

Recording Calculation methods

Addition

Recording practical activities

e.g. I have 3 sweets, then I get one more

() () () ()

The child draws the sweets. They may draw 3 sweets and then another. They may just draw 4 to start with.

They won't draw 3, then 1, then 4, nor should they be expected to at this stage.

This means that any recording of the format $3+1=4$ is very unhelpful.

When pupils are ready to record numerals (possibly at the end of the summer term in Year R, but probably in Year 1) they may begin to record the above example as:

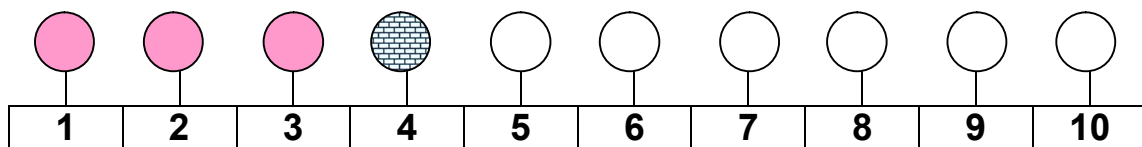
3 1

or just as

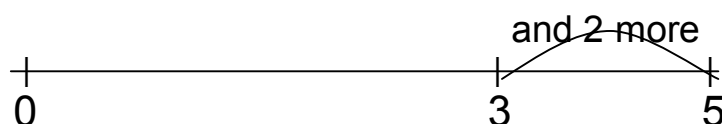
4

but not yet as $3+1$, and certainly not as $3+1=4$.

As well as using objects, pupils will begin to use number tracks and then number lines. For calculations it is useful to have 'lollipop' number tracks, where counters can be placed in the circles without covering over the numerals.



Pupils will use numbered number lines to record jumps, for example for $3+2$, before recording on blank number lines.



Before pupils move to recording $3+1$ they will need lots of experience of practical addition, and an ability to respond to mathematical vocabulary practically. For instance, if you ask a child to show you 5 and 2 more, or 3 plus 1, or 1 add 4, they can use the teddies, counters or number tracks to do it. They will also be developing their use of mathematical vocabulary to explain what they have done.

From this it will be possible to develop an understanding of the + sign, which will enable pupils to begin to record in the form $5+2$.

Pupils then need to understand the concept of equality before using the = sign. This means they can see an example such as $7=6+1$, or $5=5$, as well as the more common arrangement $3+1=4$, and know that it makes sense.

Recording number sentences

Pupils will still work practically with equipment and real objects, but now can record their explanation of what they have done as a conventional number sentence:

$$3+1=4 \text{ or } 4=3+1$$

However, pupils will still record with drawings and number lines **on a frequent basis**, and whenever they are learning new concepts or starting to use a wider range of numbers they will need to return to using these easily understood and explained methods of recording.

Mental methods

Pupils need to develop their use of jottings to support mental calculation. These jottings may be as drawings, number lines or number sentences.

For instance partitioning may be recorded in numbers as:

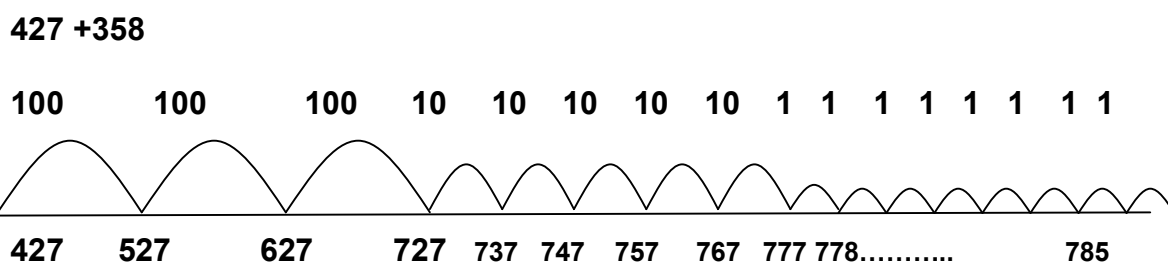
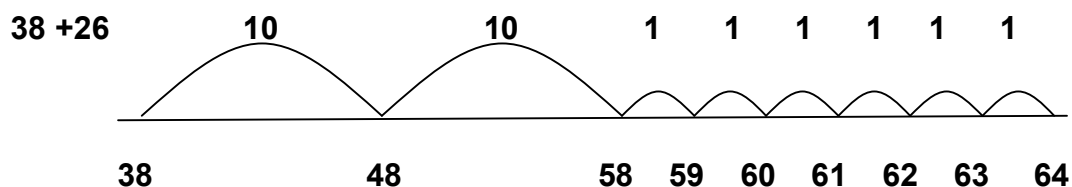
$$\begin{aligned} 36 + 45 &= 30 + 40 + 6 + 5 \\ &= 70 + 11 \\ &= 81 \end{aligned}$$

