PROGRESSION THROUGH CALCULATIONS FOR SUBTRACTION

MENTAL CALCULATIONS

Mental recall of addition and subtraction facts

10 – 6 = 4 17 - ☐ = 11
20 - 17 = 3 10 - ☐ = 2

Knowing 'how far to the next multiple of 10' (café number)

Find a small difference by counting up

82 – 79 = 3

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

86 - 52 = 34 (by counting back in tens and then in ones)
460 - 300 = 160 (by counting back in hundreds)

Subtract the nearest multiple of 10, 100 and 1000 and adjust

24 - 19 = 24 - 20 + 1 = 5
458 - 71 = 458 - 70 - 1 = 387

Use the relationship between addition and subtraction (fact families)

36 + 19 = 55 19 + 36 = 55
55 – 19 = 36 55 – 36 = 19

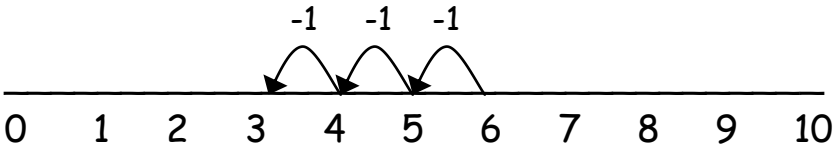
MANY MENTAL CALCULATION STRATEGIES WILL CONTINUE TO BE USED. THEY ARE NOT REPLACED BY WRITTEN METHODS.

Progression

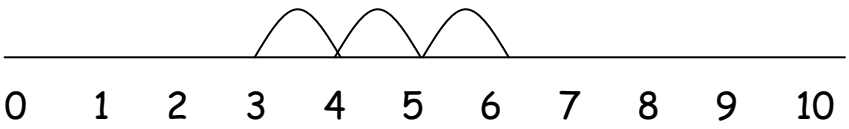
Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They develop ways of recording calculations using pictures etc.

They use numberlines and practical resources to support calculation. Teachers *demonstrate* the use of the numberline.

6 – 3 = 3

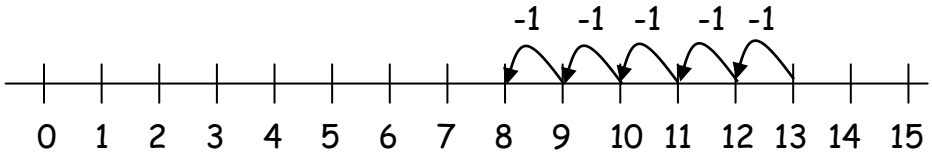


The numberline should also be used to show that 6 - 3 means the '**difference between** 6 and 3' or 'the difference between 3 and 6' and how many jumps they are apart.



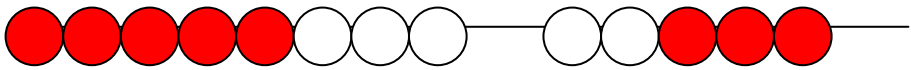
Children then begin to use numbered lines to support their own calculations - using a numbered line to count back in ones.

13 – 5 = 8



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

13 – 5 = 8



Use 100 square to see the patterns in counting backwards in 10s 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

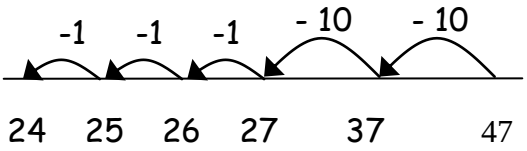
55 – 30 = 25

Children will begin to use empty number lines to support calculations.

Counting back

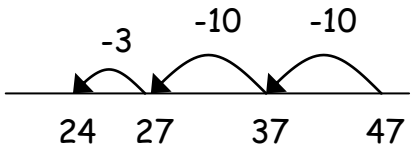
✓ First counting back in tens and ones.

47 – 23 = 24



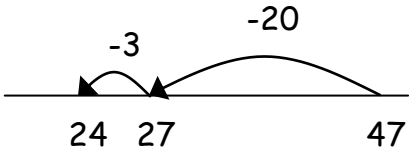
✓ Then helping children to become more efficient by subtracting the units in one jump (by using the known fact 7 – 3 = 4).

