

Sacred Heart R.C. Primary School Hindsford

Visual Mathematics Policy Addition and Subtraction



Policy written by L. Delargy

Science Leader

September 2019

Accepted by Governors:

J. Carter

signed (chair)

S. M. Dornell

signed (Head)

Shared with staff: date: October 2019

Mission Statement:

By living out our Catholic faith

TOGETHER

we ENCOURAGE

and ACHIEVE.

I have called you by name.

Introduction:

This policy outlines the teaching, organisation and management of mathematics taught and learnt at Sacred Heart. The policy is based on the 2014 expectations and aims of the 'New Curriculum' for mathematics and the Early Years 'Development Matters' EYFS document. This ensures continuity and progression in the learning and teaching of mathematics. The policy has been drawn up by the mathematics leader, shared and discussed with all staff and has the full agreement of the Governing Body.

Aims:

The National Curriculum for mathematics aims to ensure that all pupils:

- become **fluent** in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils have conceptual understanding and are able to recall and apply their knowledge rapidly and accurately to problems
- **reason mathematically** by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language
- can **solve problems** by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions.

Mathematics is a subject in which pupils need to be able to move fluently between representations of mathematical ideas. The programmes of study are organised in a distinct sequence and structured into separate domains. Pupils should make connections across mathematical ideas to develop fluency, mathematical reasoning and competence in solving increasingly sophisticated problems. They should also apply their mathematical knowledge to science and other subjects.

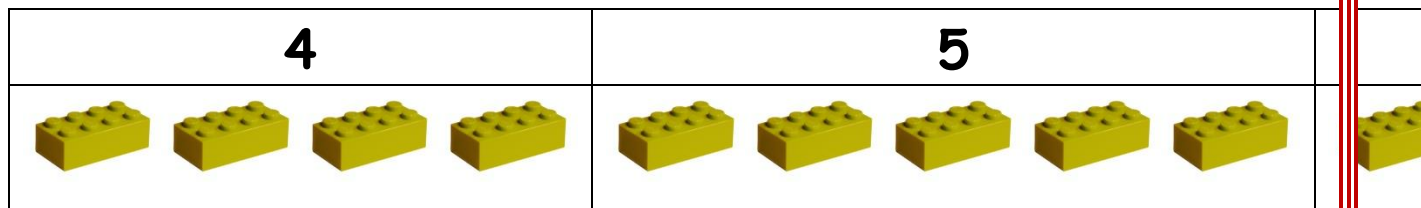
Numbers as objects



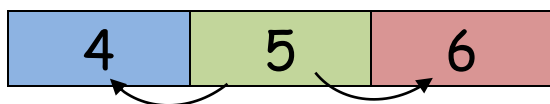
Max has **MORE** than Ann
Max has the **MOST**

Ann has **LESS** than Max
Ann has the **LEAST**

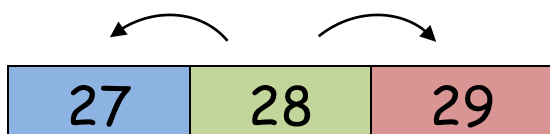
One more and one less



One more or less



1 less than 1 more than



Total number in two groups


$$2 + 6 = 8$$

Dice 1 and Dice 2 altogether

Mathematical statements involving (+)
(-) and (=)

