

St. Joseph's Catholic Primary School

Calculation Policy April 2016



Information...

The following calculation policy has been devised to meet requirements of the National Curriculum 2014 for the teaching and learning of mathematics, and is also designed to give pupils a consistent and smooth progression of learning in calculations across the school.

Age stage expectations:

The calculation policy is organised according to age stage expectations as set out in the National Curriculum 2014, **however it is vital that pupils are taught according to the stage that they are currently working at**, being moved onto the next level as soon as they are ready, or working at a lower stage until they are secure enough to move on.

Providing a context for calculation:

It is important that any type of calculation is given a real life context or problem solving approach to help build children's understanding of the purpose of calculation, and to help them recognise when to use certain operations and methods when faced with problems. This must be a priority within calculation lessons.

Choosing a calculation method:

Children need to be taught and encouraged to use the following processes in deciding what approach they will take to a calculation, to ensure they select the most appropriate method for the numbers involved.

Addition

+ Foundation Stage +

Progression of calculation in Foundation Stage

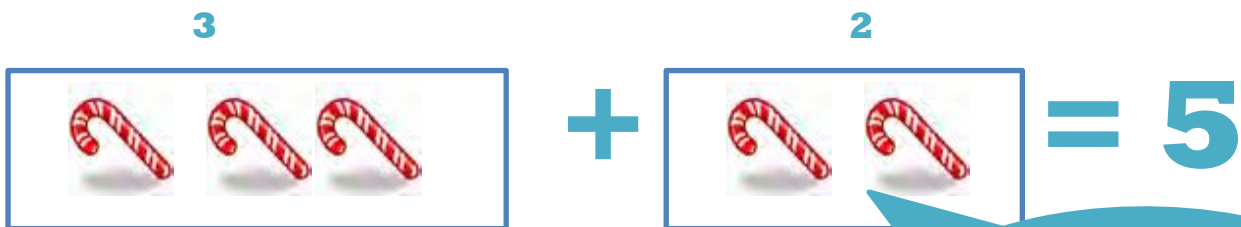
U+U (aggregation: combining objects)

1 more than a given number up to 20.

U+U (augmentation: counting on)

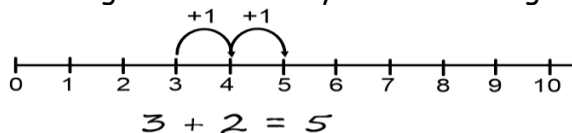
Written recording

- Make a record in counters, dienes, pictures or marks of addition activities.



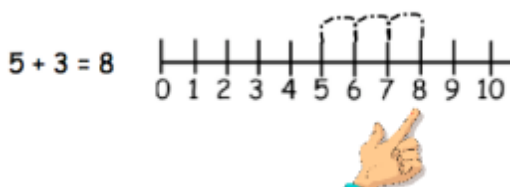
Number lines

and using numbers and symbols including + and =



Add 2 groups together by counting all of them. Understand that addition can mean adding 2 groups together.

Children jump forwards along the number line using a finger and, if ready, record using number lines and symbols.



Exchange

Children have played simple exchange games with coins and other materials (see appendix 1)

Expectations:

Can count reliably to at least 20.

Can find one more than a given number.

Can estimate how many objects they can see and check by counting.

Use the language 'more' to compare two sets of objects.

Through games, songs and practical activities children begin to use vocabulary of addition.

Use fingers and practical equipment to combine two sets and begin to count on.

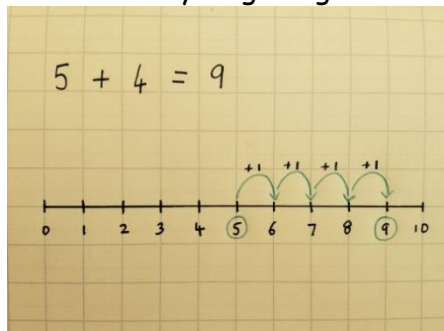
Addition

+ Year 1 +

Number lines

Add with numbers up to 20

Add 10 to any single digit number in one jump



Exchange

Play exchange games and know that you can exchange 10-ones for one ten and vice versa - using dienes and money (1p's and 10p's)

Children should be capable of...

- ✓ Reading and writing the addition (+) and equals (=) signs when forming number sentences.
- ✓ Interpreting a range of addition number sentences.
- ✓ Solving missing box problems using objects and number lines. For example:
 $9 + 4 = \square$ $13 + 6 = \square$ $3 + 2 + 5 = \square$ $\square + \square = 6$
- ✓ Undertaking addition using a range of counting equipment, everyday objects, number lines in a variety of contexts.

Key vocabulary: add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line.

Links to the curriculum:

- ✓ Read and write numbers to 100 in numerals, incl. 1–20 in words
- ✓ Recall bonds to 10 and 20, and addition facts within 20
- ✓ Count to and across 100
- ✓ Count in multiples of 1, 2, 5 and 10
- ✓ **Solve simple 1-step problems involving addition, using objects, number lines and pictorial representations.**

Video explanation: [number bonds to 10](#)

Addition

+ Year 2 +

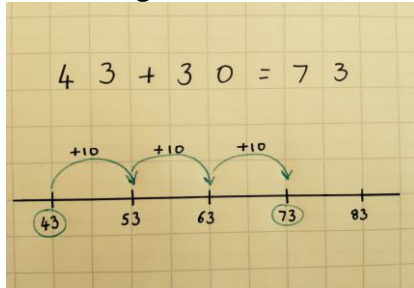
Add with 2-digit numbers

Developing mental fluency with addition and place value involving 2-digit numbers, then progressing to more formal methods. (see mental calculation grid)

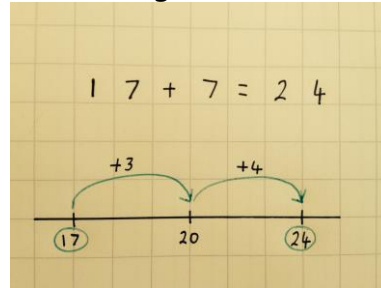
Number lines

Phase 1

Add 2-digit numbers and tens:



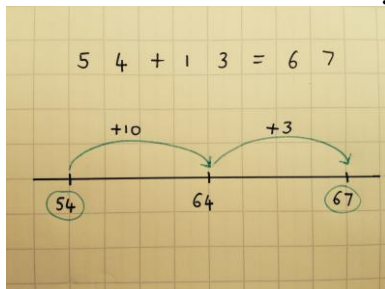
Add 2-digit numbers and ones:



Use empty number lines and hundred squares to build confidence and fluency in mental addition skills.

