

## Mental Calculation Strategies for Subtraction

### Counting forwards and backwards

Many of the mental strategies that children use require them to be able to count forwards and backwards efficiently. Children will begin counting back in ones from an early age and this will be extended to counting back in twos, tens, hundreds and so on to ensure children can use the most efficient methods to help them solve calculations.

E.g.

7 - 3	count back in ones from 7	18 - 4	count back in twos from 18
90 - 40	count back in tens from 90 or count on in tens from 40	960 - 500	count back in hundreds from 960 or count on in hundreds and tens from 500

### Partitioning

It is important for children to know that numbers can be partitioned into , for example, hundreds, tens and ones, so that  $326 = 300 + 20 + 6$ . Once children have the ability to partition numbers they can use this to support them with their calculations. Both numbers can be partitioned in this way, although for subtraction it may be easier to partition just the number that is being subtracted.

E.g.

#### Partitioning both numbers

$$\begin{aligned} 68 - 32 & \quad 60 + 8 - 30 - 2 \\ & \quad 60 - 30 = 30 \\ & \quad 8 - 2 = 6 \\ & \quad 30 + 6 = 36 \end{aligned}$$

#### Partitioning the number which is to be subtracted

$$\begin{aligned} 68 - 32 & \quad 68 - 30 - 2 \\ & \quad 68 - 30 = 38 \\ & \quad 38 - 2 = 36 \end{aligned}$$

$$\begin{aligned} 276 - 153 & \quad 200 - 100 = 100 \\ & \quad 70 - 50 = 20 \\ & \quad 6 - 3 = 3 \\ & \quad 100 + 20 + 3 = 123 \end{aligned}$$

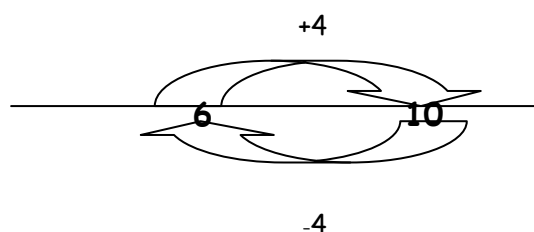
$$\begin{aligned} 276 - 153 & \quad 276 - 100 - 50 - 3 \\ & \quad 276 - 100 = 176 \\ & \quad 176 - 50 = 126 \\ & \quad 126 - 3 = 123 \end{aligned}$$

### Using addition facts to support with subtraction calculations.

Children are taught to use their knowledge of inverse facts to support them in using the number line to solve subtraction problems.

E.g. If  $6 + 4 = 10$  then  $10 - 4 = 6$

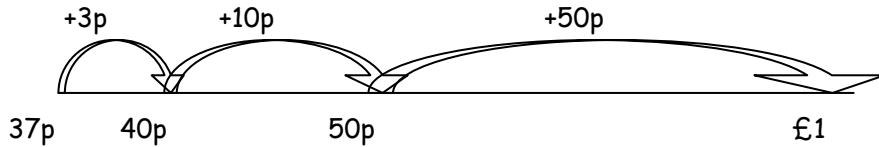
This can be shown on a number line to provide children with an image to enhance their understanding. Children are then able to understand that they can use a counting on strategy to support them with subtractions.



## Bridging

If children have an awareness of how to get to the next multiple of ten this can support them in counting on in larger numbers rather than in steps of 1. The use of an empty number line is used in school to model this concept to the children. (Bear in mind that the arrows/jumps do not need to be to scale)

In the case of subtraction bridging through the next multiple of 10 is a very useful method. For example when finding change from £1 for a purchase of 37p we could count on to find the change needed.

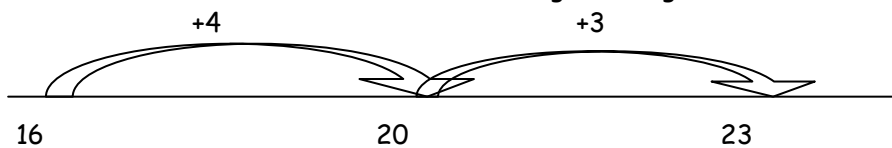


$$50p + 10p + 3p = 63p$$

Therefore 63p change would be needed.

The empty number line can provide an image for this method when the subtraction does not involve money.

For example the calculation  $23 - 16$  can be worked out using counting on.

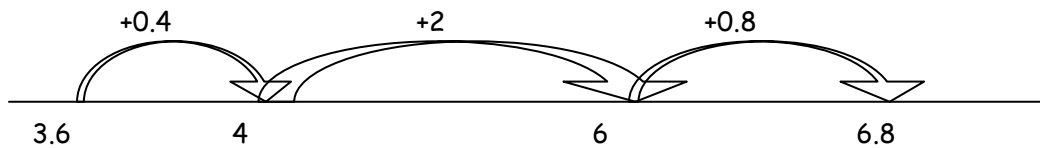


$$4 + 3 = 7$$

Therefore  $23 - 16 = 7$

A similar method can be applied to the subtraction of decimals, but here, instead of building up to a multiple of 10, numbers are built up to the next whole number.

