Collingwood Primary School Calculation Policy: Addition

Key language: sum, total, parts and wholes, plus, add, altogether, more, 'is equal to' 'is the same as'.
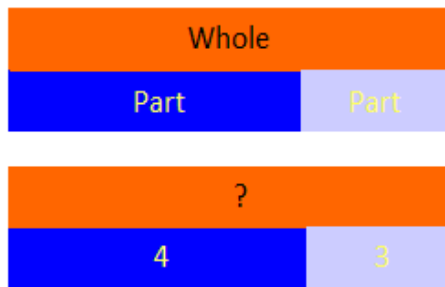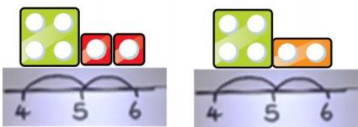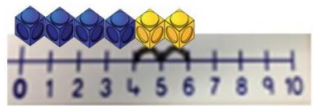
Stage 1

Children understand the concept of addition as combining two or more groups together. Children start to use + and = correctly. During this stage children will gain an understanding that = is not just interpreted as the answer. E.g. 5+2=7, 7=5+2

Children will use number lines, numicon and part whole models to aid addition. They will also begin to use simple bar models.
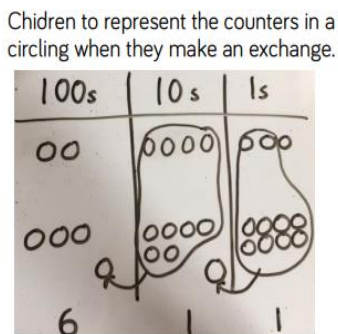
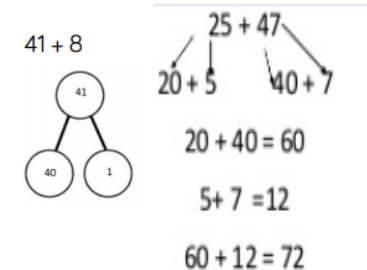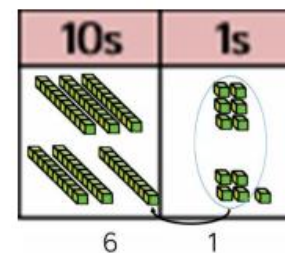Counting on using number lines using cubes or Numicon.

Stage 2

In this stage, children will add numbers together greater than 10. They will also begin to exchange when adding two 2-digit numbers together.

Children will primarily use dienes and numicon as well as 10 and 20 frames to aid addition. At this stage children will only be introduced to a more formal method of addition alongside a pictorial and practical method.

TO + TO using base 10. Continue to develop understanding of partitioning and place value.
36 + 25

41 + 8

25 + 47
20 + 5   40 + 7
20 + 40 = 60
5 + 7 = 12
60 + 12 = 72

Stage 3

Children will progress from Dienes to place value counters, gaining a better understanding of number. Children will add together 3- and 4-digit numbers (including exchanges). Continue with column addition as a formal method. They will be introduced to adding decimals in the context of money. Children will use bar models more confidently to aid solving addition problems.

Use of place value counters to add HTO + TO, HTO + HTO etc. When there are 10 ones in the 1s column- we exchange for 1 ten, when there are 10 tens in the 10s column- we exchange for 1 hundred.

Chidren to represent the counters in a place value chart, circling when they make an exchange.

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  243
+368
  611
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Stage 4

By this stage, children will have a far greater conceptual understanding and procedural fluency with formal methods. They will continue with column addition adding numbers greater than 4 digit and continue to add decimal numbers within a range of contexts. Place value counters will still be used to develop understanding alongside their formal written method. Children will be challenged with multi-step problems and expand their open investigations.

Calculate the missing values to complete the bar models. Then write the four number sentences which can be made from the bar models.

1.

