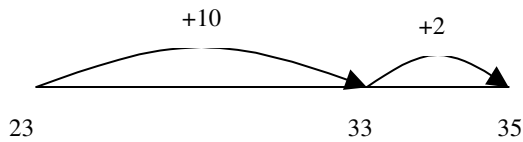
Add 9 or 11 by adding 10 and adjusting by 1
35 + 9 = 44

Add a near multiple of 10 to a two-digit number

Continue as with adding 9 and 11 but with appropriate numbers
 e.g. 35 + 19 is the same as 35 + 20 – 1.

Pencil and paper procedures

47 + 76

40 + 70 = 110	76
7+ 6= 13	+47
Therefore:	13
	110
110	123
+13	
123	

Finally once understood moving on to contracted format:

$$
\begin{array}{r}
76 \\
47 \\
\hline
123 \\
{\scriptstyle 1\ 1}
\end{array}
$$

Progressing to numbers with at least four digits

3587 + 675 = 4262

$$
\begin{array}{r}
3587 \\
+\ \ 675 \\
\hline
4262
\end{array}
$$

Extend to numbers with any number of digits and decimals with 1 and 2 decimal places.
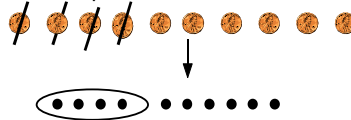124.9 + 117.25 = 242.15

```
   124.90
+  117.25
   242.15
      11
```
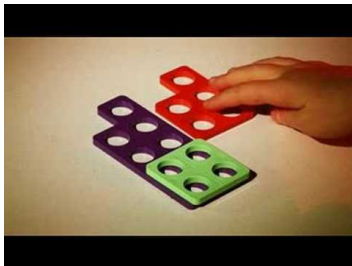
SUBTRACTION

Building the foundations for subtraction using methods as with addition:
Using range of objects and taking away a number of objects from the set.

Pictures / marks
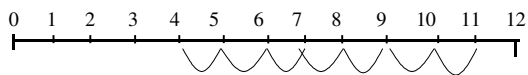Sam spent 4p. What was his change from 10p?
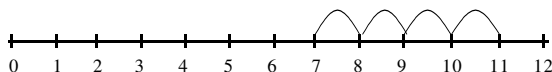
Use of Numicon:

Number lines (numbered)

  11 – 7
(Counting back)

The difference between 7 and 11
(Counting up)

Subtraction is taught as counting back and counting on depending on the numbers.

42-39 - counting on mentally or using number line.

```
  + 1              + 2
  ⌢               ⌢
39    40                42
```
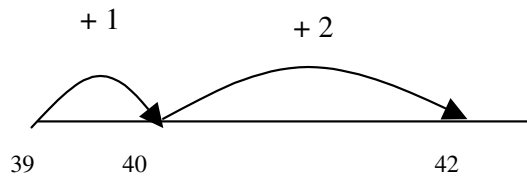
Subtract 9 or 11. Begin to add/subtract 19 or 21

35 − 9 = 26

```
      +1
25   26          35
   -10
```
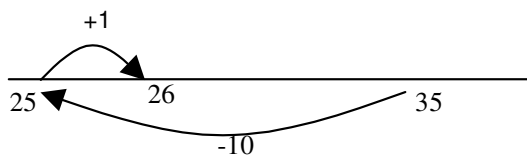
Bridging

27-14=13

20-10=10
7-4=3

<u>**Pencil and paper procedures**</u>

Move onto

```
        34
  -     12
        22
```

Progressing to 3-digit numbers

```
 563
-241
 322
```

Extending to method known as **decomposition**

```
  5 12
  6 2 7
- 1 3 5
  4 9 2
```

MULTIPLICATION

Learning multiplication facts (tables) is essential for much of the later multiplication and division that children learn to do in school.

Children need to understand that multiplication is based on repeating an addition. Division conversely is based on repeated subtraction.

