Calculation at Berryfields

Warm Up

If I know 7 + 3 = 10
What else do I know?

Berryfields Calculation Handbook

Context

This document serves to ensure that calculation is taught consistently across the school ensuring that pupils make rapid progress as they move from one teacher to another and that they can move on to the next stage or consolidate earlier stages regardless of their age or year group.

Core Skills

Pupils first develop recognition of numerals and of the associated quantities that they represent. Alongside this pupils should have opportunities to experience and practise counting every day. This counting forwards and backwards begins and supports the process of being able to use any of the 4 operations.

Aims for Pupils

- ✓ To have a strong understanding of the concept of number and of how numbers relate to one another.
- ✓ To develop a robust understanding of place value.
- ✓ To apply number concepts with increasing fluency to both mental and written calculations.

The Calculation Handbook has 5 main sections:

Progression in Counting

✓

Progression in Addition

✓

Progression in Subtraction

Progression in Multiplication

Progression in Division

Progression in Addition

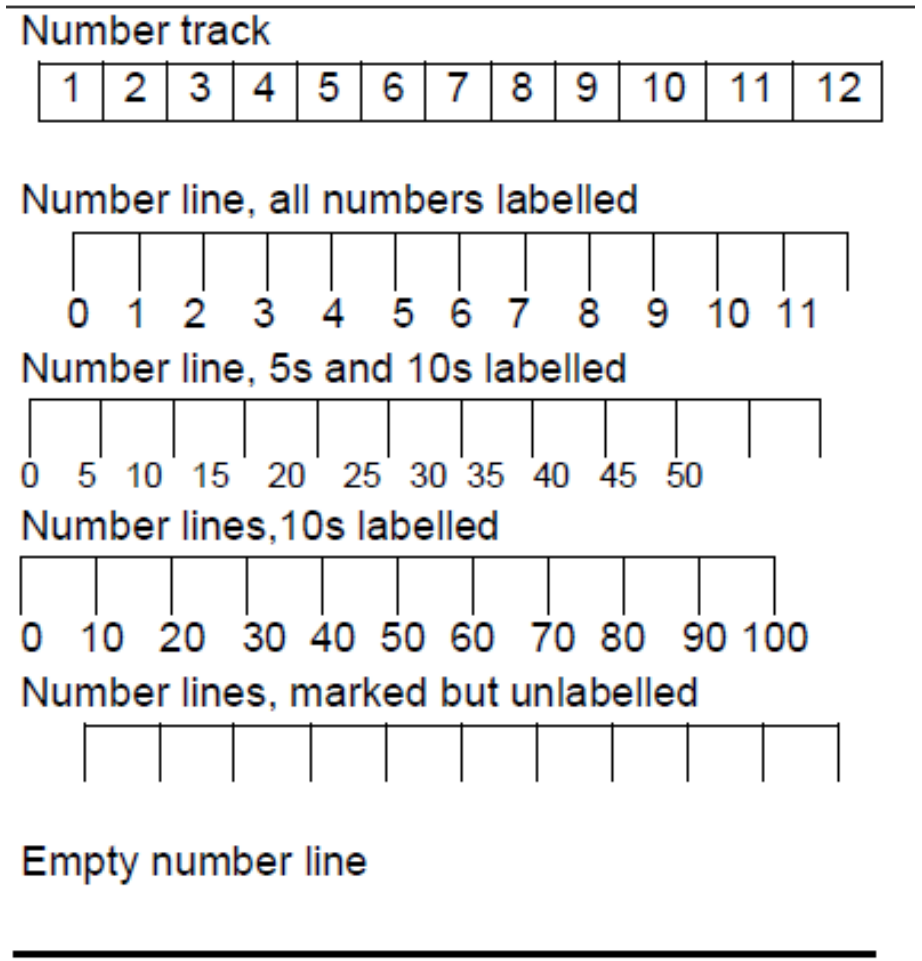
To add successfully, children need to be able to:

- ✓ recall all addition pairs to 9 + 9 and complements in 10, (such as □ + 3 =10);
- ✓ add mentally a series of one-digit numbers, (such as 5 + 8 + 4);
- ✓ add multiples of 10 (such as 60 + 70) or of 100, (such as 600 + 700) using the related addition fact, 6 + 7, and their knowledge of place value;
- ✓ partition two-digit and three-digit numbers into multiples of 100, 10 and 1 in different ways.

It is important that children's mental methods of calculation are practised and secured alongside their learning and use of an efficient written method for addition.