or

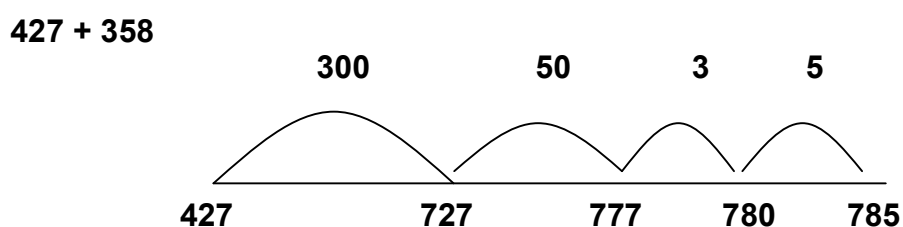
$$\begin{aligned} 36 + 45 &= 36 + 40 + 5 \\ &= 76 + 5 \\ &= 81 \end{aligned}$$

These jottings for partitioning would be used with 2-digit and some simple 3-digit calculations.

Partitioning to count on in multiples of 100, 10 or 1, is one of many examples which work well on a number line. Number lines will be used for calculations right through Key Stage 2 and beyond.



or



or

any jumps on the number line, in steps of 100, 10, 1 or multiples of these, depending on the pupil's mental strategies and ability

Pupils can then use either the expanded or compact method with larger numbers or decimals.

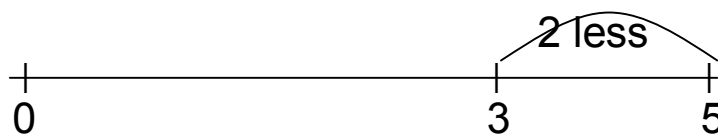
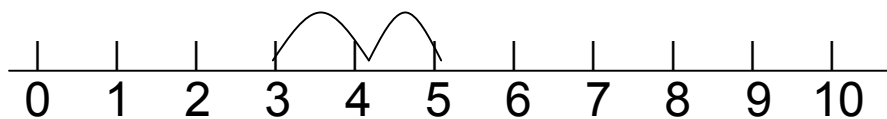
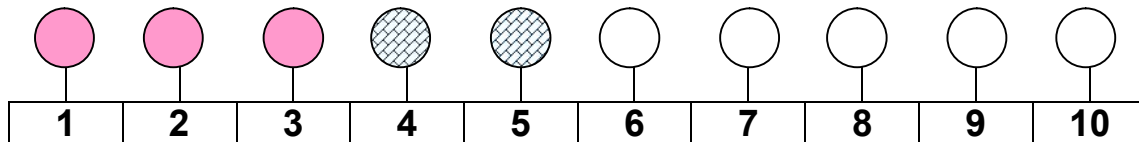
$$\begin{array}{r}
 3968 \\
 5493 \\
 \hline
 8000 \\
 1300 \\
 150 \\
 \phantom{}11 \\
 \hline
 9461
 \end{array}$$

$$\begin{array}{r}
 53.2 \\
 4.9 \\
 \hline
 58.1 \\
 1
 \end{array}$$

Subtraction

As with addition, subtraction is initially recorded as drawing the result of a practical activity, moving on to record this using numbers, on number tracks or lines or as number sentences.

Initially number tracks or lines will be used to subtract small numbers such as $5 - 2$



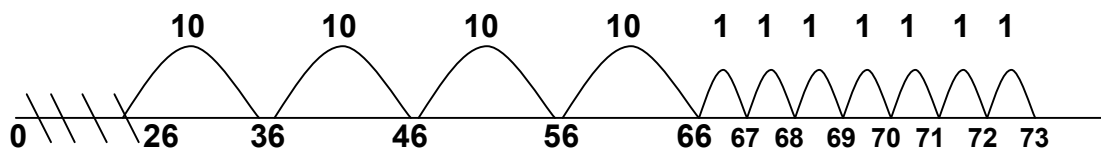
When pupils move on to use jottings the number line will become especially important. Jottings as number sentences are less useful for subtraction as partitioning cannot generally be used.

