Calculation Guidelines 2023/2024

Addition

Subtraction

Multiplication

Division

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Craneswater calculation guidelines

Progression towards a written method

1. Establish mental methods, based on a good understanding of place value in numbers and number sense.
2. Present calculations in a horizontal format, with jottings supported through use of concrete manipulatives
3. Show children how to set out written calculations vertically, initially using expanded layouts that record their mental methods
4. As children become more confident, refine the written record into a more compact/standard method.
5. Extend to larger numbers and to decimals (including those with differing number of digits)
6. Apply taught through methods through problem solving and reasoning activities.

Place value key concepts:

- Numbers are made up of digits
- Every digit has a value (see below)

1000s	100s	10s	1s ●	Tenths	Hundredths	Thousandths
	3	2	6			

For example:

3 hundreds – 300
2 tens – 20
6 ones - 6

Addition

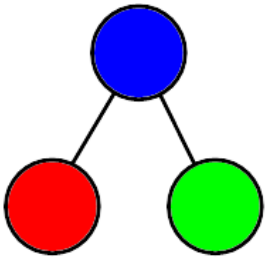
Key Vocabulary:

- Part / Whole
- More, increased by, sum, total
- Regrouping (12 ones is the same as 1 ten and 2 ones)
- Carrying (moving a digit across to its correct place value column)

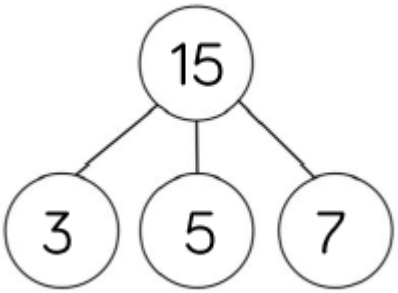
Conceptual Understanding:

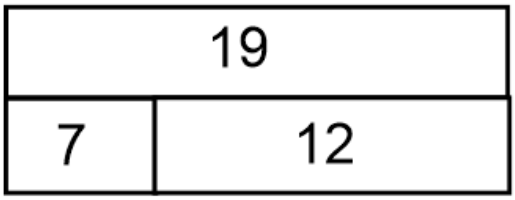
Children are taught that addition is adding two parts together to make a whole. They explore this through the use of bar models and part/whole diagrams. This idea is explored before numbers are introduced.

Red + Green = Blue
Green + Red = Blue



They next begin to explore the concept using simple numbers and how multiple parts can be added to make the whole. Children are taught that it doesn't matter which order the parts are added, the whole is still the same. However, they will learn about the idea of efficient strategies.



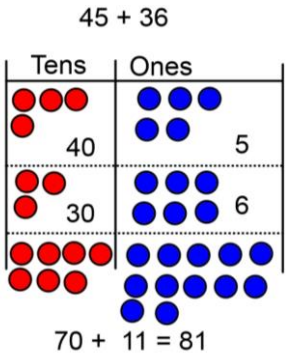


Stage 1: Mental methods with jottings

Children use their understanding of place value and partitioning of numbers to mentally add a pair of numbers together. This may be supported with the use of counters or base 10.

e.g. 45 + 36

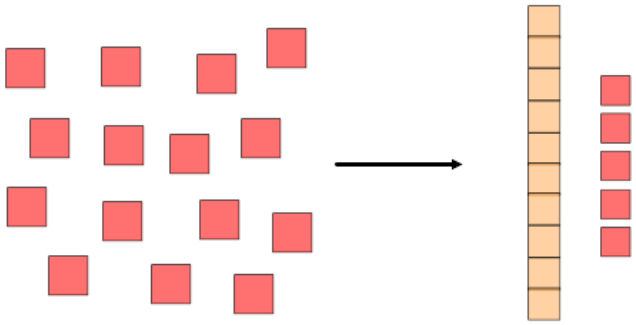
40+30 =70
5+6=11
70 + 11 = 81



During this stage, children will be taught to look for patterns and relationships between numbers. For example:
4 + 9 = 13
40 + 90 = 130