Progression in use of number line

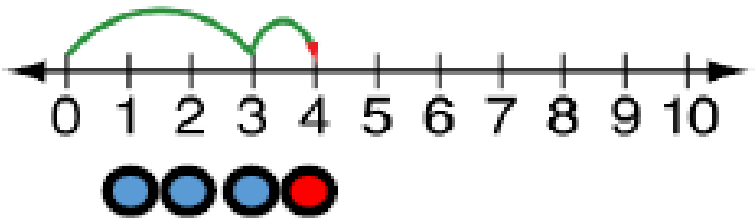
- To help children develop a sound understanding of numbers and to be able to use them confidently in calculation, there needs to progression in their use of number tracks and number lines



Stage 1: Counting on with a number line

Stage 1

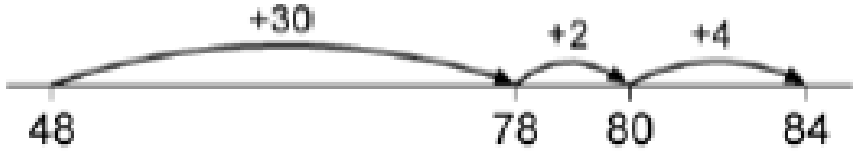
3 + 1 = 4



Steps in addition can be recorded on a number line. The steps often bridge through a multiple of 10.

8 + 7 = 15

48 + 36 = 84



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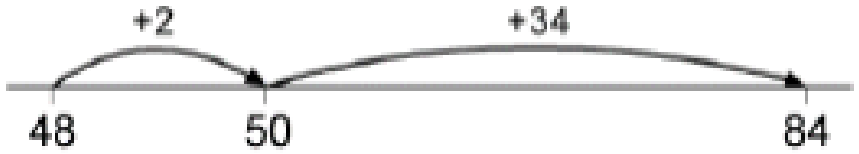
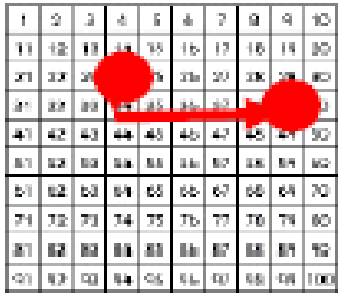


Stage 2: Partitioning

Stage 2

24 + 15 = 24 + 10 + 5= 39



Record steps in addition using partitioning:

47 + 76 = 47 + 70 + 6 = 117 + 6

117+ 6 = 123

Or 47 + 76 = 40 + 70 + 7 + 6

110 + 13 = 123

Partitioned numbers are then written under one another, for example :

$$\begin{array}{rcl} 47 & = & 40 + 7 \\ +\,76 & & 70 + 6 \\ \hline & & 110 + 13 = 123 \end{array}$$

Stage 3: Expanded method in columns

Stage 3

Write the numbers in columns.
Adding the tens first:

$$\begin{array}{r} 47 \\ +\ 76 \\ \hline 110 \\ 13 \\ \hline 123 \end{array}$$

Adding the ones first:

$$\begin{array}{r} 47 \\ +\ 76 \\ \hline 13 \\ 110 \\ \hline 123 \end{array}$$

Discuss how adding the ones first gives the same answer as adding the tens first. Refine over time to adding the ones digits first consistently.

Stage 4: Compact column method

Stage 4

$$\begin{array}{r} 258 \\ +\ 87 \\ \hline 345 \\ \hline 11 \end{array} \qquad \begin{array}{r} 366 \\ +458 \\ \hline 824 \\ \hline 11 \end{array}$$

Column addition remains efficient when used with larger whole numbers and decimals. Once learned, the method is quick and reliable.

Progression in Subtraction

To subtract successfully, children need to be able to:

- ✓ recall all addition and subtraction facts to 20;
- ✓ subtract multiples of 10 (such as 160 – 70) using the related subtraction fact, 16 – 7, and their knowledge of place value;
- ✓ partition two-digit and three-digit numbers into multiples of one hundred, ten and one in different ways (e.g. partition 74 into 70 + 4 or 60 + 14).

It is important that children's mental methods of calculation are practised and secured alongside their learning and use of an efficient written method for subtraction.

Stage 1: Counting back with a number line

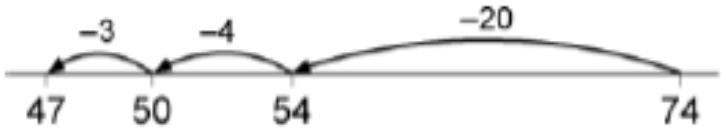
Stage 1

8 - 5 = 3

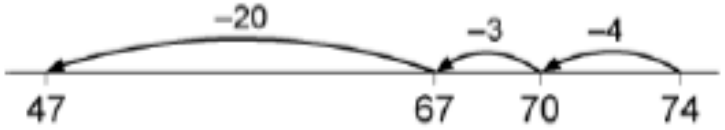
Steps in subtraction can be recorded on a number line.
The steps often bridge through a multiple of 10.