In the example $73 - 26$ it is possible to start with $70 - 20$, but $3 - 6$ is less useful!

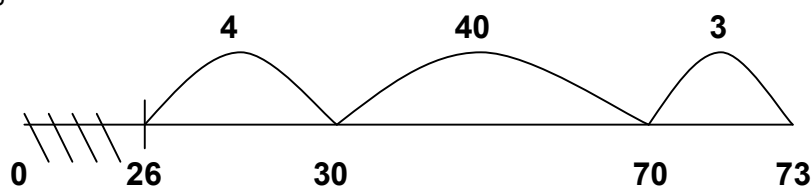
Pupils need to realise that partitioning is not appropriate for subtraction.

Number lines, however, make the calculation easy.

$$73 - 26 =$$



or,

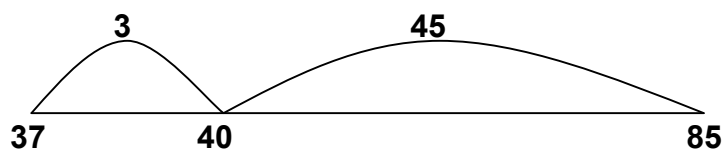


$$73 - 26 = 47$$

This use of number lines builds on the understanding of subtraction as difference or as complementary addition. Pupils will need to record the number line starting from zero, so they can see easily that the number subtracted, in this case 26, has been removed.

When they are confident with this stage, pupils can reduce the number of steps.

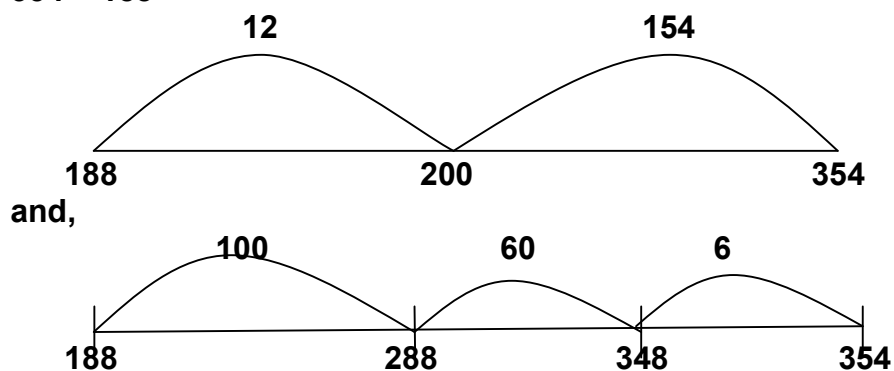
$$85 - 37 =$$



$$85 - 37 = 48$$

The above method can be extended to larger numbers by using complements to 100.

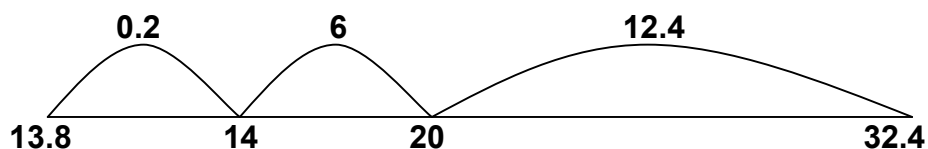
$$354 - 188 =$$



$$354 - 188 = 166$$

Subtraction of decimals is just as simple using the number line.

$$32.4 - 13.8$$

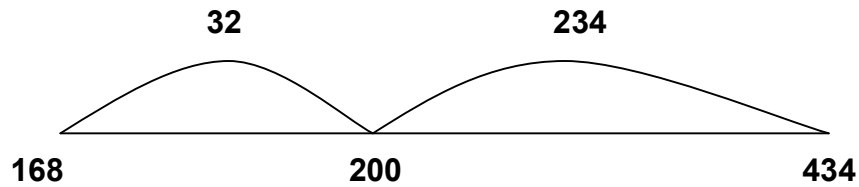


$$32.4 - 13.8 = 18.6$$

Most pupils will continue to use the number line throughout Y6 as this is known to be the most effective method for SAT / QCA testing.