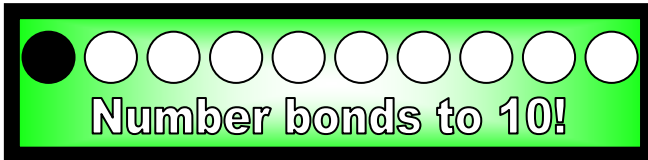
We read: 2 added to 6 makes 8

We write: $2 + 6 = 8$

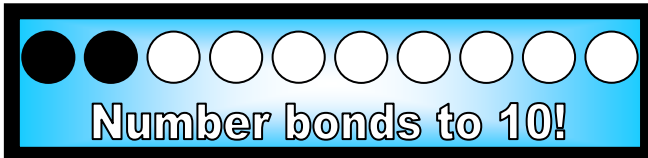
We read: 8 subtract 2 makes 6

We write: $8 - 2 = 6$

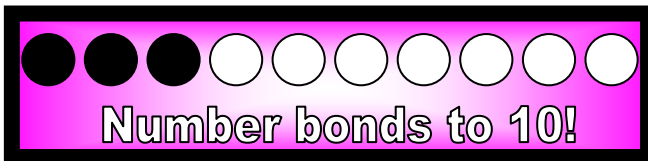
Number bonds



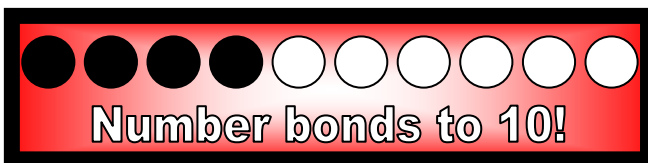
$$1 + 9 = 10 \quad \text{OR} \quad 9 + 1 = 10$$
$$10 - 1 = 9 \quad \text{OR} \quad 10 - 9 = 1$$



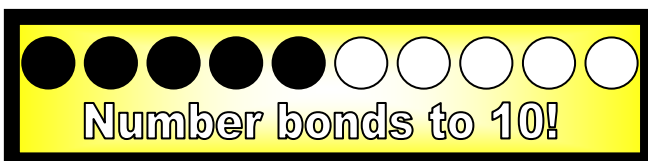
$$2 + 8 = 10 \quad \text{OR} \quad 8 + 2 = 10$$
$$10 - 2 = 8 \quad \text{OR} \quad 10 - 8 = 2$$



$$3 + 7 = 10 \quad \text{OR} \quad 7 + 3 = 10$$
$$10 - 3 = 7 \quad \text{OR} \quad 10 - 7 = 3$$



$$4 + 6 = 10 \quad \text{OR} \quad 6 + 4 = 10$$
$$10 - 4 = 6 \quad \text{OR} \quad 10 - 6 = 4$$



$$5 + 5 = 10$$
$$10 - 5 = 5$$

Addition and subtraction (to be taught alongside)

Addition

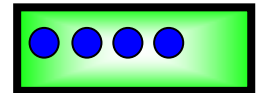
Example: $8 + 6$

$8 + 2 + 4$

$= 10 + 4$

$= 14$

I need +2
to make
10



Subtraction

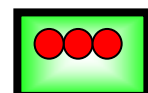
Example: $13 - 5$

$13 - 3 - 2$

$= 10 - 2$

$= 8$

I need -3
to make
10



Addition & subtraction problems

3 balloons and 4 balloons make 7 balloons



We can write: $3 + 4 = 7$

7 balloons but 3 balloons burst leaves 4 balloons



We can write: $7 - 3 = 4$

NOTICE $7 - 3 = 4$

$3 + 4$

↑

Words for ADD

altogether

sum of

total

plus

Addition facts to 10

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

| | | | | |
|----------|---------|---------|---------|---------|
| $0 + 10$ | $1 + 9$ | $2 + 8$ | $3 + 7$ | $4 + 6$ |
| $10 + 0$ | $9 + 1$ | $8 + 2$ | $7 + 3$ | $6 + 4$ |
| | | $5 + 5$ | | |

Addition facts to 20

| | | | | |
|-----------|----------|----------|----------|----------|
| $10 + 10$ | $11 + 9$ | $12 + 8$ | $13 + 7$ | $14 + 6$ |
| $15 + 5$ | $16 + 4$ | $17 + 3$ | $18 + 2$ | $19 + 1$ |
| | | $20 + 0$ | | |

Words for SUBTRACT

take away

how many left?

difference

how many more?

how many less?

Subtraction is the inverse of addition



$$3 + 2 = 5$$



$$5 - 2 = 3$$



$$5 - 3 = 2$$

Watch out!!!!!!