Phase 2

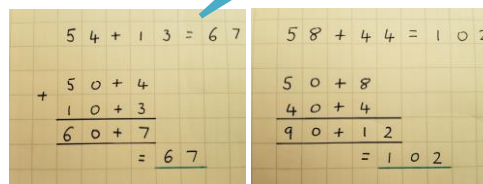
Add pairs of 2-digit numbers, progressing to the partitioned column method when secure adding tens and units:



Addition at this stage should **NOT** cross the tens boundary until the children are secure with the method itself.

Exchange using dienes- see appendix

Use dienes to add a multiple of ten to a 2-digit number show (e.g. $60+12$), then start adding pairs of 2-digit numbers that **DO** cross the tens boundary (e.g. $68 + 33$).



Children who are confident and accurate with this phase should move onto the expanded addition methods with 2 and 3-digit numbers (Y3).

Key vocabulary: add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, addition, column, tens boundary.

Links to the curriculum:

- ✓ Add a 2-digit number and ones (e.g. $27 + 6$)
- ✓ Add a 2-digit number and tens (e.g. $23 + 40$)
- ✓ Add pairs of 2-digit numbers (e.g. $35 + 47$)
- ✓ Add three single-digit numbers (e.g. $5 + 9 + 7$)
- ✓ Show that adding can be done in any order (the commutative law).
- ✓ Recall bonds to 20 and bonds of tens to 100 ($30 + 70$ etc.)
- ✓ Count in steps of 2, 3 and 5 and count in tens from any number.
- ✓ **Understand the place value of 2-digit numbers (tens and ones - partitioning)**
- ✓ Compare and order numbers to 100 using $<$ $>$ and $=$ signs.
- ✓ Read and write numbers to at least 100 in numerals and words.
- ✓ **Solve problems with addition, using concrete objects, pictorial representations, involving numbers, quantities and measures, and applying mental and written methods.**

Addition

+ Year 3 +

Number lines- see mental calculation grid

Exchange using dienes or diagrams of dienes

Add numbers with up to 3-digits.

The **expanded column addition** method:

A grid showing the expanded column addition of 337 and 72. The numbers are written in expanded form: 337 is written as 300 + 30 + 7, and 72 is written as 70 + 2. The addition is performed column by column, starting from the units: 7 + 2 = 9; 30 + 70 = 100; 300 + 100 = 400. The final sum is 409.

Always start by adding the units first, followed by the tens and then finally the hundreds.

In order to carry out this method of addition:

- ✓ Children need to recognise the value of the hundreds, tens and units without recording the partitioning.
- ✓ Pupils need to be able to add in columns.

The **compact column addition** method, with 'carrying':

Always 'carry' numbers underneath the bottom line.

A grid showing the compact column addition of 443 and 75. The numbers are written as 443 and 75. The addition is performed column by column: 3 + 5 = 8; 40 + 70 = 110; 400 + 100 = 500. The final sum is 518. The carry of 1 is written below the tens column.

Add the ones first.

Children should be made aware of the reduced number of steps required for this method. However, they should also be reminded that the actual value is '**four tens** add **seven tens**' not '**four** add **seven**'.

Key vocabulary: add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, plus, addition, column, tens boundary, hundreds boundary, increase, vertical, 'carry', expanded, compact.

Links to the curriculum:

- ✓ Read and write numbers to 1000 in numerals and words.
- ✓ Add 2-digit numbers mentally, incl. those exceeding 100.
- ✓ **Add a three-digit number and ones mentally (175 + 8)**
- ✓ **Add a three-digit number and tens mentally (249 + 50)**
- ✓ **Add a three-digit number and hundreds mentally (381 + 400)**
- ✓ Estimate answers to calculations, using inverse to check answers.
- ✓ Solve problems, including missing number problems, using number facts, place value, and more complex addition.
- ✓ Recognise place value of each digit in 3-digit numbers (hundreds, tens, ones.)
- ✓ Continue to practise a wide range of mental addition strategies, ie. number bonds, adding the nearest multiple of 10, 100, 100 and adjusting, using near doubles, partitioning and recombining.

Video explanation: [3-digit expanded column addition](#)

Addition

+ Year 4 +

Number lines- see mental calculation grid

Add numbers with up to 4 digits

In Year 4 the children should progress from expanded addition to the compact column method. It is important that **the units are always added first** and when 'carrying' numbers the carried digits are always placed **underneath** the calculation. The children will also be introduced to adding in the contexts of money and measures.

Always 'carry' numbers underneath the bottom line.

$$\begin{array}{r} 4176 \\ + 735 \\ \hline 4911 \\ \hline 11 \end{array}$$

Add the units first.

Children should be reminded that the actual value is **'one hundred add seven hundreds'** not **'one add seven'**.

$$\begin{array}{r} + \text{£ } 34.68 \\ \text{£ } 8.46 \\ \hline \text{£ } 43.14 \\ \hline 111 \end{array}$$

The decimal point should be aligned in the same way as the other place value columns, and must be in the same column in the answer.

$$\begin{array}{r} 23.04 \\ + 5.36 \\ \hline 0.80 \\ \hline 29.20 \\ \hline 11 \end{array}$$

Empty decimal places can be filled with zero to show the place value in each column. Say '3 tenths add 8 tenths' to reinforce place

Children should have an understanding of the place value of **tenths and hundredths** and use this to align the digits. Numbers with different numbers of decimal places should be used.

Key vocabulary: add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, plus, addition, column, tens boundary, hundreds boundary, increase, vertical, 'carry' expanded, compact, thousands, hundreds, digits, inverse.

Links to the curriculum:

- ✓ Select most appropriate method: mental, jottings or written and explain why.
- ✓ Recognise the place value of each digit in a four-digit number.
- ✓ Round any number to the nearest 10, 100 or 1000.
- ✓ Estimate and use inverse operations to check answers.
- ✓ Solve 2-step problems in context, deciding which operations and methods to use and why.
- ✓ Find 1000 more or less than a given number.
- ✓ Continue to practise a wide range of mental addition strategies, ie. number bonds, add the nearest multiple of 10, 100, 1000 and adjust, use near doubles, partitioning and recombining.
- ✓ Add numbers with up to 4 digits using the formal written method of column addition
- ✓ Solve 2-step problems in contexts, deciding which operations and methods to use and why.
- ✓ Estimate and use inverse operations to check answers to a calculation.