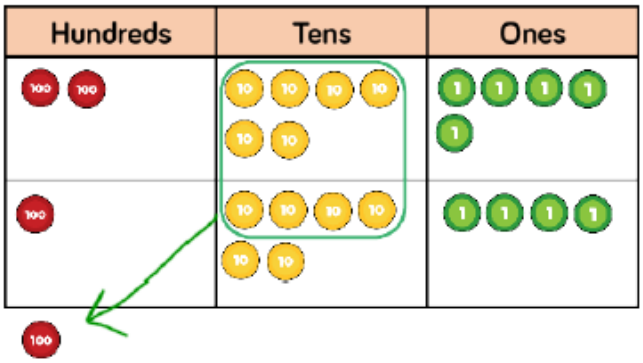
Stage 2: Understanding re-grouping

First children explore the concept of re-grouping using either place value counters or base 10. This understanding needs to be secure before the children are able to move onto the formal written method.



15 ones is the same as 1 ten and 5 ones.

This then extends to use of a place value chart:



Children consider than 10 counters can be re-grouped and the new counter is placed into the next column.
The counter is placed at the bottom.

Stage 3: Using a formal written methods

Finally, children begin to record their calculation using the formal written method. By this stage, children will understand the process of what they are doing.

$$\begin{array}{r} 265 \\ +\ 164 \\ \hline 429 \\ \hline 1 \end{array}$$

Depth:

- Exploring the idea of efficiency
- Numbers with different number of digits (for example 432 + 6,224)
- Introduce decimal numbers
- Adding more than 2 numbers together
- Application within a context, e.g. money, units of measure
- Missing digit problems

$$\begin{array}{r} 72.8 \\ +\ 54.6 \\ \hline 127.4 \\ \hline 1\ 1 \end{array}$$

$$\begin{array}{rcccccc} & £ & 2 & 3 & . & 5 & 9 \\ + & £ & & 7 & . & 5 & 5 \\ \hline & £ & 3 & 1 & . & 1 & 4 \\ & & 1 & 1 & & 1 & \end{array}$$

$$\begin{array}{r} \square\,7\,\square \\ +\ \ 7\ 5 \\ \hline 2\ 5\ 1 \\ \hline \end{array}$$

Stages of Development in subtraction

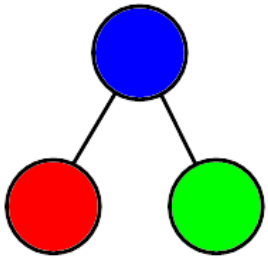
Key Terminology:

- Part / Whole
- Less, decrease by, difference, take away, minus
- Exchanging (for example a ten can be exchanged for ten ones)

Conceptual Understanding:

Children are taught that subtraction is a whole take away one of the parts. They explore this through the use of bar models and part/whole diagrams. They should know that in subtraction, the calculation always starts with the biggest number. This idea is explored in detail before numbers are introduced.

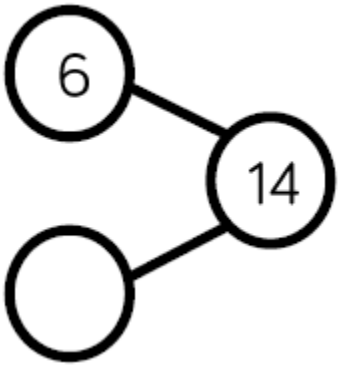
Blue – Green = Red
Blue – Red = Green

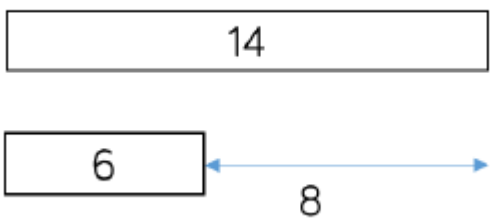


Children's understanding is extended to include the word 'difference'. They recognise that the difference between 2 numbers is the same as having a missing part.