Pictures and symbols

There are 3 sweets in one bag.
How many sweets are there in 5 bags?
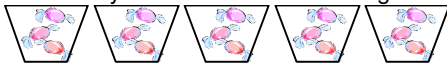
Arrays and repeated addition

● ● ● ●   4 x 2 or 4 + 4
● ● ● ●
2 x 4

or repeated addition

2 + 2 + 2 + 2

0   1   2   3   4   5   6   7   8
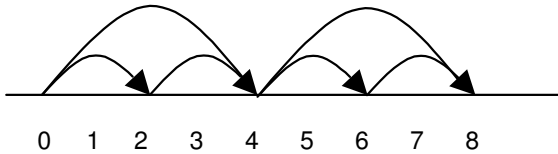
Partition

15 x 2

20 + 10 = 30

Pencil and paper procedures

Column method

```
  2 3 7
x     4
-------
  9 4 8
  1 2
```

Extending to multiplication of 2-digit numbers by a 2-digit number.

Estimate first: 70 x 40=2800

Column Method

```
        72
x       38
       576
      2160
      2736
```

Division

Children have many different ways of interpreting what division means. They often talk about 'sharing', sometimes 'grouping'.

Pictures or Use of objects
12 children get into teams of 4 to play a game. How many teams are there?
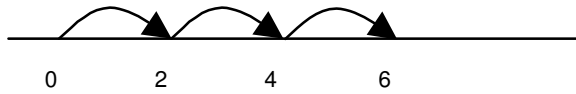
Understand division as sharing and grouping

Sharing – 6 sweets are shared between 2 people. How many do they have each?

6 ÷ 2 can be modelled as:

Grouping – There are 6 sweets. How many people can have 2 each? (How many 2's make 6?)

Remainders

16 ÷ 3 = 5 r1

Sharing - 16 shared between 3, how many left over?

Grouping – How many 3s make 16, how many left over?

e.g.
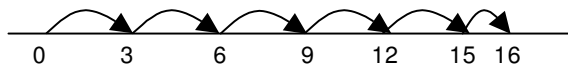
Pencil and paper procedures

Compact short division method

By Year 6 remainders should be written as a fraction of a quotient or decimal.

72 ÷ 5 =14 r2 written as 14 2/5

Or extended to:

$$\begin{array}{r} 14.\,4 \\ 5\overline{)72.\,0} \end{array}$$

Long Division method

Children are taught this when ready (usually year 5 and 6).

Long Division is easiest thought of in 4 stages:

DIVIDE
MULTIPLY
SUBTRACT
BRING DOWN

```
  2191              21            17 r 19
4│8764        216│4536        31│546
  8↓↓↓            432↓            31↓
  07              216            236
   4↓             216            217
   36               0             19
   36
   04
    4
    0
```

Remainders can be expressed as Fractions or decimals by continuing the long division sum.

```
     25.2
5)  126.0
   −10
    26
   −25
    10
   −10
     0
```

National Curriculum 2014:

Year 1:
- Calculating the answers using concrete objects, pictorial representations and arrays with the support of the teacher. At Alexander Hosea we use a range of concrete resources with a particular focus on using Numicon.

Year 2:
- Children should still be using concrete objects and pictorial representations, including those involving numbers, quantities and measures.
- The children will start to use written methods for addition and subtraction.
- They should be able to recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables and use arrays and pictorial representations to solve multiplication and division problems.

Year 3:
- Add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction.
- Children should be able to recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables.
- To write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods.

Year 4:
- Add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate.
- Recall multiplication and division facts for multiplication tables up to 12 × 12.
- Multiply two-digit and three-digit numbers by a one-digit number using formal written layout.

Year 5:
- Add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction).
- Multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers.
- Divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context.

Year 6:
- Multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication
- Divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context
- Divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context

All classes at Alexander Hosea School have practical resources such as: Numicon, objects to count, multilink, counters, number lines, dienes apparatus, number squares. The children are encouraged to use these at first to gain confidence with calculations and progress to formal written methods when they are ready. The aim is that children will have secure skills which they can apply to a range of different problem solving activities.