?	
132,447	80,321

```
   4☐2849
+  2☐2840☐
   70☐2☐4
```
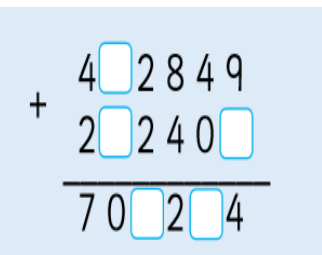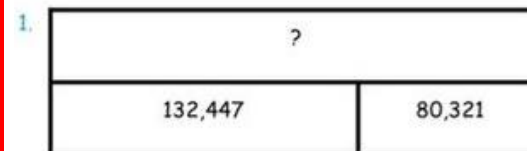
Key methods: Column addition, partitioning

**Collingwood Primary School Calculation Policy**: **Subtraction**

Key language: take away, less than, the difference, subtract, minus, fewer, decrease.

Stage 1

Children understand that subtraction is the concept of 'taking away' from one another. They will use the - and = sign precisely and understand that calculations can be written either sign of the equal sign e.g. 4-3 = 1, 1 = 4-3. Children will mainly use physical objects or counting back on a number line to solve a subtraction. They will also begin to use simple bar models.
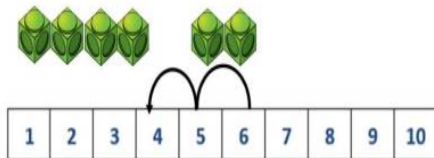
Physically taking away and removing objects from a whole (ten frames, Numicon, cubes and other items such as beanbags could be used).

4 – 3 = 1
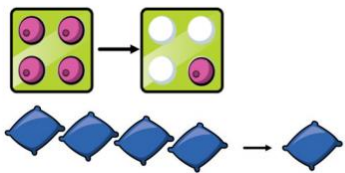
Counting back (using number lines or number tracks) children start with 6 and count back 2.

6 – 2 = 4

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Stage 2

In this stage, children will develop an understanding that subtraction is finding the difference of two or more amounts. They will use dienes to physically take away amounts from both 1 and 2 digit numbers. When subtracting they will begin to exchange e.g. exchanging 1 ten for 10 ones.

Jess had 12 beads and Ken had 4.
How many _more_ beads had Jess than Ken?

12
Jess
Ken 4

?
12 – 4 = 8

45
-29
16

Tens | Ones
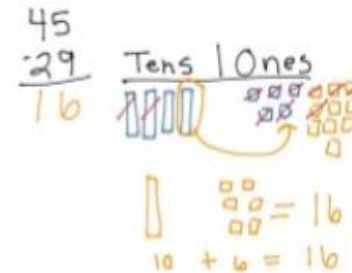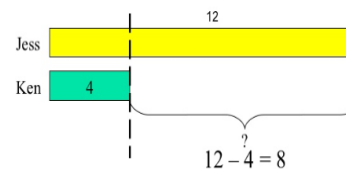
Children to show how they can make 10 by partitioning the subtrahend.

14 - 5 = 9
        4   1

14 - 4 = 10
10 - 1 = 9

14 - 4 = 16
10 + 6 = 16

Children may draw base ten or PV counters

Stage 3

Children will progress from Dienes to place value counters, gaining a better understanding of number. Children will subtract 3 and 4 digit numbers (including exchanges). Continue with column subtraction as a formal method. They will be introduced to subtracting decimals in the context of money. Children will use bar models more confidently to aid solving subtraction problems.

**Column method** using place value counters.
234 – 88

| 100s | 10s | 1s |
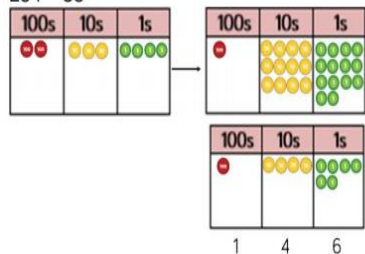
Represent the place value counters pictorially; remembering to show what has been exchanged