During this stage, children will be taught that the difference between two numbers will stay the same if you add or subtract the same number from each of the original numbers.
e.g.
The difference between 10 and 6 is the same as between 11 and 7

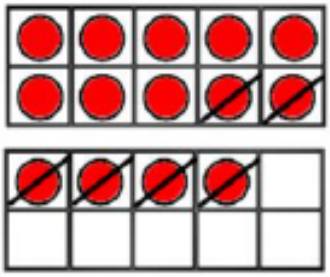
They next begin to explore the concept using simple numbers. Children are taught that the order of calculation does matter – you always start with the whole and subtract a part from it to leave the other part.

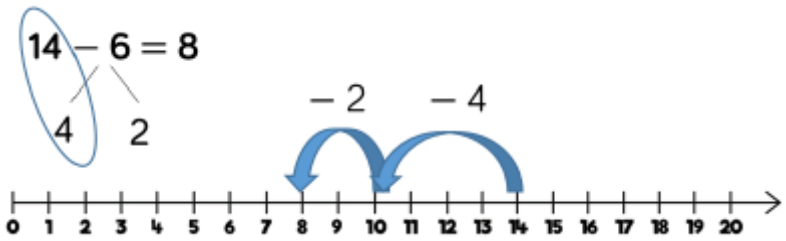




Stage 1: Subtraction crossing a 10

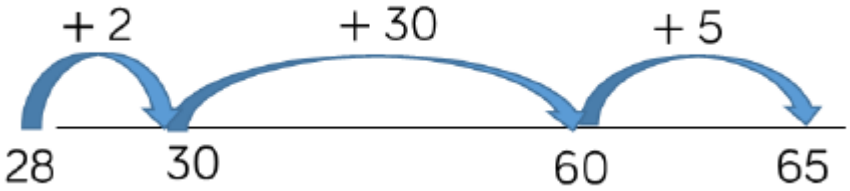
First children explore the idea of subtraction by using equipment such as counters on a tens frame . They begin to consider how they can partition a number and use their understanding of counting back to the nearest 10. At this stage, they may also use a number line to support the concept of counting backwards.





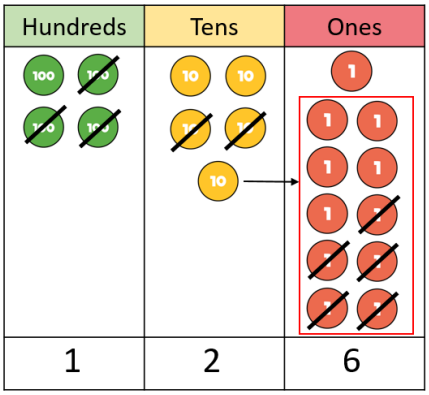
Stage 2: Finding differences by counting up

Children build on their understanding of finding the difference between numbers by counting up using a number line. They recognise that this strategy works best where the difference between the numbers is small.



Stage 3: Understanding subtraction with exchange

First children re-cap their knowledge of place value so they recognise how many ones make a ten, how many tens make a hundred. They begin to subtract using equipment such as base 10 or counters, where an exchange is needed.



In this example 451 has been made using place value counters and 325 is being subtracted. A ten counter is exchanged for 10 ones.

Stage 4: Using a standard written method

Finally, children begin to record their calculation using the formal written method. By this stage, children will understand the process of what they are doing.

	H	T	O	
	4	$^{4}\cancel{5}$	$^{1}1$	
−	3	2	5	
	1	2	6	

Depth:

- Exploring efficiency – which strategy is best to use? Can the question be adapted so that it can be solved easier?
- Numbers with different number of digits (for example 6,224 - 432)
- Exchanging across more than one column
- Introduce decimal numbers
- Subtracting amounts of money
- Application within a context, e.g. money, units of measure
- Missing digit problems

Relationship Between Addition & Subtraction

Whilst learning both methods, children will learn that addition & subtraction are the inverse of each other. They first explore calculation families, for example:

25 + 75 = 100	100 – 75 = 25
75 + 25 = 100	100 – 25 = 75

They explore how they can use this understanding as part of checking strategies and when solving missing number problems. For example:

145 + ☐ = 372 we can use subtraction 372 – 145 = ☐

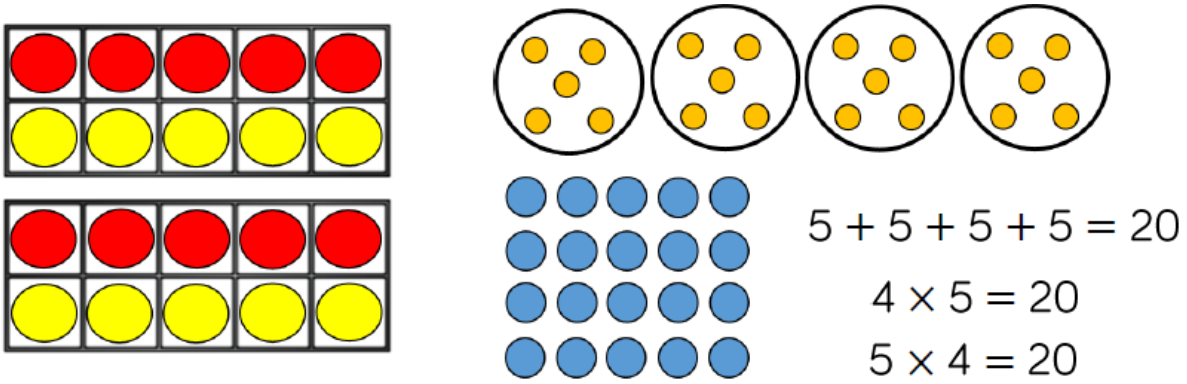
Finally they apply their understanding in the context of a range of word problems, selecting the most efficient strategy and method to use. They may use estimation for their answer first

MULTIPLICATION

Key Vocabulary:

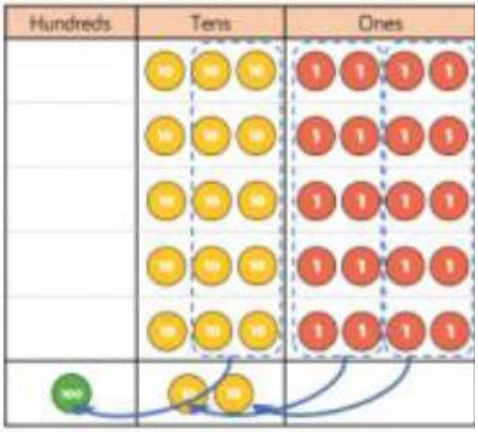
- Multiply, lots of, product, squared
- Carry over, array
- Zero as the place holder
- Commutative, multiplicand

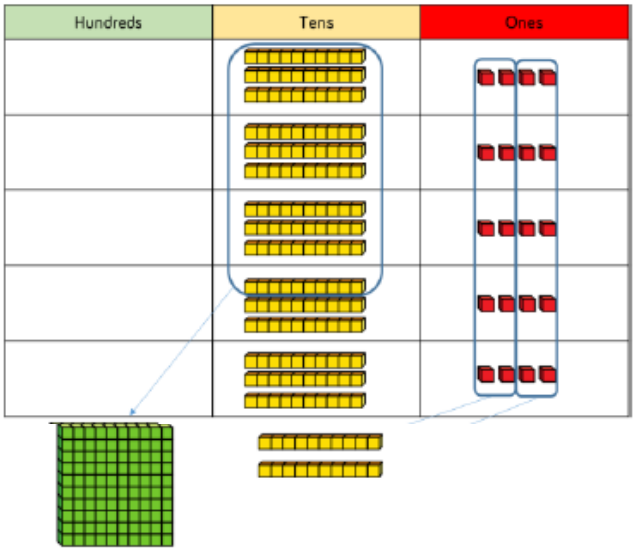
Times tables as arrays



Informal written method (Grid method)

$$34 \times 5 = 170$$





X	30	4
5	150	20

150 + 20 = 170

This then leads to TO x TO e.g. 32 x 14

x	30	2
10	300	20
4	120	8
	420	28

420 + 28 =

Expanded Written Method

Initially this is taught alongside grid method and using manipulatives.