$7 + 3 = 10$ is the same as $3 + 7$



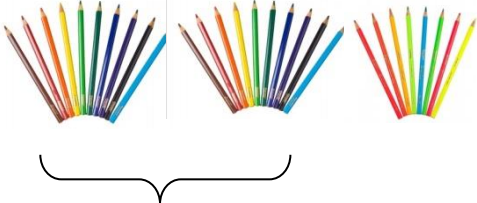
$10 - 7 = 3$ is NOT the same as $7 - 10$



Strategies for adding & subtracting larger numbers

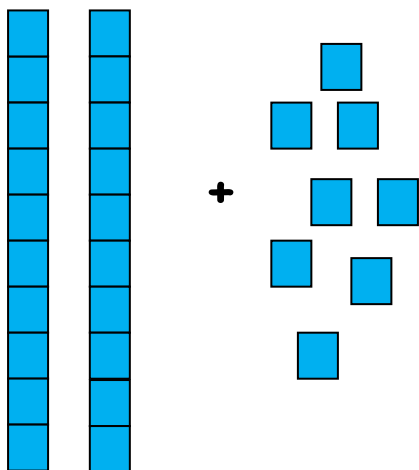
(CONCRETE)

Introduce by using every day and practical resources



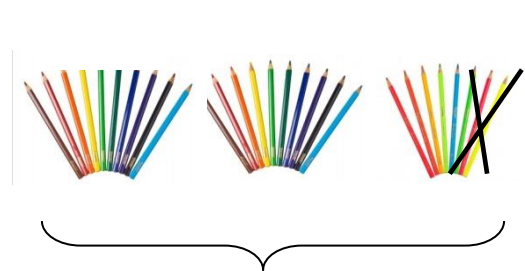
A box containing three groups of colored pencils. The first two groups are grouped together by a bracket underneath, representing 20 pencils. The third group represents 8 pencils. Below the pencils is the equation $20 + 8 = 28$.

$20 + 8 = 28$



Two vertical towers of 10 blue blocks each, representing 20. To the right, 8 blue blocks are arranged in a scattered pattern, representing 8. Below the blocks is the equation $= 28$.

$= 28$

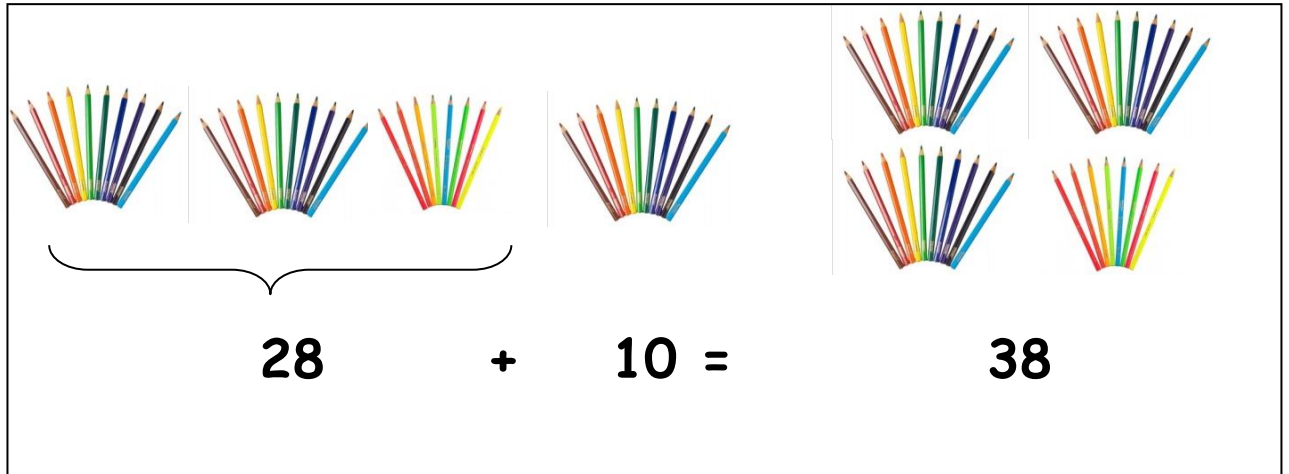


A box containing three groups of colored pencils. The first two groups are grouped together by a bracket underneath, representing 28 pencils. The third group represents 3 pencils that have been crossed out with a black line, representing 3 pencils being subtracted. Below the pencils is the equation $28 - 3 = 25$.