15 – 7 = 8

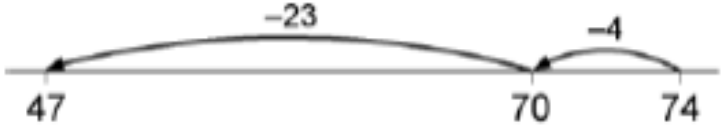
74 – 27 = 47 worked by counting back:



The steps may be recorded in a different order:

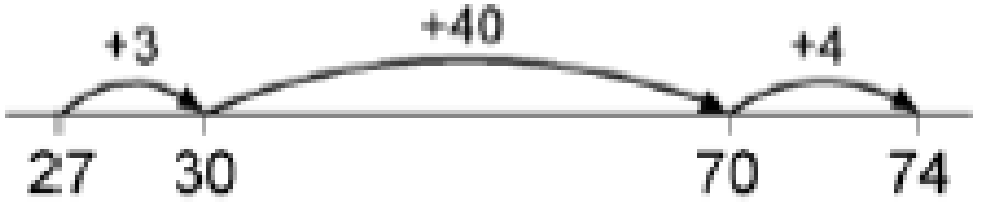


or combined:



Stage 2: Counting on with a number line part 1

74 - 27 =



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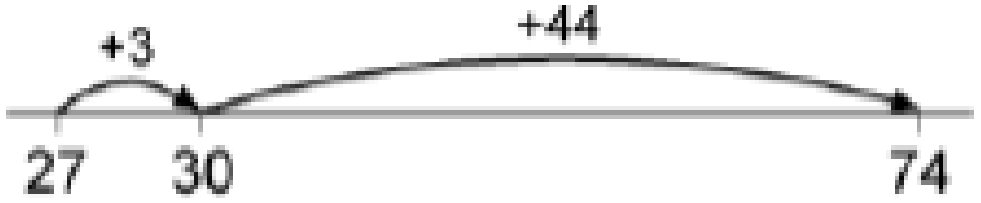
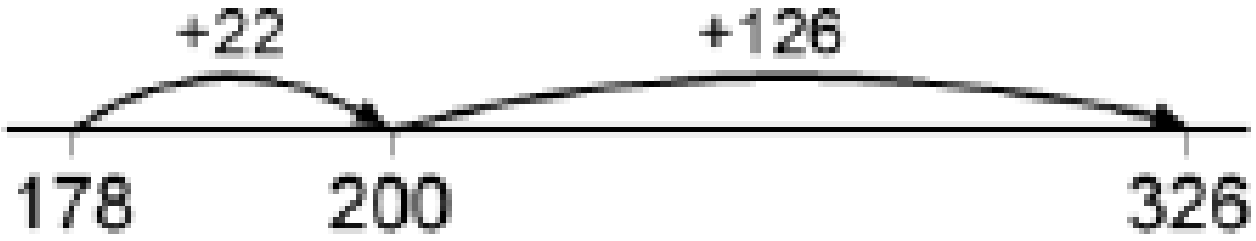


Stage 2: Counting on with a number line
part 2

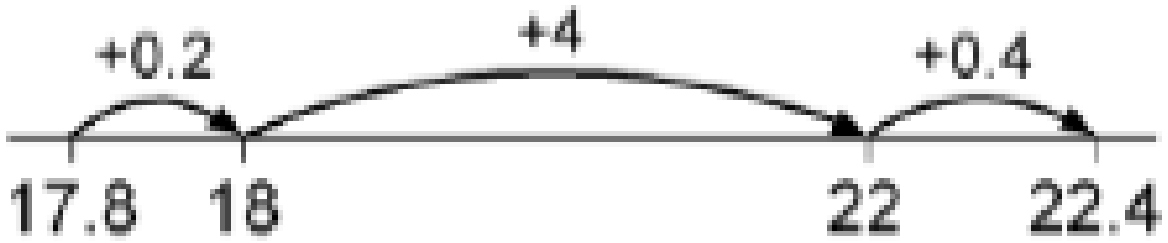
326 - 178 =

or:



Stage 2: Counting on with a number line
part 3

22.4 - 17.8 =

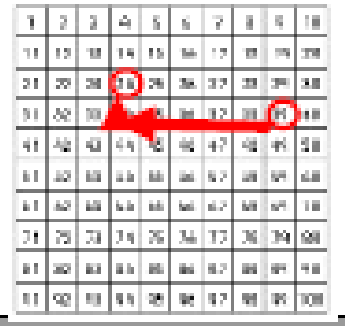


or:

Stage 3: Partitioning

Stage 2

Subtraction can be recorded using partitioning:
74 – 27
74 – 20 = 54
54 – 7 = 47
This requires children to subtract a single-digit number or a multiple of 10 from a two-digit number mentally.
The method of recording links to counting back on the number line.