34 x 5

HTO
34
X 5
20 (5 x 4)
150 (5 x 30)
170

32 x 14

HTO
32
X 14
8 (4 x 2)
120 (4 x 30)
20 (10 x 2)
300 (10 x30)
448

Standard Written Method

$$1{,}826 \times 3 = 5{,}478$$

	Th	H	T	O
	1	8	2	6
×				3
	5	4	7	8
	2		1	

Can be supported by visuals as above

$$2{,}739 \times 28 = 76{,}692$$

When using this children should be confident in formal written methods.
Times tables grids can be used to support within the method.
Exchanged digits should be placed as seen in the diagram here. Final exchange is placed underneath as in addition.
Careful use of digit terminology is vital in this stage; e.g. 20 times 700 equals…

TTh	Th	H	T	O
	2	7	3	9
×			2	8
2 (2)	1 (5)	9 (3)	1 (7)	2
5 (1)	4	7 (1)	8	0
7	6	6	9	2
		1		

It is important that the children understand the zero place holder in the second row due to the multiplier being a multiple of 10.

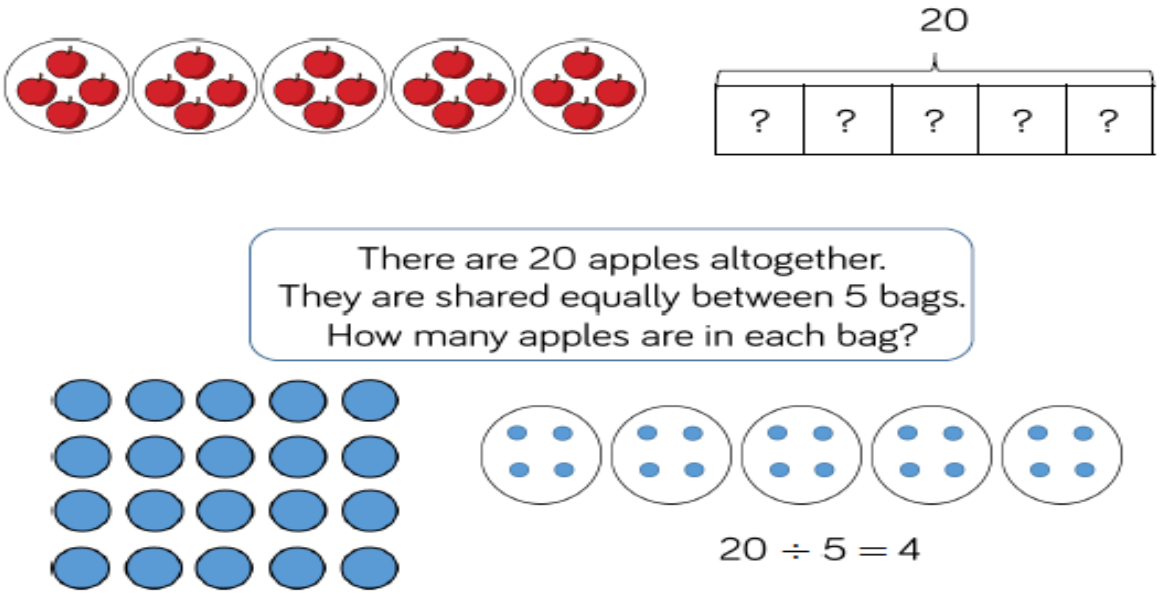
Depth:

- Move into decimals in year 6. Importance of PV at this stage. This can be introduced using the concept of money
- Missing digit problems
- Word problems and reasoning situations

DIVISION

Key Vocabulary:

- Sharing, groups, quotient, dividend, divisor
- Remainder, fractional remainder
- exchange



Understanding sharing and grouping

Children solve problems by sharing into equal groups. The use of the bar model principle is vitally important through all stage of division.

