



## PROGRESSION THROUGH CALCULATIONS FOR ADDITION

### KEY MENTAL CALCULATIONS

#### Mental recall of number bonds and their application beyond 10

Particularly important to apply number bonds to 10 to other multiples of 10 ('café numbers'): if  $3+7 = 10$  then  $23 + \square = 30$

$$6 + 4 = 10$$

$$\square + 3 = 10$$

$$25 + 75 = 100$$

$$19 + \square = 20$$

#### Use near doubles

$$6 + 7 = \text{double } 6 + 1 = 13$$

#### Knowing 'the story of 5' and all numbers to 10

$3+2 = 5$ .  $1+4 = 5$  etc. This helps later with bridging through a ten e.g.  $47+7$  ("well it's 3 to 50 and then 4 more")

#### Addition using partitioning and recombining

$$34 + 45 = (30 + 40) + (4 + 5) = 79$$

#### Counting on or back in repeated steps of 1, 10, 100, 1000

$$86 + 57 = 143 \text{ (by counting on in tens and then in ones)}$$

$$460 - 300 = 160 \text{ (by counting back in hundreds)}$$

#### Add the nearest multiple of 10, 100 and 1000 and adjust

$$24 + 19 = 24 + 20 - 1 = 43$$

$$458 + 71 = 458 + 70 + 1 = 529$$

#### Use the relationship between addition and subtraction (fact families)

$$36 + 19 = 55$$

$$19 + 36 = 55$$

$$55 - 19 = 36$$

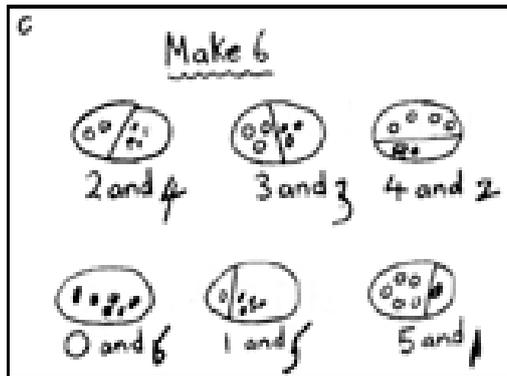
$$55 - 36 = 19$$

*MANY MENTAL CALCULATION STRATEGIES WILL CONTINUE TO BE USED. THEY ARE NOT REPLACED BY WRITTEN METHODS.*



## Progression

Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. This will only happen after repeated exposure to visual images and models i.e. number line, number track, 100 square, cubes, small world toys etc. They develop ways of recording calculations using pictures, etc.



Using dice is a key tool. Through playing games, children progress through the following stages:

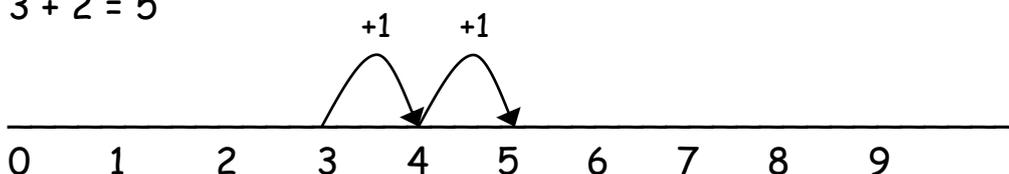


- Developing one to one correspondence as they count the dots
- Counting dice separately ("1..1,2,3,4 - 4")
- Counting all the dots ("1 2 3 4 5 - 5!")
- Counting on from the larger number ("4 - 5!")
- Subitising - this means 'to perceive the number of groups at a glance' ("5!") This is the stage we want ideally by end of Reception.

Dice with uncommon arrays, 1-9 dice and dice with numbers can be used as part of progression

Children use numberlines, number tracks and other practical resources to support calculation and teachers *demonstrate* the use of the numberline.

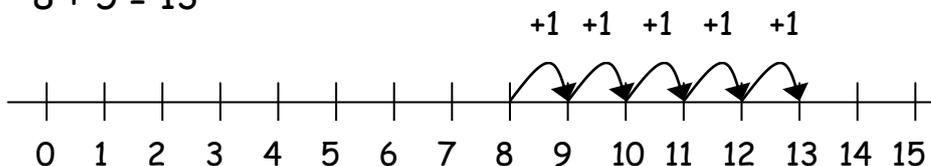
$$3 + 2 = 5$$



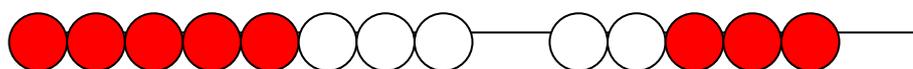


Children then begin to use numbered lines to support their own calculations using a numbered line to count on in ones.

$$8 + 5 = 13$$



Bead strings or bead bars can be used to illustrate addition including bridging through ten by counting on 2 then counting on 3.