47 – 23 = 24



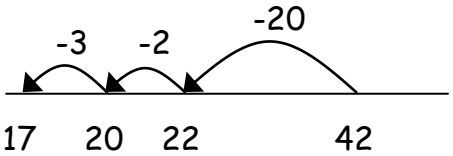
✓ Subtracting the tens in one jump and the units in one jump.

47 – 23 = 24



✓ Bridging through ten can help children become more efficient.

42 – 25 = 17



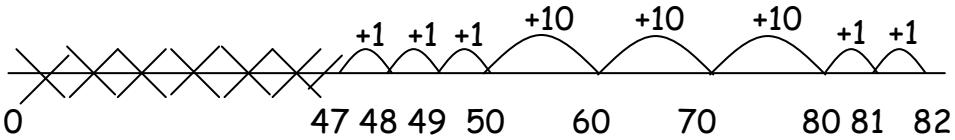
Counting on (hill sums and bald headed man sums)

This method more clearly demonstrates subtraction as 'the difference between'
If the numbers involved in the calculation are close together or near to multiples of 10, 100 etc, it can be more efficient to count on in this way even in Year 6 (e.g. 1001-898) .

Count up from 47 to 82 in jumps of 10 and jumps of 1.

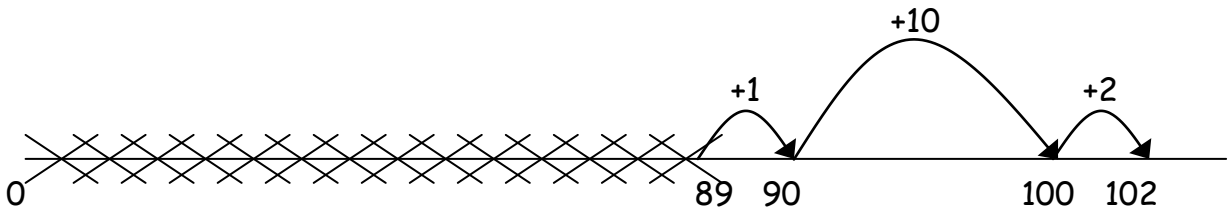
The number line should still show 0 so children can cross out the section from 0 to the smallest number. They then associate this method with 'taking away' as well as counting on.

82 - 47



Help children to become more efficient with counting on by:

102 – 89 = 13



- ✓ Counting on the units in one jump **("how far to the next café?")** ;
- ✓ Counting the tens in one jump and the units in one jump;
- ✓ Bridging through ten.
- ✓ Becoming more adventurous in the size of jumps e.g. 423 – 196 jumping 4 (from 196 to 200) then 223 (200 to 423) based on clear grasp of place value

Children will continue to use empty number lines with increasingly large numbers.

Children will begin to use informal pencil and paper methods to support, record and explain partial mental methods building on existing mental strategies.

Partitioning and decomposition

This process should be demonstrated using place value cards to show the partitioning and base 10 materials (Dienes) to show the decomposition of the number. Place value counters are also a key resource.

NOTE When solving the calculation 89 – 57, children should know that 57 **does not exist as an amount:** it is what you are subtracting from the other number. Therefore, when using base 10 materials, children would need to count out only the 89.

89	=	80	+	9		
- 57		50	+	7		
		30	+	2	=	32

Initially, the children will be taught using examples that do not need exchange.

From this the children will begin to exchange. Labelling the columns 100 10 1 is important initially.

$$\begin{array}{r} 71 \\ -\ 46 \\ \hline \end{array}$$

Step 1

$$\begin{array}{rcl} 70 & + & 1 \\ -\ 40 & + & 6 \\ \hline \end{array}$$

Step 2

$$\begin{array}{rcl} 60 & + & 11 \\ -\ 40 & + & 6 \\ \hline 20 & + & 5 \ = \ 25 \end{array}$$

The calculation should be read as e.g. "1 take away 6. <u>You can't do it!</u> So we have to…"

This would be modelled with the actual Dienes/place value counters and recorded by the children as

$$\begin{array}{rcl} \overset{60}{\cancel{70}} & + & {}^{1}1 \\ -\ 40 & + & 6 \\ \hline 20 & + & 5 \ = \ 25 \end{array}$$

Children should know that units line up under units, tens under tens, and so on.
As teacher, act as the banker exchanging the one ten for ten ones etc.