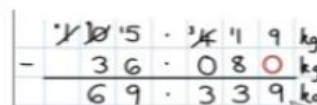| 100s | 10s | 1s |

728 - 582 = 146

7 2 8
5 8 2
1 4 6
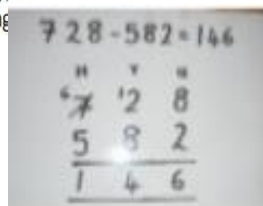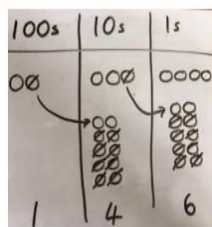
Stage 4

Children will have a far greater conceptual understanding and procedural fluency with formal methods. They will continue with column subtraction, subtracting numbers greater than 4 digit and decimal numbers with different numbers of place. Place value counters will still be used to develop understanding alongside their formal written method. Children will be challenged with multi-step problems and open investigations. Children will decide which method they are using and why. They will continue to subtract decimals in a range of contexts

1 5 0, 6 9 9
- 8 9, 9 4 9
   6 0, 7 5 0
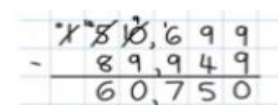
Jocelyn has £8376 in her bank account. In the next month, she takes out £4595 for a new car and a further £1806. Her salary of £2649 is paid in. How much is in her account at the end of the month?

1 0 5 . 4 1 9 kg
- 3 6 . 0 8 0 kg
   6 9 . 3 3 9 kg

Total earned

| £8376 | | £2649 |
| £4595 | £1806 | |

End of month account
Total spent

Key methods: Column subtraction, partitioning

Key language: double, times, multiplied by, the product of, groups of, lots of, equal groups.
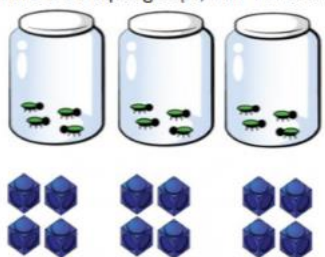
Stage 1

Children count in steps of 1,2,5,10 and 100s.

Children will see multiplication as repeated addition for the first time. They may use a number line to see this. They will begin to understand multiplication and use 'x' as groupings or lots of.
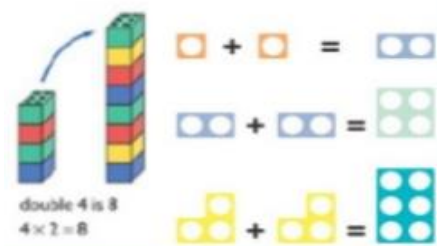
$3 \times 4 = 12$

$4 + 4 + 4 = 12$

There are 3 equal groups, with 4 in each group.

Use practical activities using manipultives including cubes and Numicon to demonstrate doubling

double 4 is 8
$4 \times 2 = 8$

Stage 2

Children rapidly recall facts for the 2x,5x,10x. They will begin to count in steps of 3. Children will learn about commutative law. E.g. 2x5=10, 5x2=10. Recognise that doubling is the same as multiplying by 2. Counting in multiples using cubes, Numicon

and other objects in the classroom. Children begin to use simple bar models to represent multiplication as 'steps of'.
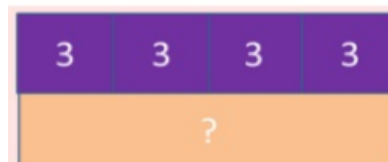
Children to represent the arrays pictorially.
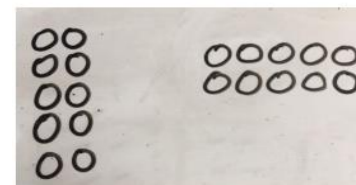
Children to be able to use an array to write a range of calculations e.g.

