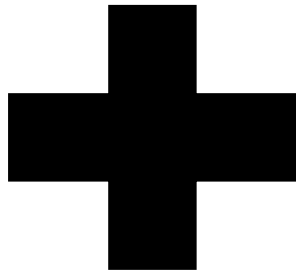# Progression in Calculation

Addition and Subtraction

Introduction

This booklet covers the methods your child is taught with regards to addition and subtraction. We hope you find this useful when supporting your child with Maths at home.

Each section shows the progression of the methods used from Foundation Stage to Year 6. The sections build gradually from introducing addition and subtraction to formal written methods. They are not split into year group or age related expectations as all children progress at different speeds.

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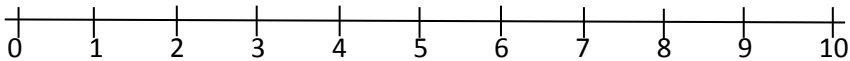
Progression in Addition

Addition up to 10

- practical demonstrations of adding, counting objects and combining sets
- pictorial representations of adding, counting objects and combining sets
- vocabulary of addition and subtraction
- introduction of number lines/100 squares for recording 'jumps'

For example

4 add 2 makes 6

number line

Hundred-square/100 square

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

- encourage mental calculations
- record simple additions in number sentences using + sign. For example 4+2=6

Addition up to 20

- practically using objects, beads, cubes etc.
- use of tens and units apparatus
- using a number line 0-20 to move along starting with the largest number
- using a 100 square, move along starting with the largest number
- mentally adding numbers up to 20 without apparatus
- recording mental additions in a number sentence using + sign

Addition above 20

- using a 100 square and/or number line to 100, add 2 digit and 1 digit numbers
  For example 35+6=41
- then add 2 digit numbers and multiples of 10
  For example 72+20=92

Using a 100 square either

a) start with the highest number and partition the 2nd number into tens and units then recombine

   For example 54+15=69

   5 4 + 1 5 =
   5 4 + 1 0 = 6 4
   6 4 +   5 = 6 9

b) partition both numbers into tens and units, add and recombine

   For example 54+15=69

   5 0 + 1 0 = 6 0
     4 +   5 =   9
     9 + 6 0 = 6 9

- move onto mentally splitting the numbers into tens and units and recombining without any apparatus
- record additions in number sentences. For example 54+15=69

Addition above 20

- when a child no longer needs the visual aid of a 100 square they can move onto using a number line with 10s marked on, then a blank number line to record jumps

For example 78+67=145

- begin to record calculations in preparation for vertical addition

For example 76+27=103

7 6 + 2 0 =   9 6
9 6 +   7 = 1 0 3

For example 85+49=134

  8 5 + 4 0 = 1 2 5
1 2 5 +   9 = 1 3 4

For example 68+24=92

6 8 + 2 0 = 8 8
8 8 +   4 = 9 2

- develop ability to do this mentally without the need for recording the working out

Column Addition

- without crossing the 10s boundary

For example 68+21=89

```
   6 8
 + 2 1
   8 9
```

- move onto adding 3 digit numbers without crossing the 10s boundary
- crossing the 10s boundary

For example 345+237=582

```
   3 4 5
 + 2 3 7
   5 ¹8 2
```

- crossing 10s and 100s boundaries

For example 387+444=831

```
   3 8 7
 + 4 4 4
   8 ¹3 1
```

- moving onto adding 4 and 5 digit numbers as above
- move onto adding more than two numbers

For example 538+465+239=1242

```
     5 3 8
     4 6 5
 +   2 3 9
   1 ¹2 ²4 2
```

- include decimals and different numbers of digits

For example 22.4+17.8=40.2

```
    2 2 . 4
+   1 7 . 8
   ⁱ4ⁱ0 . 2
```

For example 2734+361=3095

```
    2 7 3 4
+     3 6 1
   ⁱ3 0 9 5
```

Progression in addition vocabulary
more
add, addition
sum
total
altogether
one more, two more, ten more…
how many more to make…?
equals sign, plus
increase

Progression in Subtraction (counting back)

Subtraction up to 20
- use of songs and nursery rhymes
- practically using objects, beads, cubes etc.
- using a number line 0-20 to move along starting with the highest number and counting back the correct number of spaces