Stick to two digits to begin with and always model the same answer reached through empty number line sums

Where the numbers are involved in the calculation are close together or near to multiples of 10, 100 etc - 201-196 for example - this should be highlighted and counting on using a number line should be used.

Partitioning and decomposition extended

Step 1

$$\begin{array}{rcrcrcr} 754 & = & 700 & + & 50 & + & 4 \\ -\ 286 & & -\ 200 & + & 80 & + & 6 \\ \hline \end{array}$$

Step 2

$$\begin{array}{rcrcr} 700 & + & 40 & + & 14 \\ -\ 200 & + & 80 & + & 6 \\ \hline \end{array}$$

(adjust from 10 to 1)

Step 3

$$\begin{array}{rcrcrcr} 600 & + & 140 & + & 14 & & \\ -\ 200 & + & 80 & + & 6 & & \\ \hline 400 & + & 60 & + & 8 & = & 468 \end{array}$$

(adjust from 100 to 10)

This would be modelled by you and recorded by the children first in its expanded form

$$\begin{array}{rcccccc} & & & 40 & & & \\ & 700 & + & \cancel{50} & + & {}^{1}4 & \\ - & 200 & + & 80 & + & 6 & \\ \hline & & & & & 8 & \end{array}$$

$$\begin{array}{rcccccccc} & 600 & & 140 & & & & & \\ & \cancel{700} & + & \cancel{50} & + & {}^{1}4 & & & \\ - & 200 & + & 80 & + & 6 & & & \\ \hline & 400 & + & 60 & + & 8 & = & 468 \end{array}$$

Then as standard decomposition

$$\begin{array}{r} 614\ 1 \\ \cancel{7}\cancel{5}4 \\ -\ 286 \\ \hline 468 \end{array}$$

Children will then progress through decomposition by:

- ✓ *Being able to do calculations where there are two columns that need exchanging*
- ✓ *Being able to deal with zeros (if it is not more efficient to do empty number line)*
- ✓ *be able to subtract numbers with different numbers of digits;*
- ✓ *using this method, children should also begin to find the difference between two three-digit sums of money, with or without 'adjustment' from the pence to the pounds;*
- ✓ *know that decimal points should line up under each other.*
- ✓ *be able to subtract numbers with different numbers of digits;*
- ✓ *begin to find the difference between two decimal fractions with up to three digits and the same number of decimal places;*
- ✓ *know that decimal points should line up under each other.*

For example:

$$\begin{array}{rcccccc} £8.95 & = & 8 & + & 0.9 & + & 0.05 \\ -£4.38 & & -\ 4 & + & 0.3 & + & 0.08 \\ \hline & = & 8 & + & 0.8 & + & 0.15 \\ & & -\ 4 & + & 0.3 & + & 0.08 \\ \hline & & 4 & + & 0.5 & + & 0.07 \end{array}$$

(adjust from 10 to 1)

= £4.57

leading to

$$\begin{array}{r} 1 \\ 8.85 \\ -\ 4.38 \\ \hline \end{array}$$

Alternatively, children can set the amounts to whole numbers, i.e. 895 – 438 and convert to pounds after the calculation.

NB If your children have reached this concise stage they will then continue this method through into years 5 and 6. They will not go back to using the expanded methods.

Once the children are totally secure it is fun to show two other methods of subtraction, both efficient

A 'sandwich sum' version of the empty number line where steps up the number line from the bottom number to the top are recorded:

```
   71
 - 46
    4 (46-50)
   20 (50-70)  +
    1 (70-71)
   25
```

The negative number method ("you can take 6 away from 1 - it's minus 5")

```
   71
 - 46
   -5  (1-6)
   30  (70-40)
   25  (30-5)

754
286
  -2   (4-6)
 -30   (50-80)
500   (700-200)
468
```

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

By the end of year 6, children will have a range of calculation methods, mental and written. Selection will depend upon the numbers involved.

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.