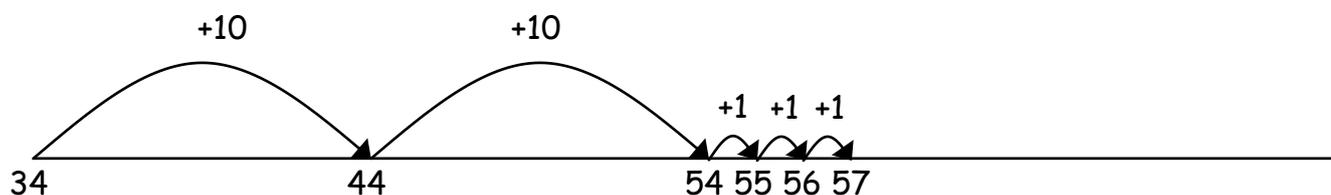
✓ Use of the 100 square for adding in 10s (spider counting) and 1s

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

Children will begin to use 'empty number lines' themselves starting with the larger number and counting on.

✓ First counting on in tens and ones.

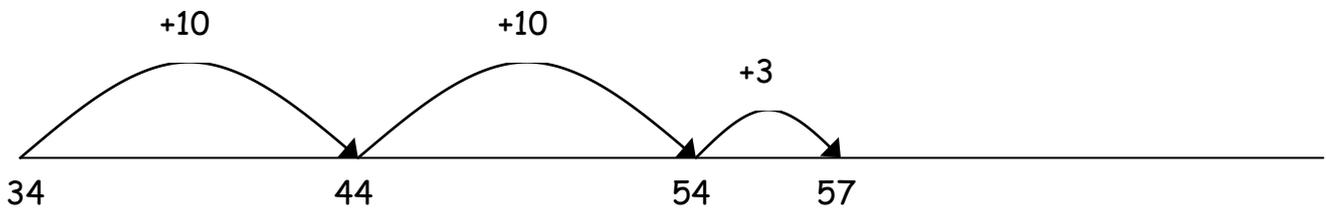
$$34 + 23 = 57$$





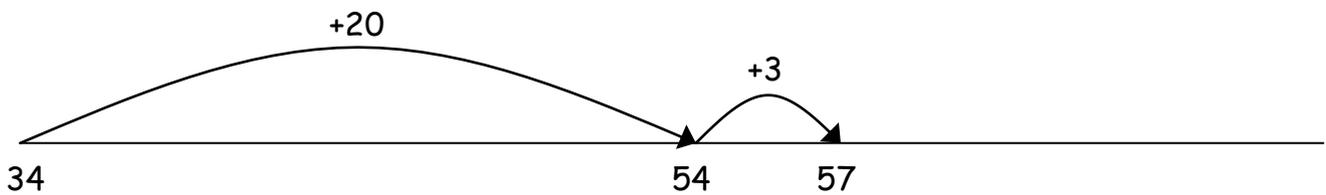
- ✓ Then helping children to become more efficient by adding the units in one jump (by using the known fact  $4 + 3 = 7$ ).

$$34 + 23 = 57$$



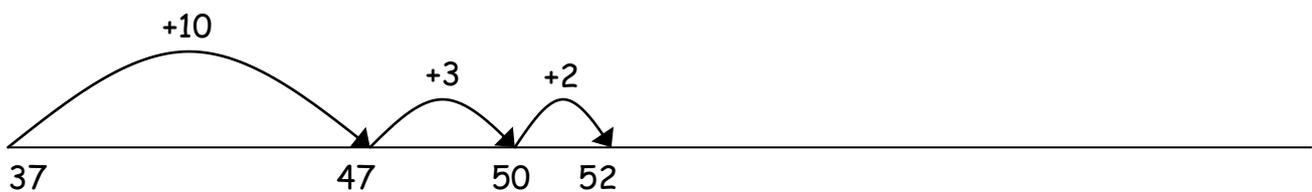
- ✓ Followed by adding the tens in one jump and the units in one jump.

$$34 + 23 = 57$$



- ✓ Bridging through ten can help children become more efficient.

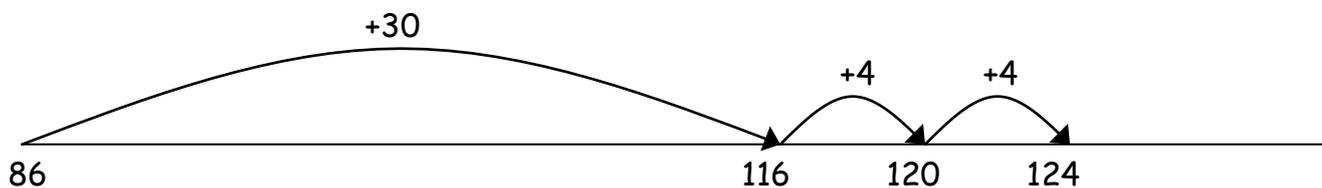
$$37 + 15 = 52$$



Children will continue to use empty number lines and hundred squares with increasingly large numbers, including compensation where appropriate.