Using a number line (counting up)

81÷3

Use chunks of 10 lots
Use knowledge of times tables

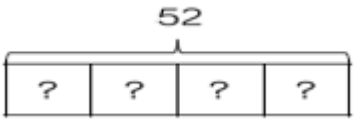
10 + 10 + 7 = 27

Children use efficient chunks (10s) of the divisor.
Use of times tables will support this method

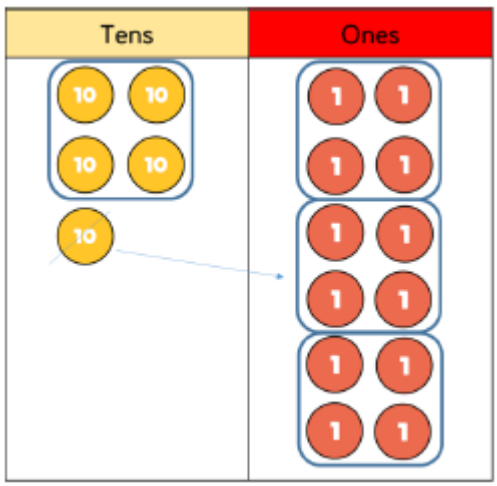
Formal short division method

$52 \div 4 = 13$

		1	3	
	4	5	$^{1}2$	



This is where the 'bus stop' method is introduced. The bar model visual to be used explicitly as you move into this method. Visuals and manipulatives can still be used to support the understanding of this method (see below.)



When using short division method, start with the largest PV and group by the divisor.
Language is important. Children should use 'How many groups of 4 tens can we make?' Then, 'How many groups of 4 ones can we make?

		0	3	6
	12	4	$^{4}3$	$^{7}2$

$432 \div 12 = 36$

Short method is extended to include 2 digit divisors such as 11, 12, 13 as shown above. Concrete and visual representations are less effective at this stage so children need to be confident in the abstract by this stage.

Long Division 4 digit divided by 2 digit

$7{,}335 \div 15 = 489$

	0	4	8	9
15	7	3	3	5
	6	0	↓	↓
−	1	3	3	↓
	1	2	0	↓
		1	3	5
		1	3	5
				0

Children should write out multiples of the divisor to support their calculations with larger remainders (see below).
Children should continue to use the PV values e.g. 'How many groups of 15 thousands?' etc…
At each stage the next digit is brought down to the remainder (red arrow)

15	30	45	60	75	90	105	120	135

Division with remainders

$372 \div 15 = 24\ r12$

$372 \div 15 = 24\frac{4}{5}$

When working with remainders, children can either leave it as a remainder; turn it into a fraction or round it according to the question requirements

Things you can do at home to help your child in maths

	0	2	4	r12
15	3	7	2	
	3	0	↓	
−	0	7	2	
	0	6	0	
		1	2	

Mental maths strategies underpin many aspects of mathematics.

The key to mental maths is little and often. 5 or 10 mins regularly is much more effective than sitting down for 30mins. Keep mental maths fun and varied.

Children do not need to write anything down, but they may wish to make simple jottings.

- Chanting times tables and their division facts up to 12 x 12

e.g. 6 x 8 = 48 48÷6 = 8

Children should have quick recall of times tables and not need to do any working out or count up through the times table.

- Counting forwards and backwards in steps of: 1s, 2s, 5s, 10s, 20s, 50s, 100s, 1000s, 0.1, 0.01 (start at different numbers to further extend)

- Partitioning numbers – e.g. 26 = (20 + 6)

- Number bonds to 10, 20, 50, 100, 1000, 1 (decimals)

e.g. 17 + 3 = 20 11 + 9 = 20
Also include inverses, e.g. 20 – 8 = 12
Children should have quick mental recall of these.

- Quick fire addition and subtraction of single digits, e.g. 23 + 9, 24 – 7, 18 + 8

  Encourage mental strategies such as add 10, subtract 1 for adding 9 to a number.
  Use known number bonds to help

- Adding / subtracting small quantities of money

Extending to questions such: How much change? How much more do I need? What coins do I need to make this total?

- Telling the time and asking questions such as, how much longer until....? Reading timetables such as bus/train/TV listings is also useful.

  Children should also become familiar with the 12/24 hour clock and their conversions.

- Measuring and weighing, e.g. cooking/reading from scales

- Playing card games such as ‘sevens’ and ‘pontoon’