Addition

+ Year 5 +

Number lines- see mental calculation grid

Addition using exchange

Add numbers with more than 4 digits

(including money, measures and decimals with different numbers of decimal places).

4	4	5	7	1	
+	2	3	6	2	
<hr/>					
4	6	9	3	3	
					1

Numbers should exceed four digits

Pupils should be able to add more than two values, carefully aligning place value columns.

Key vocabulary: add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, plus, addition, column, tens boundary, hundreds boundary, increase, 'carry', expanded, compact, vertical, thousands, hundreds, digits, inverse & decimal places, decimal point, tenths, hundredths, thousandths.

Links to the curriculum:

- ✓ Add numbers mentally with increasingly large numbers, using and practising a range of mental strategies ie. add the nearest multiple of 10, 100, 100 and adjust; use near doubles, inverse, partitioning and re-combining; using number bonds.
- ✓ Use rounding to check answers and accuracy.
- ✓ Solve multi-step problems in contexts, deciding which operations and methods to use and why.
- ✓ Read, write, order and compare numbers to at least 1 million and determine the value of each digit.
- ✓ Round any number up to 1 000 000 to the nearest 10, 100, 1000, 10 000 and 100 000.
- ✓ Add numbers with more than 4 digits using formal written method of columnar addition.

Addition

+ Year 6 +

Add several numbers of increasing complexity

Adding several numbers with different numbers of decimal places (including money and measures):

- ✓ Tenths, hundredths and thousandths should be correctly aligned, with the decimal point lined up vertically (including in the answer row).
- ✓ Zeros could be added into any empty decimal places, to show there is no value to add.

A handwritten addition problem on a grid background. The numbers are 43.471, 06.040, and 02.300. They are aligned vertically with their decimal points. The sum is 89.361. The numbers are written in green ink.

$$\begin{array}{r} 43.471 \\ 06.040 \\ + 02.300 \\ \hline 89.361 \end{array}$$

A handwritten addition problem on a grid background. The numbers are 73,034, 4,863, 14,201, and 30,155. They are aligned vertically. The sum is 122,253. The numbers are written in black ink.

$$\begin{array}{r} 73,034 \\ 4,863 \\ + 14,201 \\ 30,155 \\ \hline 122,253 \end{array}$$

This is an example of adding several numbers with more than 4 digits.

Key vocabulary: add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, plus, addition, column, tens boundary, hundreds boundary, increase, 'carry', expanded, compact, vertical, thousands, hundreds, digits, inverse, decimal places, decimal point, tenths, hundredths, thousandths.

Links to the curriculum:

- ✓ Perform mental calculations, including with mixed operations and large numbers, using and practising a range of mental strategies.
- ✓ Solve multi-step problems in context, deciding which operations and methods to use and why.
- ✓ Use estimation to check answers to calculations and determine, in the context of a problem, levels of accuracy.
- ✓ Read, write, order and compare numbers up to 10 million and determine the value of each digit.
- ✓ Round any whole number to a required degree of accuracy.
- ✓ Pupils understand how to add mentally with larger numbers and calculations of increasing complexity.

Subtraction

- Foundation Stage -

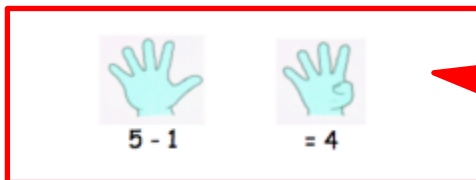
Progression of calculation

O - O (take away structure)

1 less than a given number: First from 1 - 5, moving to 1 - 10 and finally 1 - 20

O - O (comparison structure, finding the difference, "how many more ...; "how many less ...")

Written recording



Make a record in counters, dienes words, or fingers of subtraction activities already carried out. Children progress to record in numbers and symbols. e.g. $6 - 3 = 3$

Children use number lines, tracks to find one less and support with counting back. (see addition)

Teacher demonstrates how to record counting back on a number line.

Children use objects and coins to help them to compare objects and state how many more or less.
E.g. "Six is two more than four."

Expectations:

Can find one less than a given number.

Can estimate how many objects they can see and check by counting.

Use the language 'fewer' to compare two sets of objects.

Through games, songs and practical activities children begin to use vocabulary of subtraction.

Use fingers and practical equipment to calculate.

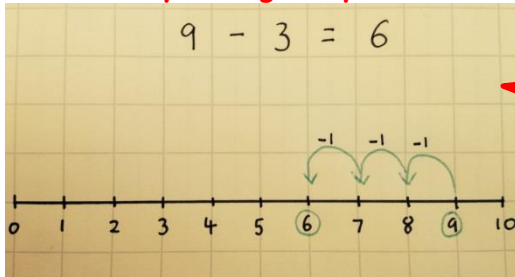
Subtraction

- Year 1 -

Subtract from numbers up to 20

- ✓ Children consolidate understanding of subtraction practically, showing subtraction on bead strings, using cubes etc. and in familiar contexts, and are introduced to more formal recording using number lines as below.
- ✓ Read, write and interpret number sentences with - and = signs.

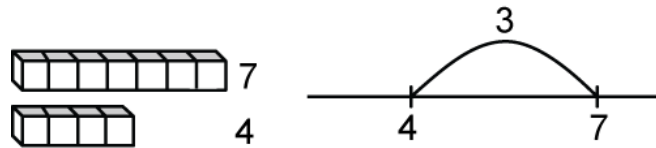
Subtract by taking away:



Count back in ones on a number number line to take away (with numbers up to 20).
Model subtraction using practical equipment such as 100 squares.

Subtract by finding the 'distance between':

This should be introduced practically with the language 'find the distance between' and 'how many more?' in a range of familiar contexts.



The difference between 7 and 4 is 3.

Mental subtraction:

Children should start recalling subtraction facts up to **and within** 10 and 20, and should be able to subtract zero.

Exchange:

Play **exchange games** and know that you can exchange 10-ones for one ten and vice versa - using dienes and money (1p's and 10p's)

Key vocabulary: equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer / less than, most, least, count back, how many left, how much less is_?