E.g.  $6.8 - 3.6$



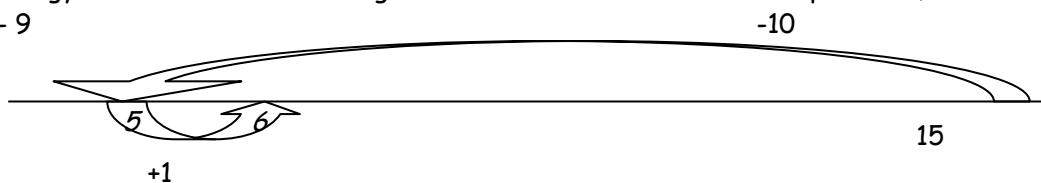
$$2 + 0.8 + 0.4 = 3.2$$

Therefore  $6.8 - 3.6 = 3.2$

## Rounding and Compensating

This strategy is useful for subtracting numbers that are close to a multiple of 10, i.e. end in 1, 2, 8 or 9.

E.g.  $15 - 9$

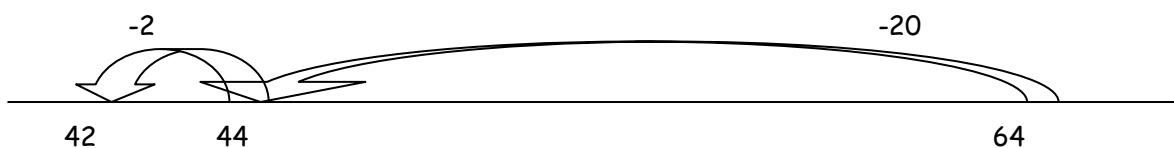


$15 - 10 = 5$  By taking away 10 we have taken away too many so we have to add one back on.

$$5 + 1 = 6$$

Therefore  $15 - 9 = 6$

$64 - 22$



$64 - 20 = 44$  By taking away 20 we haven't taken away enough so we need to take away two more

$$44 - 2 = 42$$

Therefore  $64 - 22 = 42$

## Progression in written methods of Subtraction

Below is the progression through the expanded written methods to the compact written method. It is important to emphasise that children should not be rushed through these stages. They should gain a thorough understanding of each method before they move onto the next stage. Children will work horizontally before moving onto vertical methods. Class teachers will indicate on any subtraction homework which method your child is currently using with the following headings.

### Partitioning - no exchange

E.g.  $87 - 35$

$$\begin{array}{l} 80 \text{ and } 7 \\ - 30 \text{ and } 5 \\ \hline 50 \text{ and } 2 \end{array} \quad \text{Recombine} = 52$$

### Compact written method - no exchange

$$\begin{array}{r} 87 \\ - 35 \\ \hline 52 \end{array}$$

Here children rely on their knowledge of place value to partition both numbers involved in the calculation. They will then subtract 30 from 50, then 5 from 7. This leaves the children with 50 and 2 which they then recombine to give the answer, 52. Once the children understand the partitioning method they can use the compact method to carry out these calculations.

E.g.  $563 - 248$

In this example we cannot take 8 away from 3, therefore we need to exchange a ten for ten units.

By using an expanded method children the children are able to see the exchange clearly and develop a thorough understanding of the processes involved. When this understanding is secure we can then move children onto the compact written method, which is the most effective when carried out effectively.

### Partitioning using exchange

$$\begin{array}{l} 500 \text{ and } 60 \text{ and } 3 \\ - 200 \text{ and } 40 \text{ and } 8 \end{array}$$

Exchange 60 into 50 and 10

$$\begin{array}{l} 500 \text{ and } 50 \text{ and } 13 \\ 200 \text{ and } 40 \text{ and } 8 \\ \hline 300 \text{ and } 10 \text{ and } 5 \end{array} \quad \text{Recombine} = 315$$

### Compact written method - using exchange

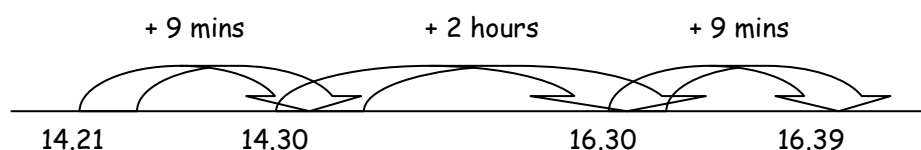
$$\begin{array}{r} 563 \\ - 248 \\ \hline 315 \end{array}$$

Exchange 60 into 50 and 10

$$\begin{array}{r} \phantom{5} 1 \\ 563 \\ - 248 \\ \hline 315 \end{array}$$

The compact written method is generally the most efficient method for children to use, however, there are times when children will choose to use the number line when they feel it is appropriate. For example if we were using the compact method to calculate  $\pounds 20 - 13.48$  we would need to complete a great deal of exchange. Using the number line in this case would be quicker and more accurate as there is less chance for children to make a mistake. This is also true when calculating the difference between two times.

E.g. A train leaves a station at 14.21. It arrives at its destination at 16.39. How long was the journey?



Therefore  $\rightarrow 2 \text{ hours} + 9 \text{ mins} + 9 \text{ mins} \rightarrow$  The journey took 2 hours and 18 minutes.

The children will be encouraged to choose the method that they feel is appropriate depending on the calculation. If your child chooses a different method to the one you would use, discuss this together and compare both of your ideas.