$10 = 2 \times 5$
$5 \times 2 = 10$
$2 + 2 + 2 + 2 + 2 = 10$
$10 = 5 + 5$

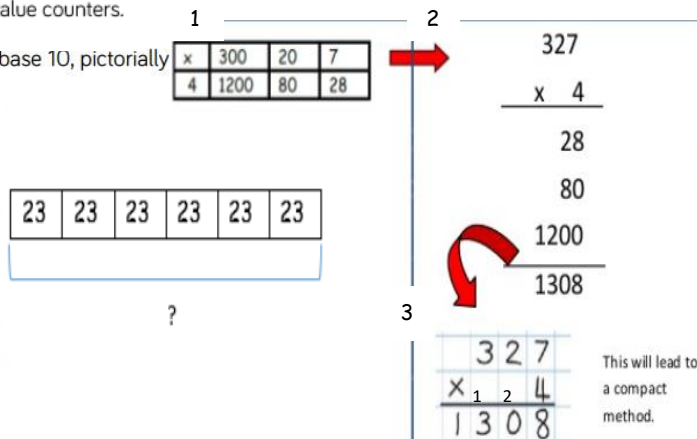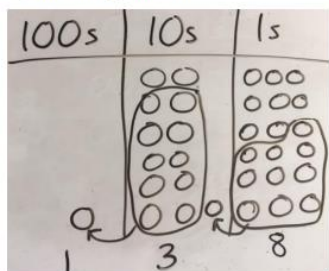| 3	3	3	3
?			

Stage 3

By the end of this stage, children recall all times tables.

Children will further their learning by multiplying 2 then 3-digit numbers by 1-digit numbers. Children will begin this stage by using place value counters through the 'grid method' and progress to a formal written method.

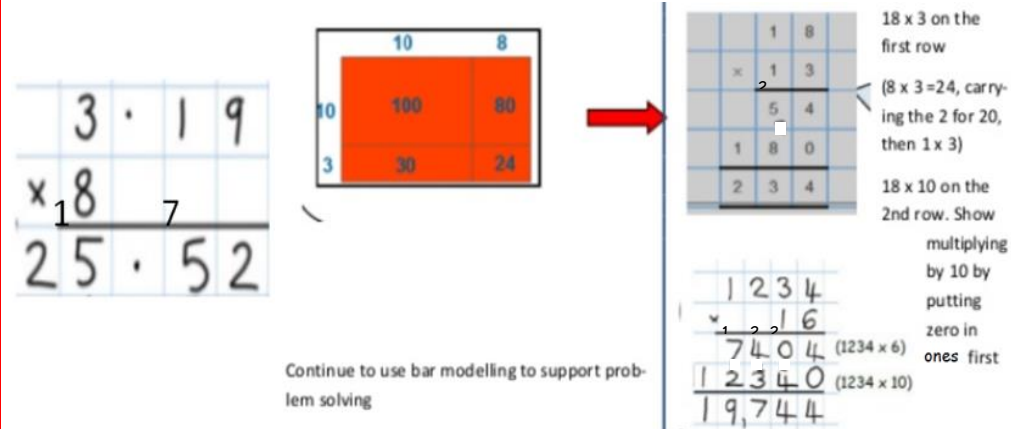Formal column method with place value counters.

6×23

Children to represent the counters/base 10, pictorially e.g. the image below.

x	300	20	7
4	1200	80	28

$$\begin{array}{r} 327 \\ \times\ 4 \\ \hline 28 \\ 80 \\ 1200 \\ \hline 1308 \end{array}$$

$$\begin{array}{r} 327 \\ \times\ _1\ _2\ 4 \\ \hline 1308 \end{array}$$

This will lead to a compact method.

Stage 4

Children consolidate and rapidly recall all times tables. They can now understand long multiplication when multiplying 2digit by 2digit. First demonstrate partition and grid method progressing to formal written methods. Continue to deepen understanding for up to 4d x 2d numbers and using decimals. These are to be used to solve multi-step problems in real life-contexts.

$$\begin{array}{r} 3 \cdot 1 \ 9 \\ \times\ 8 \\ \hline 2 5 \cdot 5 2 \end{array}$$

	10	8
10	100	80
3	30	24

Continue to use bar modelling to support problem solving

18 x 3 on the first row

(8 x 3 =24, carrying the 2 for 20, then 1 x 3)

18 x 10 on the 2nd row. Show multiplying by 10 by putting zero in ones first

$$\begin{array}{r} 1234 \\ \times\ 16 \\ \hline 7404 \ (1234 \times 6) \\ 12340 \ (1234 \times 10) \\ \hline 19,744 \end{array}$$

Key methods: Short multiplication, long multiplication

Key language: share, group, divide, divided by, half.