Links to the curriculum:

- ✓ Given a number, say **one more or one less**.
- ✓ Count to and over 100, **forward and back**, from any number.
- ✓ Represent and use **subtraction facts to 20 and within 20**.
- ✓ Subtract with **one-digit and two-digit** numbers to 20, including zero.
- ✓ Solve one-step problems that involve addition and subtraction, using concrete objects (ie bead string, objects, cubes) and pictures, and missing number problems.
- ✓ Read and write numbers from 0 to 20 in numerals and words.

Subtraction

- Year 2 -

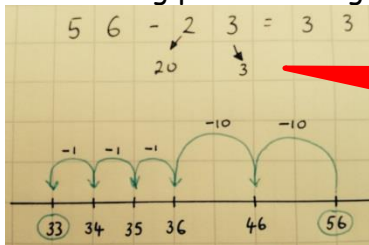
Subtract with 2-digit numbers

Subtract on a number line by counting back, aiming to develop mental subtraction skills. This area of learning consists of three phases.

In calculations where exchange would be required, eg $53-14$, children should be taught to draw their own number line to calculate the answer and record this as a vertical or horizontal number sentence/

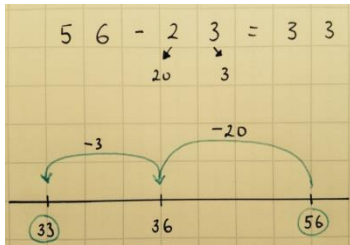
Phase 1

Subtracting pairs of 2-digit numbers on a number line:



Partition the second number and subtract it in tens and ones.

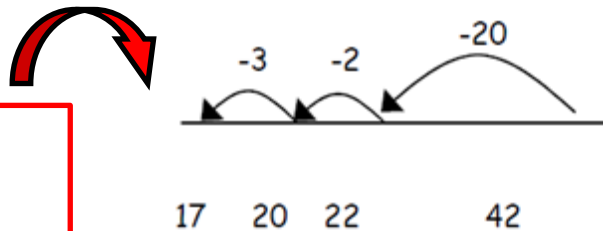
Phase 2



Children should progress to more **efficient** jumps back. Combine this method with use of a hundred square to reinforce understanding of number value and order.

Phase 3

The final phase involves the children understanding how to bridge through 10. For example $42-25 = 17$



Mental strategy

Subtract numbers close together by **counting on**:

Children are taught to recognise that when numbers are close together, it is more efficient to **count on the difference**. They need to be clear about the relationship between addition and subtraction (to recognise the inverse of addition and subtraction).

Key vocabulary: equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer / less than, most, least, count back, how many left, how much less is _? the difference, count on, strategy, partition, tens, ones.

Links to the curriculum:

- ✓ Recognise the place value of each digit in a two-digit number.
- ✓ Recall and use subtraction facts to 20 fluently, and derive and use related facts up to 100.
- ✓ Subtract using concrete objects, pictorial representations, 100 squares and mentally, including: a two-digit number and ones, a two-digit number and tens, and two two-digit numbers.
- ✓ Show that subtraction of one number from another cannot be done in any order.
- ✓ Recognise and use inverse relationship between addition and subtraction, using this to check calculations and missing number problems.
- ✓ Solve simple addition and subtraction problems including measures, using concrete objects, pictorial representation, and also applying their increasing knowledge of mental and written methods.
- ✓ Read and write numbers to at least 100 in numerals and in words.

Subtraction

- Year 3 -

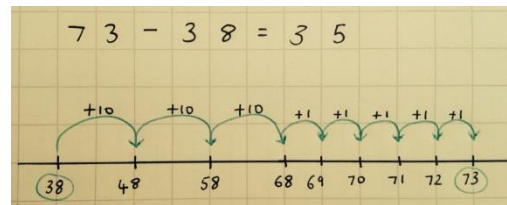
Subtracting with 2 and 3-digit numbers.

Number lines

See mental calculation grid

As in Year 2 the 'counting on' strategy is an efficient method when finding the difference between **close-together** numbers.

The children should start at the smaller number and count on in **tens** first, then count on in ones to find the rest of the difference.



Using exchange- towards formal written methods

The children should be introduced to the **partitioned column subtraction** method. This area of learning consists of three phases and is modelled using dienes blocks

Phase 1

(Partitioned column subtraction- **no** exchanging required)

$$\begin{array}{r} 75 - 23 = 52 \\ 70 + 5 \\ - 20 + 3 \\ \hline 50 + 2 = 52 \end{array}$$

Partition the numbers and then start by subtracting the ones first.

Phase 2

(Partitioned column subtraction- **with** exchanging)

$$\begin{array}{r} 72 - 47 = 25 \\ 60 + 1 \\ \cancel{70} + 2 \\ - 40 + 7 \\ \hline 20 + 5 \\ \hline = 25 \end{array}$$

Before subtracting '7' from the 72 blocks, they will need to exchange a row of 10 for ten units. Then subtract 7 ones, and subtract 4 tens.

$$72 - 47$$



Phase 3

(Partitioned column subtraction- with 2 and 3-digit numbers)

$$\begin{array}{r} 336 - 142 = \\ 200 + 100 + 6 \\ \cancel{300} + 30 + 6 \\ - 100 + 40 + 2 \\ \hline 100 + 90 + 8 \\ \hline = 198 \end{array}$$

The 'exchanging' method is the same as in phase 2, however this time the exchange has occurred between the hundreds and the tens.

Key vocabulary: equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer / less than, most, least, count back , how many left, how much less is_? difference, count on, strategy, partition, tens, ones, exchange, decrease, hundreds, value, digit.

Links to the curriculum:

- ✓ Subtract mentally a: **3-digit number and ones, 3-digit number and tens, 3-digit number and hundreds** .
- ✓ Estimate answers and use inverse operations to check.
- ✓ Solve problems, including missing number problems.
- ✓ Find 10 or 100 more or less than a given number.
- ✓ Recognise the place value of each digit in a 3-digit number .
- ✓ Counting up differences as a mental strategy when numbers are close together or near multiples of 10
- ✓ Read and write numbers up to 1000 in numerals and words.
- ✓ Practise mental subtraction strategies, such as subtracting near multiples of 10 and adjusting (e.g. subtracting 19 or 21), and select most appropriate methods to subtract, explaining why.