The number line method may be developed into a vertical method by finding what to add to make the next multiple of 1, 10, 100 etc. Initially the number line and then the vertical method will be recorded side by side.

$$434 - 168 =$$

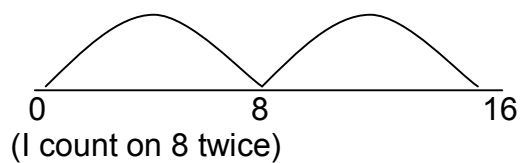


-	4	3	4	
	1	6	8	
	2	3	4	(to make 200)
	2	6	6	(to make 434)

Multiplication

Concepts of multiplication begin with doubling and are extended using the array. Arrays and number lines and number sentences will be the initial methods of recording.

***** $8 \times 2 = 16$



Once pupils begin to multiply one-digit by two-digit numbers this will be by using partitioning. Pupils will be unlikely to have used brackets at this stage and it is best to let them record without brackets, but with a clear understanding of what they are doing, based on an understanding of arrays.

```

*****      *****      *****
*****      *****      *****
*****      *****      *****
*****      *****
*****      *****      8 x 23
*****      *****
*****      *****
*****      *****
*****      *****
*****      *****

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$$\begin{aligned}
 8 \times 23 &= 8 \times 10 + 8 \times 10 + 8 \times 3 \\
 &= 80 + 80 + 24 \\
 &= 184
 \end{aligned}$$

This develops into the grid method.

$8 \times 23 =$

X	10	10	3	
8	80	80	24	=184

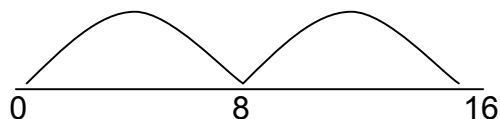
leading to

X	20	3	
8	160	24	= 184

Division

As with multiplication, division is recorded as arrays, number lines or number sentences.

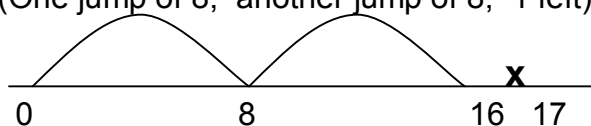
***** $16 \div 8 = 2$



(I start at zero and count in 8s until I get to 16)

Calculations with remainders in the quotient can also be recorded on a number line.

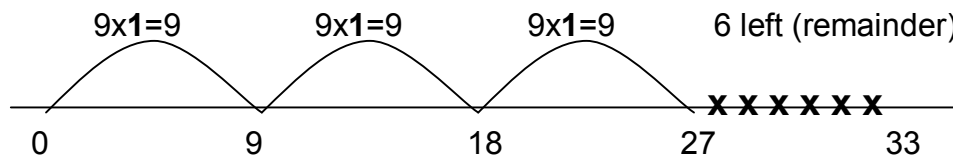
(One jump of 8; another jump of 8; 1 left)



(I start at zero and count in 8s until I get to 16, then there is 1 more to get to 17, so I have 2 jumps of 8 and 1 remainder)

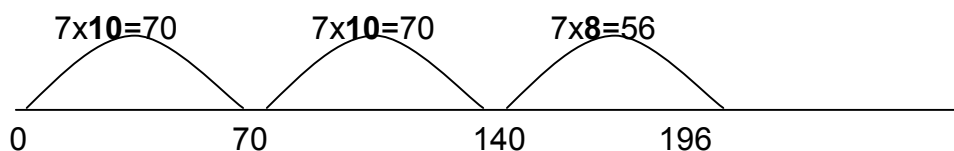
Number lines can also be used for more complex calculations, where the pupil is working with multiples of the divisor.

$33 \div 9 =$



so **$33 \div 9 = 3 \text{ r } 6$**

$196 \div 7 =$



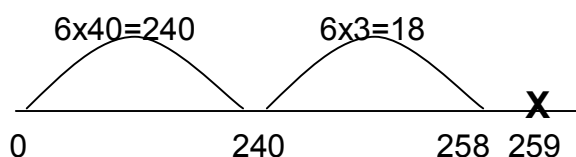
so **$196 \div 7 = 28$**

Place value understanding is needed to count on in multiples of the divisor.

For many pupils, the addition of an 'I Know' box can be very beneficial e.g.

$$259 \div 6 =$$

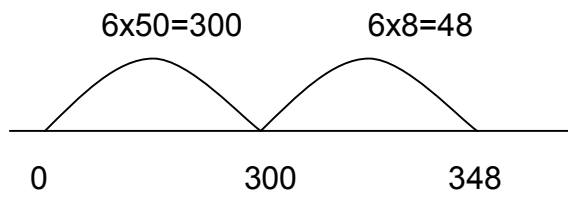
I Know
$6 \times 10 = 60$
$6 \times 20 = 120$
$6 \times 30 = 180$
$6 \times 40 = 240$
$6 \times 50 = 300$ too many
so I will use 6×40



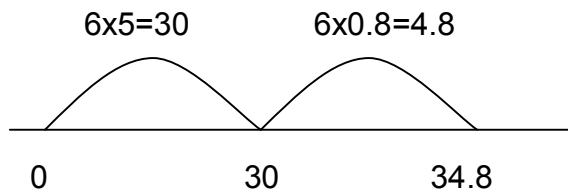
$$259 \div 6 = 43r1$$

When dividing decimals it is useful to begin by adapting a calculation that can already be understood.

I Know		