   For example 19-7=12
   from 19 count back 7 places to reach 12

```
+  +  +  +  +  +  +  +  +  +  +  +  +  +  +  +  +  +  +  +  +
0  1  2  3  4  5  6  7  8  9  10 11 12 13 14 15 16 17 18 19 20
```
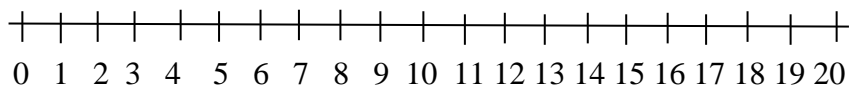
- using a 100 square move along starting with the highest number and counting back the correct number of spaces

   For example 19-7=12
   from 19 count back 7 places to reach 12

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

- move on mentally subtracting numbers without apparatus
- use a 100 square and/or number line to 100 to subtract a 1 digit number from a 2 digit number
   For example 35-6=29
- subtract a multiple of 10 from a 2 digit number
   For example 72-20=52

Subtraction above 20 using a 100 square

- using a 100 square starting with the highest number and count back to the lower number. Count back in tens and then back in units
  For example 45-26=19
  start at 45, back 2 tens to 25, then back 6 units to 19

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

- move on to mentally subtracting the numbers without apparatus

Subtraction above 20 using 0-100 number line

- using a 0-100 number line starting at the highest number and counting back the tens and then the units
  For example 45-26=19
  start at 45 count back 2 tens then 6 units
  begin to record

  4 5 - 2 6 =
  4 5 - 2 0 = 2 5 start at 45 count 2 tens to 25
 2 5 -   6 = 1 9 from 25 count back 6 units to 19

- Move on to mentally subtracting the numbers without apparatus

Progression in Subtraction (counting on)

Subtraction up to 20

- use of songs and nursery rhymes
- practically using objects, beads, cubes etc.
- using a number line 0-20 to move along starting with the lowest number and count up to the higher number

  For example 19-7=12
  from 7 count on 12 places to reach 19

  0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
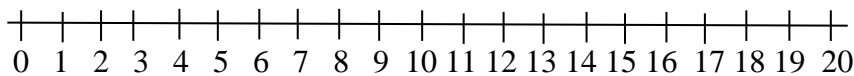
- using a 100 square to move along starting with the lowest number and counting up to the higher number

  For example 19-7=12
  from 7 count on 12 places to reach 19

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
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71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

- use addition knowledge to mentally subtract numbers within 20 without apparatus
- understand that subtraction is the inverse of addition with the use of number stories
  For example three numbers 7, 12 and 19 will give 4 stories

  7+12=19   12+7=19   19-7=12   19-12=7

Subtraction above 20 using 100 square

- using a 100 square start with the lowest number and count up to the higher number. Count on in units to the next multiple of 10, then on in 10s

  For example 100-37
  start at 37 across 3 units to 40 then 6 tens to 100 = 63

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

$$3\ 7 \longrightarrow 4\ 0 = 3$$
$$4\ 0 \rightarrow 1\ 0\ 0 = 6\ 0$$
$$3\ + \quad 6\ 0 = 6\ 3$$

- understand that subtraction is the inverse (opposite) of addition
- moving onto mentally subtracting the numbers

Subtraction above 20 using 0-100 number line

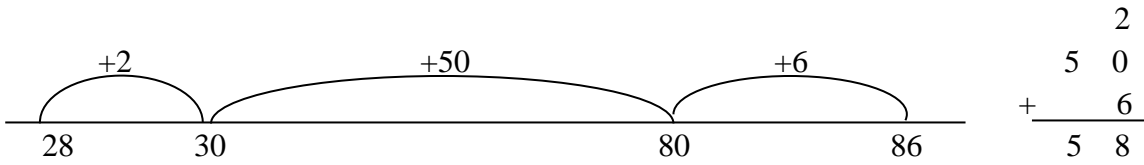- using a 0-100 number line starting at the lowest number and up to the highest number

  For example 100-37=63
  start at 37 count up 3 units to 40, then 6 tens to 100. Add the 3 units and 6 tens together

Subtraction using a blank number line

- when a child no longer needs the visual aid of a 100 square or labelled number line
  they can move onto using a blank number line to record jumps
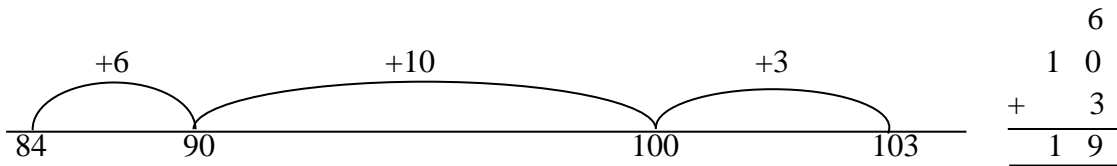 use vertical addition to add if necessary