Video explanations:

1. [What is the most efficient method?](#)
2. [Partitioned column subtraction method \(from practical to written method\).](#)

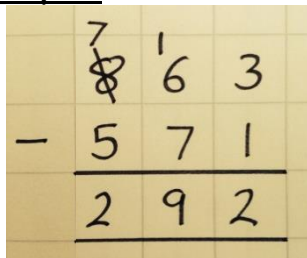
Subtraction

- Year 4 -

Subtract with up to 4-digit numbers

Column subtraction with 'exchanging' using 3d numbers
see appendix

Compact column subtraction.



	7	6	3
-	5	7	1
	2	9	2

When introducing the compact method to the children, ask them to perform a partitioned column subtraction calculation and then display the compact subtraction method. Ask the children to distinguish the differences and similarities between the two. This method should be applied to money and various units of measure.

Extend to 4 digit numbers, and decimals in the context of money

Key vocabulary: equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer / less than, most, least, count back, how many left, how much less is_? The difference, count on, strategy, partition, tens, units exchange, decrease, hundreds, value, digit, inverse.

Links to the curriculum:

- ✓ Subtract by counting on where numbers are close together or they are near to multiples of 10, 100 etc.
- ✓ Children select the most appropriate and efficient methods for given subtraction calculations.
- ✓ Estimate and use inverse operations to check answers.
- ✓ Solve addition and subtraction 2-step problems, choosing which operations and methods to use and why.
- ✓ Solve simple measure and money problems involving fractions and decimals to two decimal places.
- ✓ Find 1000 more or less than a given number.
- ✓ Count backwards through zero, including negative numbers.
- ✓ Recognise place value of each digit in a 4-digit number Round any number to the nearest 10, 100 or 1000
- ✓ Solve number and practical problems that involve the above, with increasingly large positive numbers.

Video explanation: [Progression to the compact column subtraction method.](#)

Subtraction

- Year 5 -

Subtract with bigger and smaller numbers

(including money, measures, decimals).

Compact column subtraction

(with larger integers and 'exchanging').

	2	1	0	5	6
-		2	1	2	8
<hr/>					
	2	8	9	2	8



	7	1	6	9	·	0
-		3	7	2	·	5
<hr/>						
	6	7	9	6	·	5

Add a 'zero' in any empty decimal places to aid understanding of what to subtract in that column.

Create lots of opportunities for subtracting and finding differences with money and measures!

Key vocabulary:

equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer / less than, most, least, count back, how many left, how much less is_? difference, count on, strategy, partition, tens, ones, exchange, decrease, hundreds, value, digit, inverse, tenths, hundredths, decimal point, decimal.

Links to the curriculum:

- ✓ Subtract numbers mentally with increasingly large numbers .
- ✓ Use rounding and estimation to check answers to calculations and determine, in a range of contexts, levels of accuracy .
- ✓ Solve addition and subtraction multi-step problems in context, deciding which operations and methods to use and why.
- ✓ Read, write, order and compare numbers to at least 1 million and determine the value of each digit.
- ✓ Count forwards or backwards in steps of powers of 10 for any given number up to 1 million.
- ✓ Interpret negative numbers in context, counting forwards and backwards with positive and negative integers through 0.
- ✓ Round any number up to 1 million to the nearest 10, 100, 1000, 10 000 and 100 000.

Subtraction

- Year 6 -

Subtracting with increasingly large and more complex numbers and decimal values.

$$\begin{array}{r}
 \cancel{9}^{\text{th}} \cancel{5}^{\text{th}} \cancel{10}^{\text{th}} \text{,} 6 \text{ } 9 \text{ } 9 \\
 - \quad \quad 8 \text{ } 9 \text{,} 9 \text{ } 4 \text{ } 9 \\
 \hline
 \quad \quad 6 \text{ } 0 \text{,} 7 \text{ } 5 \text{ } 0
 \end{array}$$

Using the compact column method to subtract more complex integers



$$\begin{array}{r}
 \cancel{7}^{\text{th}} \cancel{10}^{\text{th}} \text{ } 5 \text{ } \cdot \quad \cancel{4}^{\text{th}} \text{ } 1 \text{ } 9 \text{ } \text{kg} \\
 - \quad \quad 3 \text{ } 6 \text{ } \cdot \quad 0 \text{ } 8 \text{ } \text{kg} \\
 \hline
 \quad \quad 6 \text{ } 9 \text{ } \cdot \quad 3 \text{ } 3 \text{ } 9 \text{ } \text{kg}
 \end{array}$$

Using the compact column method to subtract money and measures, including decimals with different numbers of decimal places.

Mental Strategy:

Pupils should be able to apply their knowledge of a range of mental strategies, mental recall skills, and informal and formal written methods when selecting **the most appropriate method** to work out subtraction problems.

Key vocabulary:

equal to, take, take away, less, minus, subtract, leaves, dis-tance between, how many more, how many fewer / less than, most, least, count back , how many left, how much less is_? difference, count on, strategy, partition, tens, ones, exchange, decrease, hundreds, value, digit, inverse, tenths, hundredths, decimal point, decimal.

Links to the Curriculum:

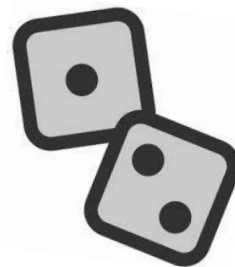
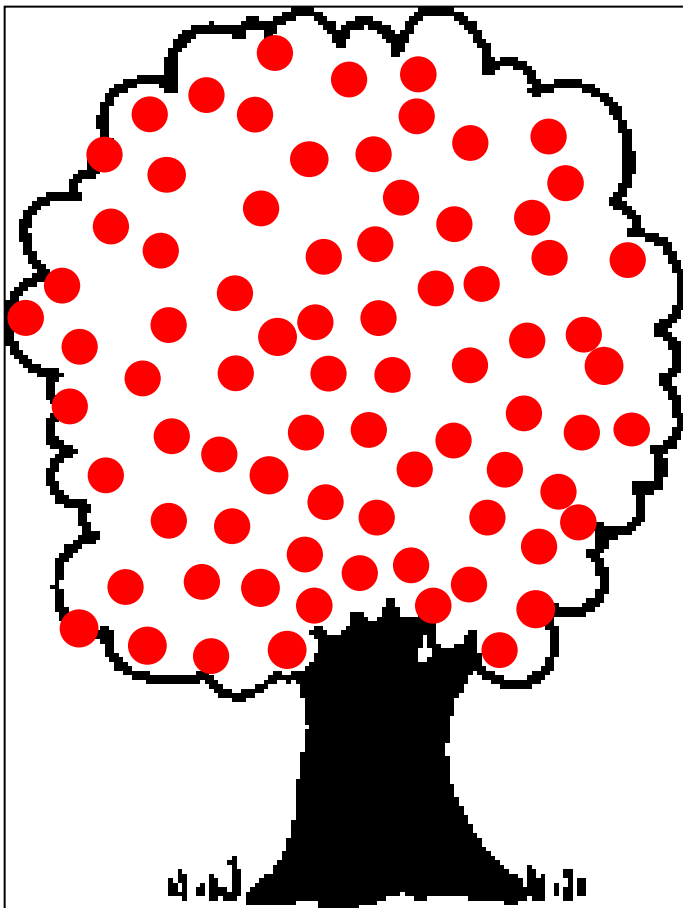
- ✓ Solve addition and subtraction multi-step problems in context, deciding which operations and methods to use and why.
- ✓ Read, write, order and compare numbers up to 10 million and determine the value of each digit
- ✓ Round any whole number to a required degree of accuracy
- ✓ Use negative numbers in context, and calculate intervals across zero.
- ✓ Children need to utilise and consider a range of mental subtraction strategies, jottings and written methods before choosing how to calculate.

EXCHANGE GAMES TO SUPPORT EARLIER UNDERSTANDING

CHERRY TREE GAME

The children need:-

- a large 'cherry tree' picture with red counters on (cherries!),
- some 'bags' (small envelopes)
- and a 121212 dice
- some small boxes for the 'Next Steps'.



The children work in pairs or a small group.

They take turns to roll the dice and 'pick' cherries from the tree.

When the children have 3 cherries they put them in a bag.

The first player with 3 'bags' is the winner.

Next steps

- If the children can concentrate for a slightly longer game, they continue collecting cherries. When they have three bags, they can put them in a box. This time, the winner is the first player to collect enough cherries for three boxes.
- The children can play the game with the rule of 4 or 5 instead of 3.

Key ideas for this activity:-

- Incrementation.
- Counting

MONEY IN PURSES

For this game the children need:

- lots of pennies
- some purses.



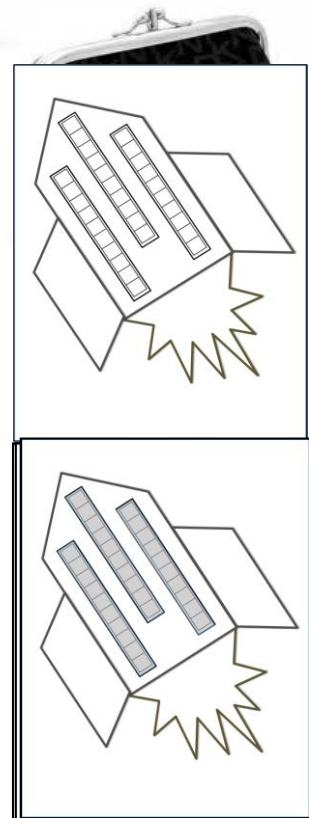
The children work in a small group with an adult, or in groups of 2 or 3. Ask them to take turns to count out ten pennies and put them in a purse. Each purse has only ten pennies

Next steps

This activity can turn into a game by asking the children to roll a dice and collect pennies. When they have ten pennies, they can collect a purse to put them in. The winner is the person who has the most money, or the most full purses when the teacher says stop.

Key ideas for this activity:-

- Developing an understanding of the importance of 10.
- Counting up to ten objects.
- Recognising pennies.
- Turn taking



ROCKET GAME

The children need:-

- a rocket game board each (fig 1).
- Base 10 equipment
- a dice

The children work in pairs or small groups.

fig. 1

They take turns to:

- roll the dice
- collect that number of ones
- place them on the fire at the base of the rocket
(In fig 2, 5 has been rolled).

fig. 2

- When a player has ten or more ones, they can be exchanged for a ten-stick (In fig.3, 6 has been rolled, and then ten ones have been exchanged for one ten). The ten-stick can be placed on the rocket to make one of the windows.

fig. 3

The first player to fill the three the ten-spaces on their rocket, wins the game.

