Cranwell Primary School

Progression in calculation for Addition and Subtraction

Vocabulary

Add, addition, more, plus, increase, sum, total, altogether, double, near double, difference, same as, equals, sign, tens boundary, hundreds boundary, units/ones boundary, tenths boundary, inverse, how many more to make…?, is the same as, equals, sign, tens boundary, hundreds boundary, ones boundary, tenths boundary.

Remember: Use the language **calculation** not 'sum' (sum means plus or total)

Use the language **digit** not number (number is the amount or quantity)

Stage 1

Children will use practical equipment to combine groups of objects to find a total. Practical resources will support children's development of mental pictures and images.

Children will begin to understand **commutativity** and the **principle of exchange**. They will be confident in using the terms 'worth' and 'value' when talking about single- **digit** numbers.

Children can represent calculations using objects and talk about their **representations.**

Children will count on their fingers, beads, pegs on a coat hanger, counters, cubes, Cuisenaire rods, Numicon and straws.

Stage 2

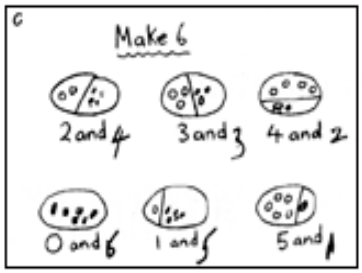
Practical resources will continue to support children's development of mental pictures and images. As these become firm, children will begin to develop ways to represent their mental images and their practical resources using pictures.

The children will begin to use number sentences alongside their pictures and practical resources.

They will also begin to think and talk flexibly about addition. The direct link between addition and subtraction should be made explicit when using models and representations.

3 + 2 = 5

5 = 3 + 2



9 and 1 more is 10

9 add 1 equals 10 **9+ 1 = 10**

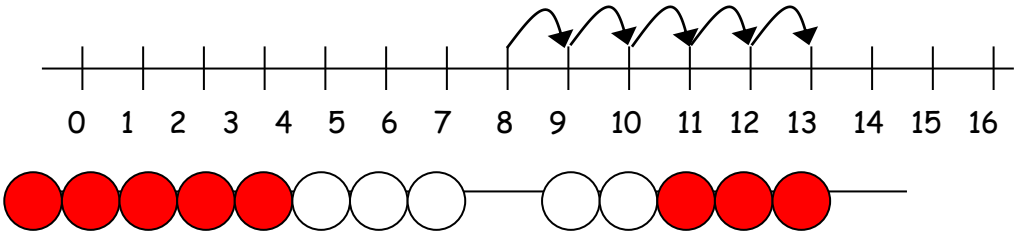
They will record calculations horizontally including counting on to find missing numbers.

8 + 2 = 10 **6 +** ☐ **= 10**

They will continue using practical equipment as they begin to also use number tracks, lines and hundred squares.

9 + 5 = 14

Bead strings or bead bars can be used to illustrate addition including bridging through ten.



8+ 5 = 13

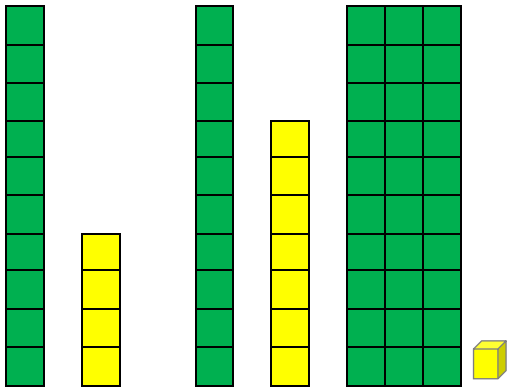
Stage 3

Children will now be confident in using concrete equipment to help them combine groups of objects with numbers up to 20.

Children will still use number tracks, number lines and hundred squares to support their mental methods.

Children will start to work with totals greater than 20 which require them to apply their knowledge of the principle of exchange. They will talk confidently about this.