Expanded layout, leading to column method (Decomposition)

Example: 563 – 241, no adjustment or decomposition needed

Expanded method

$$\begin{array}{r} 500 + 60 + 3 \\ -\ 200 + 40 + 1 \\ \hline 300 + 20 + 2 \end{array}$$

Start by subtracting the ones, then the tens, then the hundreds.

Refer to subtracting the tens, for example, by saying ‘sixty take away forty’, not ‘six take away four’.

…continued

Example: 563 – 246, adjustment from the tens to the units

		50	13	
	500	+ ~~60~~	+ ~~3~~	
-	200	+ 40	+ 6	
	300	+ 10	+ 7	= 317

Begin by reading aloud the number from which we are subtracting: ‘five hundred and sixty-three’.

Then discuss the hundreds, tens and ones components of the number, how there is a “snag” with the units and the need to exchange a ten.

To release units, 60 + 3 can be partitioned into 50 + 13.

The subtraction of the tens becomes ‘13 minus 6,

…continued

563 – 271

$$\begin{array}{l} \cancel{500} + 60 + 3 \\ -\ \underline{200 + 70 + 1} \\ 200 + 90 + 2 \end{array}$$

Begin by reading aloud the number from which we are subtracting: ‘five hundred and sixty-three’.

Then discuss the hundreds, tens and ones components of the number, how there is a “snag” with the tens and the need to exchange a hundred to release needed tens.

500 + 60 can be partitioned into 400 + 160. The subtraction of the tens becomes ‘160 minus 70.

…continued

Example: 563 – 278, adjustment from the hundreds to the tens and the tens to the ones

400 150

		5	6	0	+	13
-	500	+	60	+	3	
	200	+	70	+	8	
	200	+	80	+	5	= 285

Here both the tens and the ones digits to be subtracted are bigger than both the tens and the ones digits you are subtracting from.

Discuss how 60 + 3 is partitioned into 50 + 13, and then how 500 + 50 can be partitioned into 400 + 150, and how this helps when subtracting.

…continued

Example: 503 − 278, dealing with zeros when adjusting

		90		13	
	400	10			
		0			
	~~500~~	+ ~~0~~	+	3	
−	200	+ 70	+	8	
	200	+ 20	+	5	= 225

Here 0 acts as a place holder for the tens.

The adjustment has to be done in two stages.

First the 500 + 0 is partitioned into 400 + 100 and then the 100 + 3 is partitioned into 90 + 13.

Stage 5: Compact method for three-digit numbers

NB Expanded method needs to be shown alongside compact method

Example: 563 – 241, no adjustment or decomposition needed

500 + 60 + 3	563
- 200 + 40 + 1	-241
300 + 20 + 2	322

Start by subtracting the ones, then the tens, then the hundreds.

Refer to subtracting the tens, for example, by saying ‘sixty take away forty’, not ‘six take away four’.

…continued

Example: 563 – 246, adjustment from the tens to the units

		50	13	
	500	+ ~~60~~	+ ~~3~~	
-	200	+ 40	+ 6	
	300	+ 10	+ 7	= 317

$$\begin{array}{r} 5\ 1 \\ 5\not{6}\ 3 \\ -\ \underline{2\ 4\ 6} \\ 3\ 1\ 7 \end{array}$$

Ensure that children can explain the compact method, referring to the real value of the digits.

They need to understand that they are repartitioning the 60 + 3 as 50 + 13.

…continued

Example: 563 – 271, adjustment from the hundreds to the tens, or partitioning the hundreds

	400		16				4 1
	~~500~~	+	0	+	3		~~5~~63
			~~60~~				
-	200	+	70	+	1		271
	200		90		2	= 292	292

Begin by reading aloud the number from which we are subtracting: ‘five hundred and sixty-three’.

Then discuss the hundreds, tens and ones components of the number, and how 500 + 60 can be partitioned into 400 + 160.

The subtraction of the tens becomes ‘160 minus 70’, an application of subtraction of multiples of ten.

Ensure that children are confident to explain how the numbers are repartitioned and why.

Useful websites

- ✓RM Easimaths
- ✓Top Marks Hit the Button
- ✓Bubble Multiples
- ✓ICT Games
- ✓Woodlands Junior School
- ✓Primary Interactive
- ✓Crickweb
- ✓BBC Bitesize