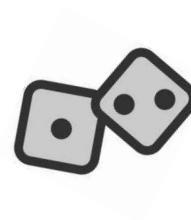
Next Steps

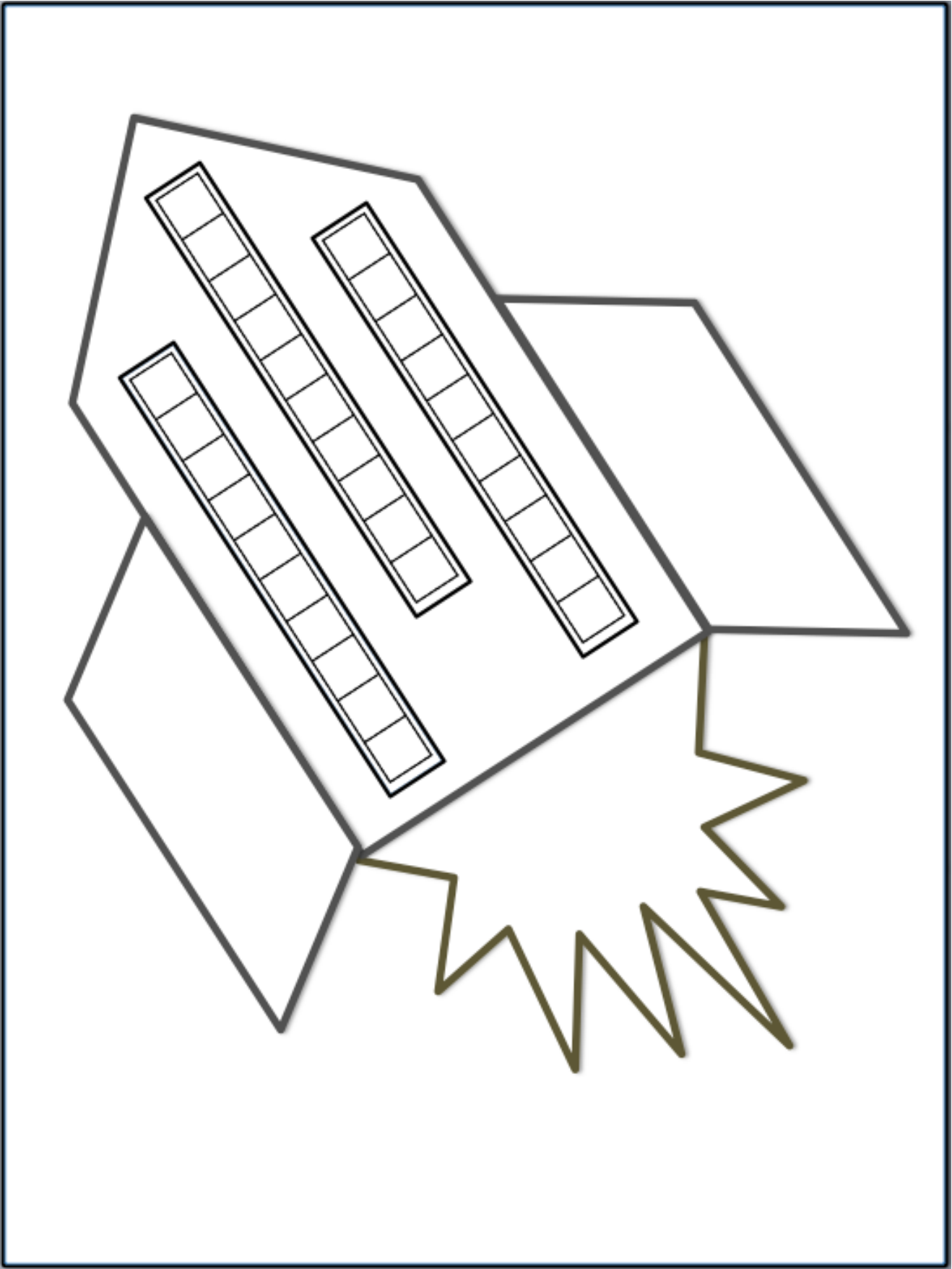
- After each turn, ask the children to say how much they have.
For example, 'I have one ten and one unit, that's 11'
- Ask the children to play the game in reverse.
Begin the game with 3 tens (fig.4), roll the dice and return the number of ones.
(Actually, it is easier to begin with 3 tens and 5 ones, because you do not necessarily have to begin by exchanging the ten for ten ones!)

fig. 4

Key ideas for this activity:-

- Developing an understanding of the importance of 10.
- Counting up to ten objects.
- Recognising pennies.





Rocket Game Board

THE EXCHANGE GAME- USING BASE 10 MATERIALS

Players need to work in small groups (2-4)

Each player needs a game board like this

(A3 is a good size for the HTU (hundreds, tens ones) board)

They need one or two dice to share and some Base 10 materials:

H	T	O


or

T	O


Players take turns to:

- roll the dice
- collect that number of ones and place them in the ones (U) part of their game board
- any time they have ten (or more) ones in that column, ten must be exchanged for a ten stick, which is placed in the tens (T) column



For example,

H	T	O
		

Turn 1 5 is rolled on the dice

H	T	O
		

Turn 2.... 3 is rolled on the dice

H	T	O
		

Turn 3.... 6 is rolled on the dice

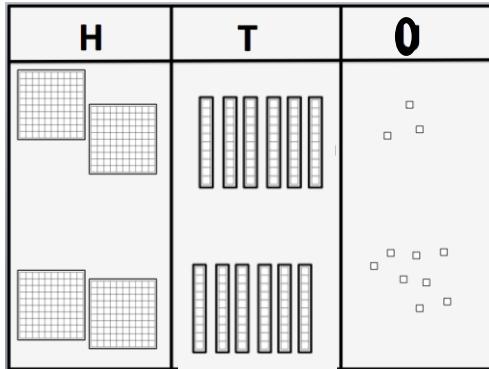
... and so on. The winner is the player with the highest total, when the teacher says 'STOP'.

- **PLAY THE GAME IN REVERSE.** Whatever is rolled on the dice needs to be put back, which may involve exchanging hundreds for tens or tens for ones.
- Record the reverse game, first in their own way, then as number sentences

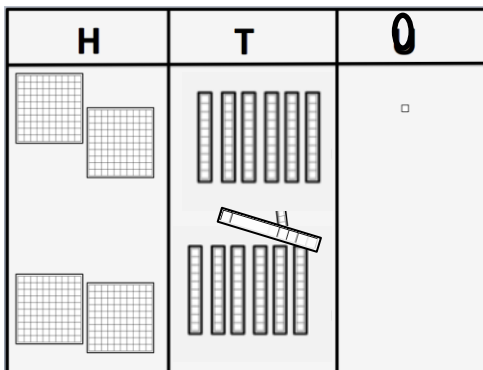
ADDITION USING BASE 10 MATERIALS AND THE CORRESPONDING LANGUAGE AND RECORDING

It will help secure the children's understanding if:-

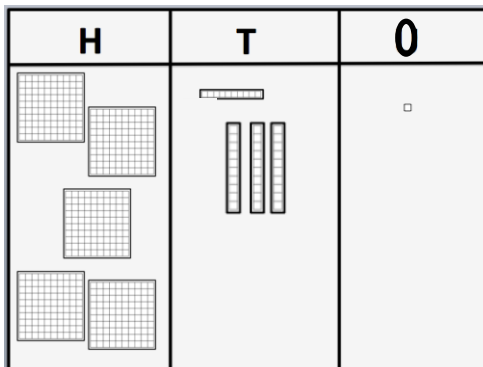
- *all supporting adults use the same language for these calculations.*
- *the same language is used even when the children no longer need/use the Base 10 materials.*
- *teachers clarify the language for some children using other words if necessary.*



For example: $263 + 268 =$



*"8 plus 3 equals 11 ones.
Exchange ten of the ones for a
ten stick.
Put the ten in the tens
column, and the one stays in
the ones column"*



*"6 tens plus 6 tens equals 12
tens, plus the extra ten,
equals 13 tens.*

*Exchange ten of the ten-sticks
for a 100 block
Put the 100 block in the
hundreds column, and the
three tens stay in the tens
column."*