14 + 17 = 31



Horizontal Partitioning

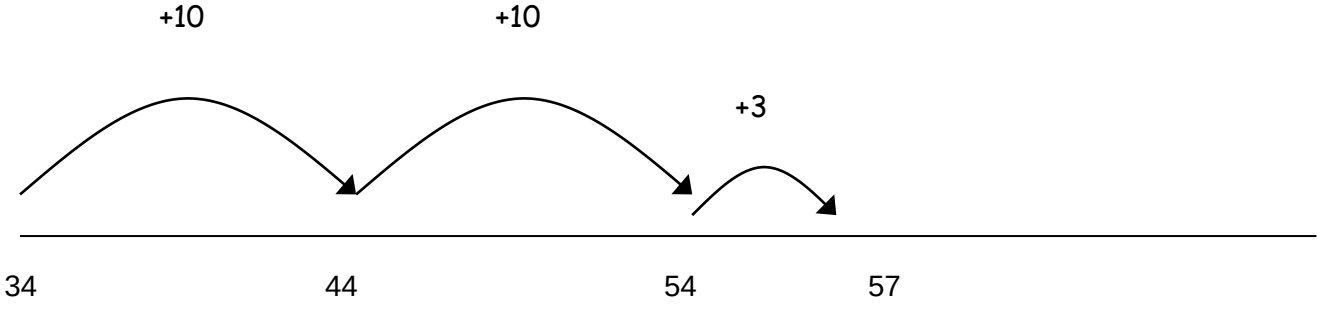
24+ 15= 20 + 10 4+ 5

30 9

= 39

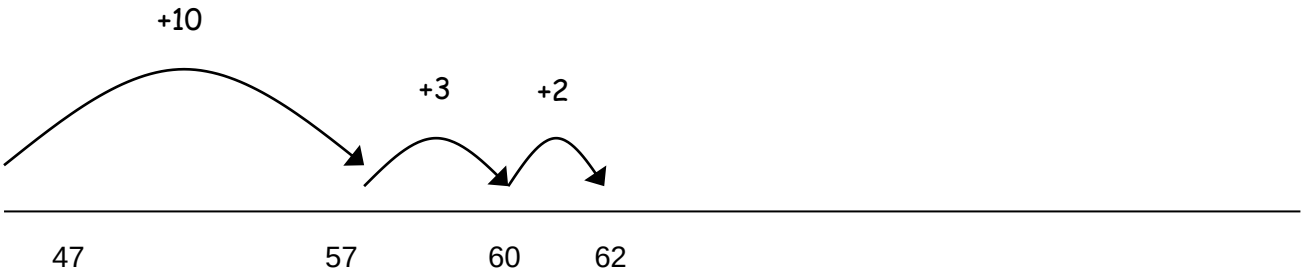
Children will begin to use 'empty number lines' themselves starting with the larger number and counting on. First counting on in tens and ones.

34 + 23 = 57



Followed by adding the tens in one jump and the units in one jump.
Bridging through ten can help children become more efficient.

47 + 15 = 62

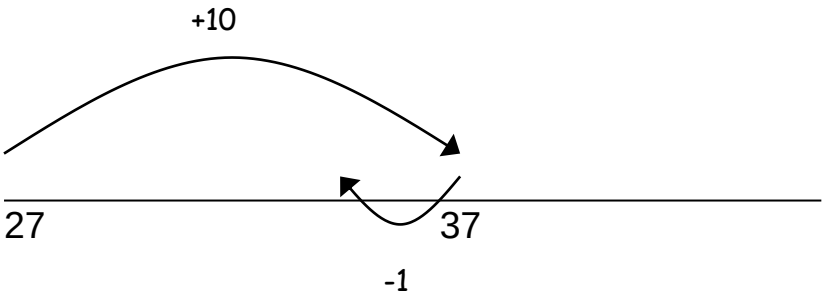


Adding ten and then compensating when adding 9, 11, 19, 21 etc.

27+ 9

27 + 10= 37

37 – 1 = 36

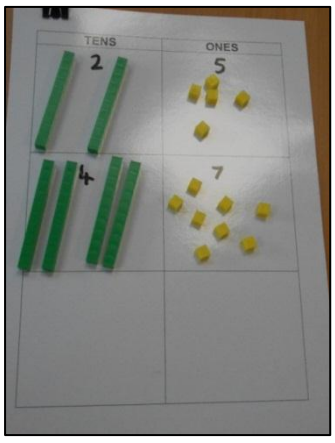


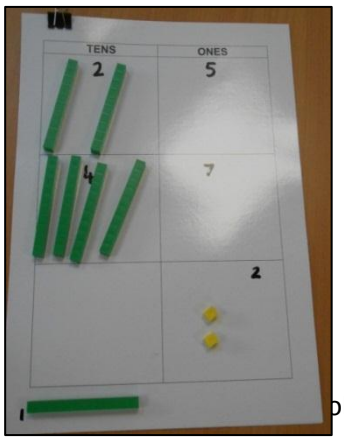
Stage 4

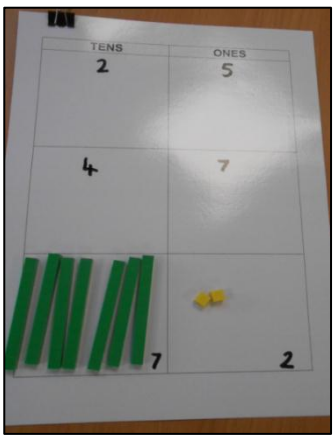
Children are now confident in using concrete equipment to combine objects using the **principle of exchange** appropriately.