$28 - 3 = 25$

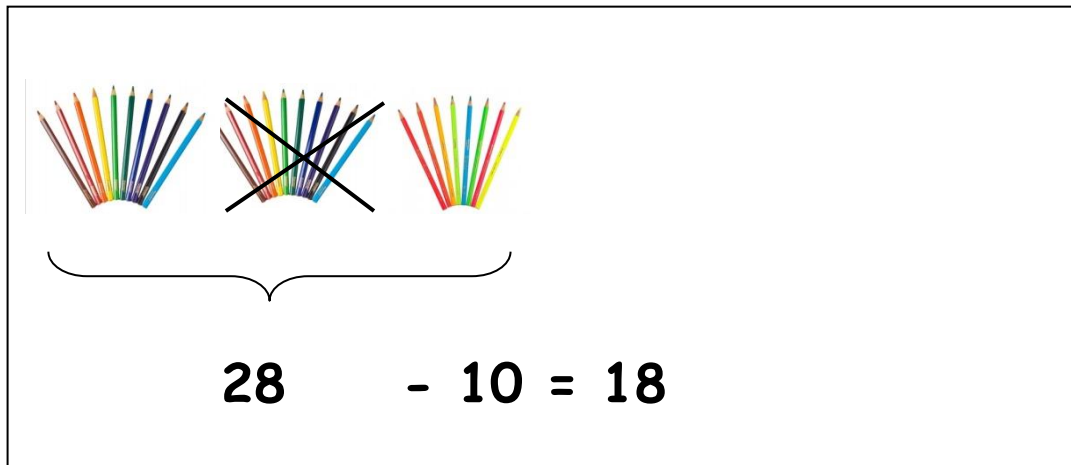
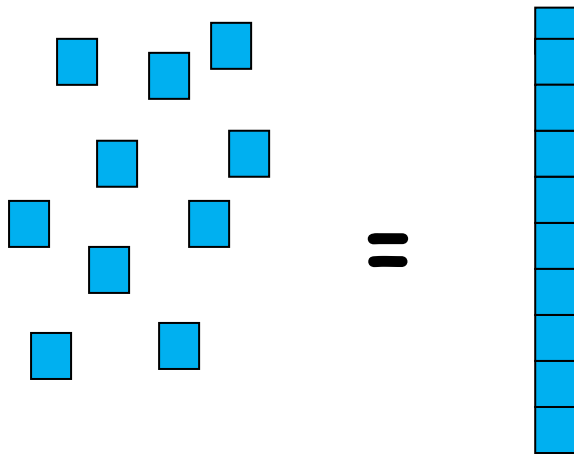
When children can carry out similar calculations then ...

(PICTORIAL REPRESENTATIONS)



| | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|-----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

Model using tens and ones equipment.

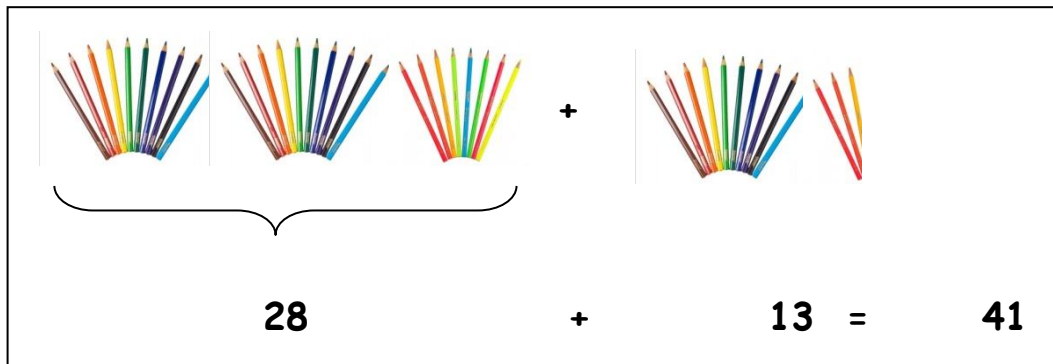


Show that when we add or subtract 10 we jump on (up) and jump back (down) on a 100 square.