- ✓ Count on from the largest number irrespective of the order of the calculation.

$$38 + 86 = 124$$





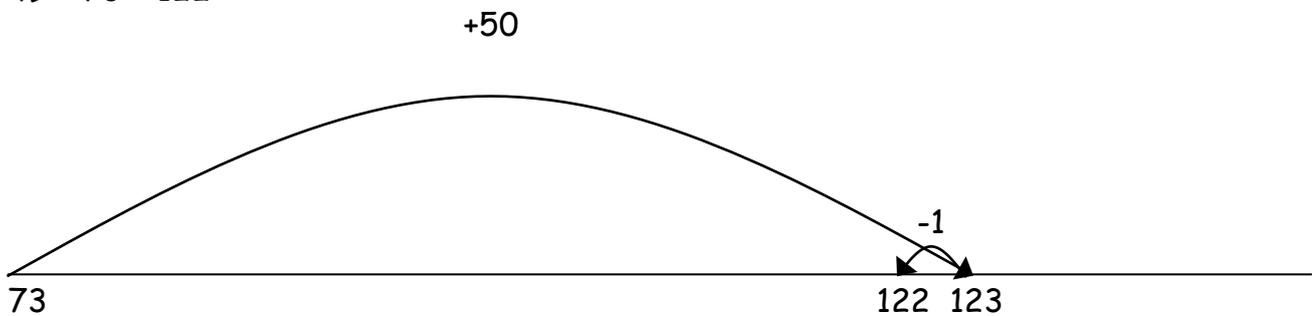
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

56 + 32 = 88

On the hundred square, modelling the tens first (spider counting) then the units (remember the 200 grid we have! Numbers don't stop at 100)

✓ Compensation

49 + 73 = 122



Children will begin to use informal pencil and paper methods to support, record and explain partial mental methods building on existing mental strategies and understanding of place value. Initially no 'carrying' (i.e. units totalling more than 10)

$$55 + 31$$

$$50 + 30 = 80 \quad 5 + 1 = 6$$

$$80 + 6 = 86$$

$$67 + 24$$

$$60 + 20 = 80 \quad 7 + 4 = 11$$

$$80 + 11 = 91$$



Adding most significant digits first (do not dwell on this stage!):

$$\begin{array}{r}
 67 \\
 + 24 \\
 \hline
 80 \text{ (60 + 20)} \\
 \underline{11} \text{ (7 + 4)} \\
 \hline
 91
 \end{array}$$

$$\begin{array}{r}
 267 \\
 + 85 \\
 \hline
 200 \\
 140 \text{ (60 + 80)} \\
 \underline{12} \text{ (7 + 5)} \\
 \hline
 352
 \end{array}$$

Adding the least significant digits in preparation for 'carrying' explaining that the convention is starting with the units.

$$\begin{array}{r}
 67 \\
 + 24 \\
 \hline
 11 \text{ (7 + 4)} \\
 \underline{80} \text{ (60 + 20)} \\
 \hline
 91
 \end{array}$$

$$\begin{array}{r}
 267 \\
 + 85 \\
 \hline
 12 \text{ (7 + 5)} \\
 140 \text{ (60 + 80)} \\
 \underline{200} \\
 \hline
 352
 \end{array}$$

From this, children will begin to carry below the line ('column addition'). Using Dienes apparatus and place value counters helps to show what is happening. Writing 100 10 1 as column headers is important too.

$$\begin{array}{r}
 625 \\
 + 48 \\
 \hline
 673 \\
 \hline
 1
 \end{array}$$

$$\begin{array}{r}
 783 \\
 + 42 \\
 \hline
 825 \\
 \hline
 1
 \end{array}$$

$$\begin{array}{r}
 367 \\
 + 85 \\
 \hline
 452 \\
 \hline
 11
 \end{array}$$

*Using similar methods, children will progress to:*

- ✓ *learn to cope when 2 or more columns have carrying;*
- ✓ *understand how to 'carry' hundreds when there are no thousands already in the calculation;*
- ✓ *be able to align columns correctly when adding 2 or more numbers with different numbers of digits;*



- ✓ *begin to add two or more three-digit sums of money, with or without adjustment from the pence to the pounds;*
- ✓ *know that the decimal points should line up under each other, particularly when adding or subtracting mixed amounts, e.g. £3.59 + 78p.*
- ✓ *add several numbers with different numbers of digits;*
- ✓ *begin to add two or more decimal fractions with up to four digits and either one or two decimal places;*
- ✓ *know that decimal points should line up under each other, particularly when adding or subtracting mixed amounts, e.g. 401.2 + 26.85 + 0.71. The decimal point never move; we call it 'lazy'.*

+ - + - + - + - + - + - +

**By the end of Year 6, children will have a range of calculation methods, mental and written. Selection will depend upon the numbers involved and the method the child feels most comfortable with.**

**Children should not be made to go onto the next stage if:**

- 1) they are not ready.
- 2) they are not confident.

**Remember, keeping the place value explicit helps with understand. The formal compact method has implicit place value...**

**Children should be encouraged to approximate their answers before calculating. Children should be encouraged to check their answers after calculation using an appropriate strategy.**

**Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.**