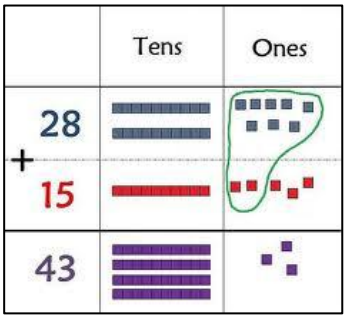
They will now begin to organise their equipment in a vertical manner where their combined totals are situated at the bottom. (Straws, Dienes, Place value counters)

25 + 47









12 ones exchanged to 1 ten and 2 ones

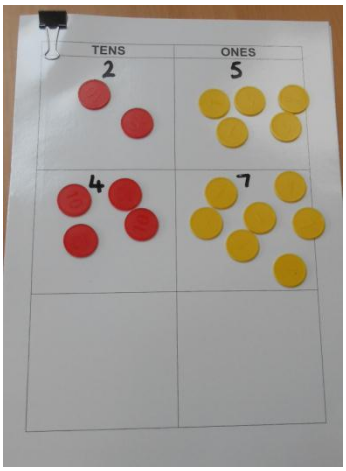
.

Stage 5

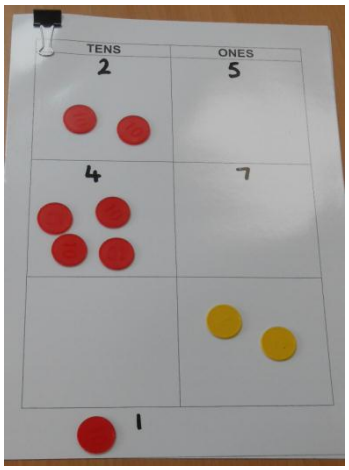
Children are will now be secure in organising their concrete equipment in a vertical manner where their combined totals are situated at the bottom.

They will now be able to make the link between this representation and the formal column addition when seen alongside each other.

25 + 47

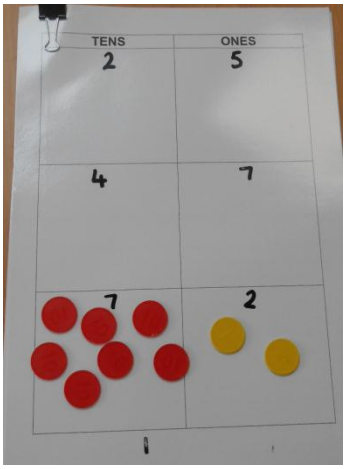


$$\begin{array}{rr} & 2\ \ 5 \\ + & 4\ \ 7 \\ \hline & \\ \hline \end{array}$$



$$\begin{array}{rr} & 2\ \ 5 \\ + & 4\ \ 7 \\ \hline & 2 \\ \hline & 1 \end{array}$$

12 ones exchange to 1 ten and 2 ones 1



$$\begin{array}{rr} & 2\ \ 5 \\ + & 4\ \ 7 \\ \hline & 7\ \ 2 \\ \hline & 1 \end{array}$$

Stage 6

Children will have a full understanding of the links between the concrete representation for column addition and the formal written method. They will now be able to explore calculating with larger numbers using their understanding of the formal written method.

From this, children will begin to carry below the line.

625	783	327
+ 48	+ 42	+ 496
673	825	823
1	1	1 1

Children should extend the carrying method to number with any number of digits.

7648	6584	42
+ 1486	+ 5848	6432
9134	12432	786
1 1 1	1 1 1	3
		+ 4681
		11944
		1 2 1

Using similar methods, children will:

- ✓ add several 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.
- ✓ 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.

Most pupils will be able to work out mentally and explain that:

37 + 86 = 123 because it is 30 + 80 and 7 + 6 making 110 + 13 = 123
and

324 + 58 = 382 because it is 320 + 50 = 370 and 4 + 8 = 12 or 370 + 12 = 382

Children should extend the carrying method to numbers with at least four digits.

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:

- they are not ready
- they are not confident

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.