$6 \times 10 = 60$	$6 \times 1 = 6$	$6 \times 0.1 = 0.6$
$6 \times 20 = 120$	$6 \times 2 = 12$	$6 \times 0.2 = 1.2$
$6 \times 30 = 180$	$6 \times 3 = 18$	$6 \times 0.3 = 1.8$
$6 \times 40 = 240$	$6 \times 4 = 24$	$6 \times 0.4 = 2.4$
$6 \times 50 = 300$	$6 \times 5 = 30$	$6 \times 0.5 = 3$
$6 \times 60 = 360$	$6 \times 6 = 36$	$6 \times 0.6 = 3.6$
$6 \times 70 = 420$	$6 \times 7 = 42$	$6 \times 0.7 = 4.2$
$6 \times 80 = 480$	$6 \times 8 = 48$	$6 \times 0.8 = 4.8$
$6 \times 90 = 540$	$6 \times 9 = 54$	$6 \times 0.9 = 5.4$



$$348 \div 6 = 58$$



$$34.8 \div 6 = 5.8$$

The 'I know' box is particularly important when dividing decimals.

Year Group	Addition	Subtraction	Multiplication	Division
1	Use of number tracks and number lines, mainly numbered in 1s, moving to numbering in 5s and 10s. Introduction to number sentences.	Use of number tracks and number lines, mainly numbered in 1s, moving to numbering in 5s and 10s. Introduction to number sentences.		
2	Number lines, including blank number lines. Horizontal number sentences.	Number lines, including blank number lines. Horizontal number sentences.	Number lines, including blank number lines. Horizontal number sentences.	Number lines, including blank number lines. Horizontal number sentences.
3	Number lines, including blank number lines. Horizontal number sentences.	Number lines, including blank number lines. Horizontal number sentences.	Number lines, including blank number lines, Horizontal number sentences. Arrays.	Number lines, including blank number lines. Horizontal number sentences. Arrays.
4	Number lines, including blank number lines. Horizontal number sentences.	Number lines, including blank number lines. Horizontal number sentences.	Number lines, including blank number lines. Horizontal number sentences. Expanded grid method.	Number lines, including blank number lines. Horizontal number sentences.
5 Autumn	Blank number lines.	Blank number lines.	Expanded grid method leading to non-expanded grid method.	Blank number lines.
5 Spring	Blank number lines and extended vertical, most significant digit first.	Blank number lines.	Grid method.	Blank number lines.
5 Summer	Blank number lines and extended vertical, most significant digit first.	Blank number lines. Schools who choose to move to vertical calculation for <u>some</u> children, may initially record a vertical calculation of the number line next to the number line, eventually using either method.	Grid method.	Blank number lines. Schools who choose to move to vertical calculation for <u>some</u> children, may initially record a vertical calculation of the number line next to the number line, eventually using either method.
6	No new methods of recording are developed in Y6. The expectation is that children will confidently use what is familiar to them.			