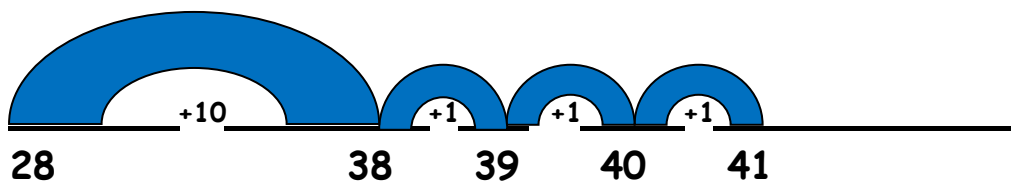
The ones do not change.

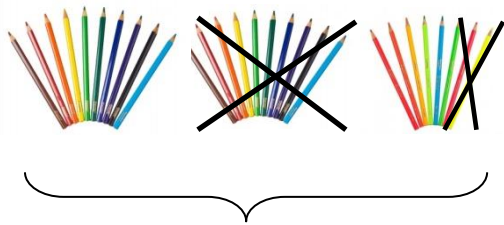
| | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|-----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

When children are confident using practical equipment and place value then introduce blank number lines to add and subtract the tens and the units.



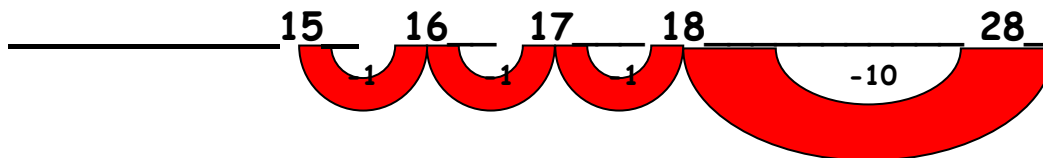
To add jump on along the top





$$28 - 13 = 15$$

To subtract jump back along the bottom



When children are confident with concept practically and pictorially then we introduce symbolic representations.

Expanded Method

$$28 + 13 =$$

$$\begin{array}{r} 28 = 20 + 8 \\ + \underline{13} = \underline{10 + 3} \\ \underline{41} = \underline{40 + 1} \\ 1 \quad 10 \end{array}$$

Compact Method

$$28 + 13 =$$

$$\begin{array}{r} 28 \\ + \underline{13} \\ \underline{41} \\ 1 \end{array}$$

Expanded Method

$28 - 13 =$

$$\begin{array}{r} 28 = 20 + 8 \\ - 13 = \underline{10 + 3} \\ \underline{15} = \underline{10 + 5} \end{array}$$

Compact Method

$28 - 13 =$

$$\begin{array}{r} 28 \\ - 13 \\ \hline 15 \end{array}$$

Fact family for add and subtract

$13 + 7 = 20$

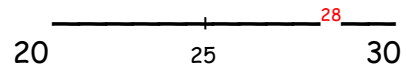
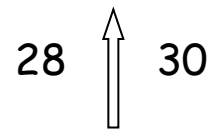
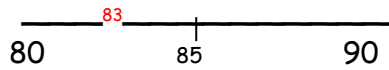
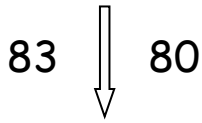
$7 + 13 = 20$

 $20 - 13 = 7$

 $20 - 7 = 13$

Estimating answers to calculations

- Round each number up or down.



- Then do the calculation
- Check using the inverse

Example: Estimate $83 - 28$

$$80 - 30 = 50$$

$$\text{Inverse: } 50 + 30 = 80 \checkmark$$

Missing number problems

Fact family for +/-

$$34 + 23 = 57$$

$$57 - 23 = 34$$

$$23 + 34 = 57$$

$$57 - 34 = 23$$

Mental methods for addition

Add 3 digit numbers mentally

Partitioning

$$236 + 319$$

I start by partitioning the number into Hundreds, Tens and Ones:


$$200 + 30 + 6 + 300 + 10 + 9$$

$$= 500 + 40 + 15$$

$$= 555$$

Now I add up the Hundreds,
Tens and Ones separately.