Subtraction

Vocabulary

Subtract, subtraction, take away, minus, decrease, leave, how many are left/ left over?, difference between, half, halve, how many more/ fewer is../ than…? How much more/ less is …?, is the same as, equals, sign, tens, boundary, hundreds boundary, ones boundary, tenths boundary, inverse.

Remember: Use the language **calculation** not 'sum' (sum means plus or total)

Use the language **digit** not number (number is the amount or quantity)

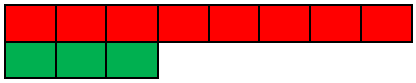
Stage 1

Children will use practical equipment to physically remove an amount from the group to find the total remaining. Practical resources will support children's development of mental pictures and images.

Children will represent calculations using objects and talk about their **representations.**

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

Children will be introduced to the language of comparison including equal use of the vocabulary ‘less’ and ‘more’ in a practical context. For example: Tom has 6 apples and Fay has 3. Fay has fewer apples.



There are more red cubes than green

Stage 2

Practical resources will continue to support children’s development of mental pictures and images. As these become firm, children will begin to develop ways to represent their mental images and their practical resources using pictures.

The children will begin to use number sentences alongside their pictures and practical resources.

They will also begin to think and talk flexibly about subtraction and make links to the inverse of addition.

Children will understand that subtraction is not commutative and so the numbers in a calculation can be in any order but will result in a different number.

The direct link between addition and subtraction should be made explicit when using models and representations.

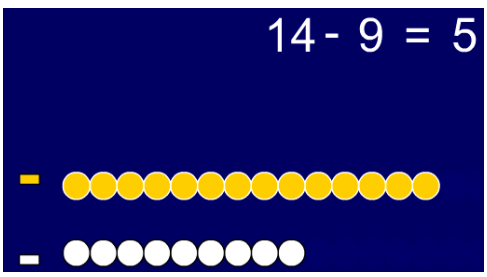
Children count back on number lines.

They count on to find missing numbers.

6 + ? = 10	**? + 6 = 10**
10- 6 = ?	**10- 4 = 6**

Finding the difference

Children build on their understanding of subtraction to interpret 14 – 9 as finding the difference between 14 and 9. ‘How many more must I add to 9 to get 14?’ They use a counting on strategy and record the process as steps on a number line.



Stage 3

Children will now be confident in using concrete equipment to help them ‘take away’ and ‘find the difference’. They will continue using practical equipment as they begin to also use number tracks, number lines and hundred squares to support mental methods.

Children will start to work with numbers greater than 20 which require them to apply their knowledge of the principles of exchange. They will talk confidently about this.

Children will have a full understanding of the link between the concrete represenation for column addition and subtraction and the formal written methods. They will be able to explore calculating with larger numbers using their understanding of the formal written method.

Stage 4

Children are confident using concrete equipment to ‘take away’ and ‘find the difference’ using the principle of exchange.

They organise equipment in a vertical manner where the amount that remains at the end of the calculation is situated at the bottom.

Stage 5

Children will be able to make the links between the practical representation and the formal column subtraction when seen alongside each other.

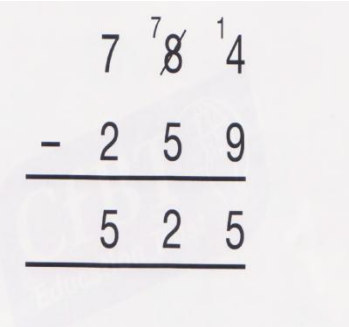
They explore other methods such as counting up.

2000- 1063

9	0	0
	3	0
		7
9	3	7

Stage 6

Children have a secure knowledge of the formal column subtraction and are able to explore calculating with larger numbers using their understanding of the formal written method.



When working with decimals, the above stages should always be followed to allow for the development of conceptual understanding. The use of equipment is essential at these stages to secure understanding of the value of each digit in a number. Wherever possible, decimal calculations should be linked to real-life experiences, e.g. money and measures.

Summary of written methods for addition and subtraction

789 + 642 becomes

	7	8	9
+	6	4	2
1	4	3	1
	1	1	

Answer: 1431

874 – 523 becomes

	8	7	4
–	5	2	3
	3	5	1

Answer: 351

932 – 457 becomes

	8	12	1
	~~9~~	~~3~~	2
–	4	5	7
	4	7	5

Answer: 475

932 – 457 becomes

		1	1
	9	3	2
–	~~4~~	~~5~~	7
		5	6
	4	7	5

Answer: 475