Stage 1

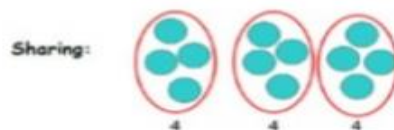Children understand division as sharing objects into a group. They will begin to use the ÷ and = signs.

Children use pictures or shapes to share quantities.

8 shared between 2 is 4

Sharing:

4   4   4

12 shared between 3 is 4

I have 10 cubes, can you share them equally in 2 groups?

Stage 2

Division becomes grouping and sharing.

Sharing: Grouping:

Children use pictures or shapes to share quantities.

Divide quantities into equal groups.

Use cubes, counters, objects or place value counters to aid understanding.

8 ÷ 2 = 4
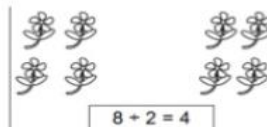
Children use bar modelling to show and support understanding.

12

12 ÷ 4 = 3

Children will be able to see division number statements from arrays. They will understand division as the inverse of multiplication. 5x2=10, 10÷2=5

Stage 3

Division with a remainder initially pictorially with lollipop sticks moving to abstract. Children will 2d divided by 1d using place value counters progressing to more formal methods of short division (up to 3 digits by 1 digit- concrete and pictorial).

Short division using place value counters to group.
615 ÷ 5

100s	10s	1s

Children to the calculation using the short division scaffold.

$$123$$
$$5 \overline{)6^11^15}$$
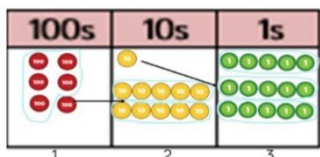
1. Make 615 with place value counters.
2. How many groups of 5 hundreds can you make with 6 hundred counters?
3. Exchange 1 hundred for 10 tens.
4. How many groups of 5 tens can you make with 11 ten counters?
5. Exchange 1 ten for 10 ones.
6. How many groups of 5 ones can you make with 15 ones?

Stage 4

Short division (up to 4 digits by a 1-digit number including remainders) progressing to long division with place value counters (up to 4 digits by a 2-digit number). Children should exchange into the tenths and hundredths column too.
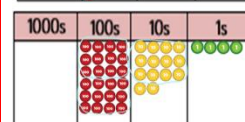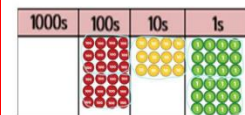
Long division using place value counters
2544 ÷ 12

1000s	100s	10s	1s

We can't group 2 thousands into groups of 12 so will exchange them.
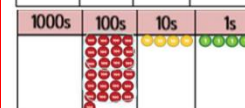
We can group 24 hundreds into groups of 12 which leaves with 1 hundred.

$$\begin{array}{r} 0\,2 \\ 12\overline{)2544} \\ 24 \\ \hline 1 \end{array}$$

After exchanging the hundred, we have 14 tens. We can group 12 tens into a group of 12, which leaves 2 tens.

$$\begin{array}{r} 0\,2\,1 \\ 12\overline{)2544} \\ 24 \\ \hline 14 \\ 12 \\ \hline 2 \end{array}$$

After exchanging the 2 tens, we have 24 ones. We can group 24 ones into 2 group of 12, which leaves no remainder.

$$\begin{array}{r} 0\,2\,1\,2 \\ 12\overline{)2544} \\ 24 \\ \hline 14 \\ 12 \\ \hline 24 \\ 24 \\ \hline 0 \end{array}$$

Short Division:

547 ÷ 23 =

2 3 r18

23)5 4 ⁸7

547 ÷ 23 = 23 r18

Key methods: sharing, grouping, long division, short division

Addition

Children will engage in a wide variety of songs and rhymes, games, and activities. They will begin to relate addition to combining two groups of objects, first by counting all and then by counting on from the largest number. They begin to understand that a group of things changes in quantity when something is added.