For example 86-28=58

```
        +2              +50              +6              2
      ⌒           ⌒                 ⌒              5  0
  ___/  \_____/       _____/    \____         +    6
  28      30                    80      86          5  8
```

- crossing the 100s boundary

For example 103-84=19

```
        +6              +10              +3              6
      ⌒           ⌒                 ⌒              1  0
  ___/  \_____/       _____/    \____         +    3
  84      90                   100     103          1  9
```

- extend to 3 digit number line
  begin to model vertical recordings for the jumps alongside the number line

For example 326-178=148
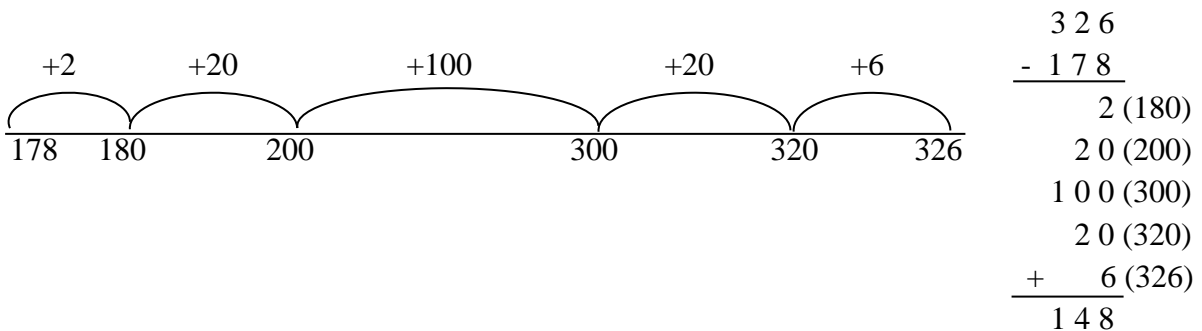
```
     +2     +20      +100       +20      +6          3 2 6
    ⌒     ⌒      ⌒          ⌒     ⌒       - 1 7 8
  _/  \_/    \_/       \__/    \_/   \_        2 (180)
  178  180   200        300   320   326        2 0 (200)
                                              1 0 0 (300)
                                                2 0 (320)
                                              +     6 (326)
                                                1 4 8
```

- Leading to a smaller number of jumps on the number line

  For example 326-178=148

```
                                        3 2 6
     +22              +126           -  1 7 8
  ⌢              ⌢                      2 2 (200)
178          200                326   + 1 2 6 (326)
                                        1 4 8
```
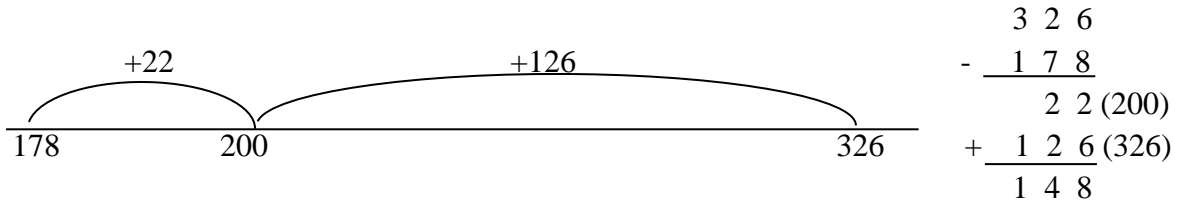
- When children no longer need the number line they can use the vertical recordings for the jumps

Progression in Subtraction (column subtraction)

- without any exchanges

    For example 36-24=12   For example 236-124=112

    ```
      3  6                                          2  3  6
    - 2  4                                        - 1  2  4
      1  2                                          1  1  2
    ```

- with one exchange (decomposition)

    For example 36-27=9

    ```
     ²Ƶ ¹6
    -  2  7
       0  9
    ```

- move on to 3 digit numbers with one exchange
- with two exchanges

    For example 235-167=68

    ```
     ¹2¹²Ƶ ¹5
    -  1  6  7
       0  6  8
    ```

- extend to use of 4 and 5 digit numbers

- include decimals and different numbers of digits

    For example 22.4-17.8=4.6   For example 2734-361=2373

    ```
     ¹2 ¹¹2 . ¹4                                    2 ⁶7 ¹3  4
    - 1  7 . 8                                    -    3  6  1
      0  4 . 6                                      2  3  7  3
    ```