Now I need to recombine.

Think of: $45 + 32$ as $45 + 30 + 2$

- But in your head say: 45 75 77

Think of: $1236 + 415$ as $1236 + 400 + 10 + 5$


- But in your head say: 1236 1636 1646 1651

Mental methods for subtraction

Subtract 3 digit numbers mentally

$$363 - 126$$

Partitioning


$$\begin{aligned}363 - 100 - 20 - 6 \\= 263 - 20 - 6 \\= 243 - 6 \\= 237\end{aligned}$$

Counting on from 126

$$\begin{aligned}(126) + 4 \\130 + 3 \\133 + 230 \\= 363\end{aligned}$$

Think of: $56 - 32$ as $56 - 30 - 2$

- But in your head say: 56 26 24

Think of: $1236 - 415$ as $1236 - 400 - 10 - 5$

- But in your head say: 1236 836 826 821 **Start**
from **LEFT** to **RIGHT**

$$\text{Answer} = 821$$

Written method for addition

- Line up the digits in the correct columns

Expanded Method

e.g. 132 + 239

$$\begin{array}{r} \text{H T U} \\ 1 \ 3 \ 2 \\ + \underline{2 \ 3 \ 9} \\ \underline{3 \ 7 \ 1} \end{array} \quad \begin{array}{l} = 100 + 30 + 2 \\ = \underline{200 + 30 + 9} \\ \underline{300 + 70 + 1} \\ 10 \end{array}$$

Compact Method

$$\begin{array}{r} \text{H T U} \\ 1 \ 3 \ 2 \\ + \underline{2 \ 3 \ 9} \\ \underline{3 \ 7 \ 1} \\ 1 \end{array}$$

Written method for subtraction

- Line up the digits in the correct columns

e.g. $327 - 119$

Expanded Method

$$\begin{array}{r} \text{H T U} \\ 3 \ 2 \ 7 \\ - 1 \ 1 \ 9 \\ \hline 2 \ 0 \ 8 \end{array} \qquad \begin{array}{l} 10 \\ = 300 + \cancel{20} + \overset{1}{7} \\ = \underline{100} + \underline{10} + \underline{9} \\ \underline{200 + 00 + 8} \end{array}$$

Compact Method

$$\begin{array}{r} \text{H T U} \\ 3 \ \overset{1}{\cancel{2}} \ \overset{1}{7} \\ - \underline{1 \ 1 \ 9} \\ \underline{2 \ 0 \ 8} \end{array}$$

Add & subtract

- Line up digits from right to left

Example 1: Add 4735 and 386

$$\begin{array}{r} 4735 \\ + 386 \\ \hline 5121 \\ \hline 111 \end{array}$$

$$\begin{array}{r} 4735 \\ + \overset{1}{\underset{1}{3}}\overset{1}{\underset{1}{8}}\overset{1}{\underset{1}{6}} \\ \hline 5121 \\ \hline \end{array}$$

Example 2: Subtract 637 from 2476

$$\begin{array}{r} \overset{1}{2} \overset{1}{4} \overset{6}{7} \overset{1}{6} \\ - 637 \\ \hline 1839 \\ \hline \end{array}$$

$$\begin{array}{r} 2 \overset{1}{4} 7 \overset{1}{6} \\ - \overset{1}{6} \overset{1}{3} 7 \\ \hline 1839 \\ \hline \end{array}$$

Adding 3 numbers

- Line up the digits in the correct columns
- Start from RIGHT to LEFT

e.g. $48 + 284 + 9$

| H | T | U |
|---|----------|------------|
| | 4 | 8 |
| 2 | 8 | 4 |
| | | <u>9</u> + |
| | <u>3</u> | <u>4</u> |
| 1 | 2 | |

- Line up the digits in the correct columns

e.g. $48\text{p} + \text{£}2.84 + \text{£}9$

| | | | |
|------------|---|----------|-------------|
| 0 | . | 4 | 8 |
| 2 | . | 8 | 4 |
| | | <u>9</u> | <u>00</u> + |
| <u>£12</u> | . | <u>3</u> | <u>2</u> |
| 1 | 1 | 1 | |