They will find one more than a given number.

In practical activities and through discussion they will begin to use the vocabulary involved in addition.

'You have five apples and I have three apples. How many apples altogether?'

Subtraction

Children begin to understand that a group of things changes in quantity when something is taken away.

Children will engage in a variety of counting songs and rhymes and practical activities.

In practical activities and through discussion they will begin to use the vocabulary associated with subtraction.

They will find one less than a given number.

They will begin to relate subtraction to 'taking away' using objects to count 'how many are left' after some have been taken away.

$$6 - 2 = 4$$

'Take two apples away. How many are left?'

Children will begin to count back from a given number.

Multiplication

Children will engage in a wide variety of songs and rhymes, games and activities. In practical activities and through discussion they will begin to solve problems involving doubling.

'Three apples for you and three apples for me. How many apples altogether?'

Division

Children will engage in a wide variety of songs and rhymes, games and activities.

In practical activities and through discussion they will begin to solve problems involving halving and sharing.

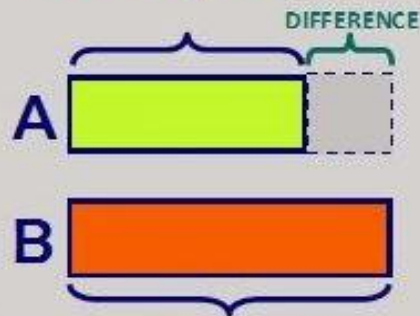Share the apples between two people.

'Half of the apples for you and half of the apples for me.'

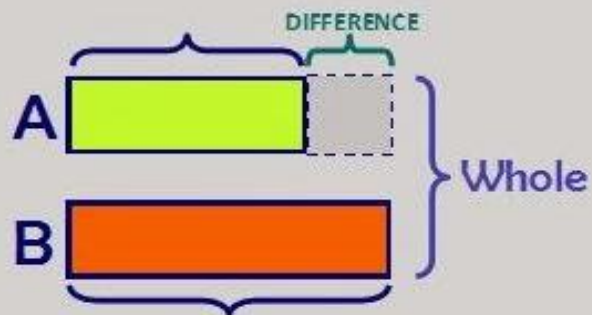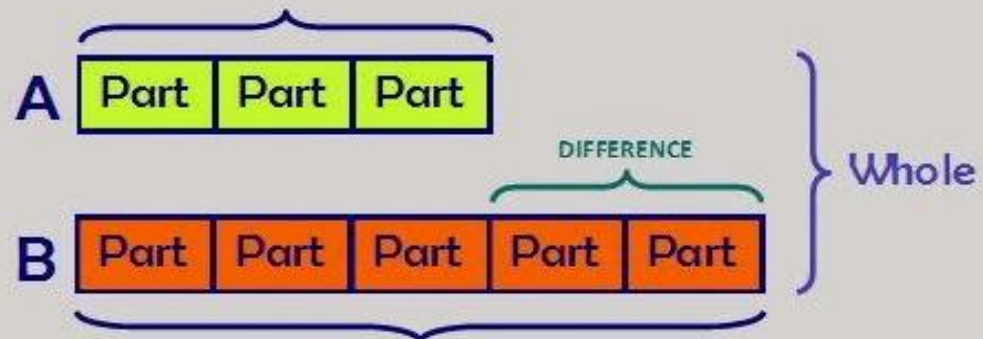# Solving Problems with Bar Modeling

Part-Part-Whole

Part	Part

Whole

Comparison

DIFFERENCE

A

B

Equal Parts of a Whole

Part	Part	Part	Part	Part

Whole

an Equal Part is a UNIT

Comparison AND Part-Part-Whole

DIFFERENCE

A

B

Whole

Comparison AND Equal Parts of Wholes

Part	Part	Part

A

DIFFERENCE

Part	Part	Part	Part	Part

B

Whole

an Equal Part is a UNIT