*"2 hundreds plus 2 hundreds,
plus the extra hundred makes*

*5 hundreds.
The total is 531"*

$$\begin{array}{r} 263 + \\ 268 \\ \hline \end{array}$$

$$\begin{array}{r} 263 + \\ 268 \\ \hline 1 \\ \hline 1 \end{array}$$










$$\begin{array}{r} 263 + \\ 268 \\ \hline 31 \\ \hline 1 \quad 1 \end{array}$$

$$\begin{array}{r} 263 + \\ 268 \\ \hline 531 \\ \hline 1 \quad 1 \end{array}$$








ADDITION USING MONEY AND THE CORRESPONDING LANGUAGE AND RECORDING

It will help secure the children's understanding if:-





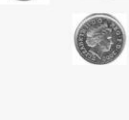

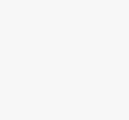
- *all supporting adults use the same language for these calculations.*
- *the same language is used even when the children no longer need/use the coins*
- *teachers clarify the language for some children using other words if necessary.*

£	10p	p
		
		
		

For example:
£2.63 + £2.68 =

£	10p	p
		
		
		

*"8p plus 3p equals 11 p.
Exchange ten pennies for a
10p coin.
Put the 10p in the ten pence
column, and the penny stays in
the pence column"*

£	10p	p
		
		
		

*"Six 10p's plus six 10p's equals
twelve 10p's, plus the extra
10p, equals thirteen 10p's.
Exchange ten of the 10p's for a
£1 coin.
Put the £1 coin in the £ column,
and the three 10p's stay in the
10p column."*

*"£2 plus £2, plus the extra £1
makes £5."*

The total is £5.31"

$$\begin{array}{r} 2.63 + \\ \underline{2.68} \end{array}$$

$$\begin{array}{r} 2.63 + \\ \underline{2.68} \\ \hline \end{array}$$

$$\begin{array}{r} 2.63 + \\ \underline{2.68} \\ \hline .31 \\ \hline \end{array}$$

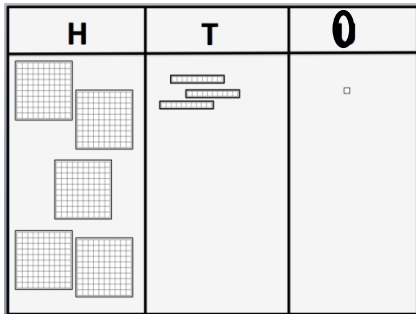
$$\begin{array}{r} 2.63 + \\ \underline{2.68} \\ \hline 5.31 \\ \hline \end{array}$$

£ 5.31

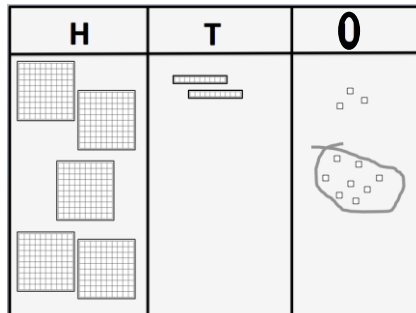
SUBTRACTION USING BASE 10 MATERIALS AND THE CORRESPONDING LANGUAGE AND RECORDING

It will help secure the children's understanding if:-

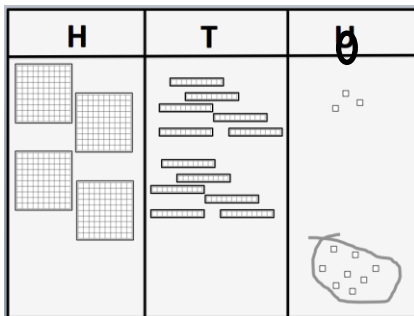
- *all supporting adults use the same language for these calculations.*
- *the same language is used even when the children no longer need/use the Base 10 materials.*
- *teachers clarify the language for some children using other words if necessary.*



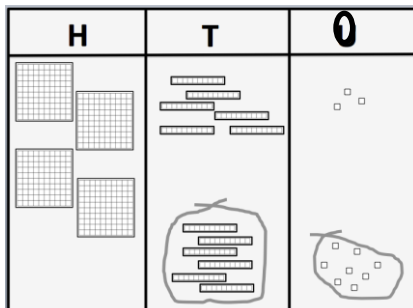
For example 531-268
Using the 'take away' model
of subtraction
"Start with the ones
It isn't possible to take 8 ones"



"So one of the tens sticks
must be exchanged for ten
ones.
Now 8 ones can be taken
away, leaving three."



"It isn't possible to take 6 tens
away, so one of the hundred
blocks must be exchanged for
ten ten-sticks."



"Now 6 tens can be taken,
leaving six."

"Two hundreds can be
removed, leaving 2
hundreds.
There are 263 left"

$$\begin{array}{r} 531 - \\ \underline{268} \end{array}$$

$$\begin{array}{r} 531 - \\ \underline{268} \\ 3 \end{array}$$

$$\begin{array}{r} 4 \overset{12}{\cancel{5}} \overset{3}{\cancel{3}} 1 - \\ \underline{268} \\ 3 \end{array}$$

$$\begin{array}{r} 4 \overset{12}{\cancel{5}} \overset{3}{\cancel{3}} 1 - \\ \underline{268} \\ 63 \end{array}$$

$$\begin{array}{r} 4 \overset{12}{\cancel{5}} \overset{3}{\cancel{3}} 1 - \\ \underline{268} \\ 263 \end{array}$$

SUBTRACTION USING MONEY AND THE CORRESPONDING LANGUAGE AND RECORDING

It will help secure the children's understanding if:-

- *all supporting adults use the same language for these calculations.*
- *the same language is used even when the children no longer need/use the money*
- *teachers clarify the language for some children using other words if necessary.*

£	10p	p

For example £5.31-£2.68
Using the 'take away' model of subtraction
"Start with the pennies.
It isn't possible to take 8 pence"

£	10p	p

"One of the 10p pieces must be exchanged for ten pennies.
Now 8 pennies can be taken away, leaving 3p"

£	10p	p

"It isn't possible to take 6 10p's away, so one of the £1 coins must be exchanged for ten 10p's."

£	10p	p

"Now six 10p's can be taken, leaving 60p."

£	10p	p

"£2 can be removed, leaving £2.
There is £2.63 left"

$$\begin{array}{r} 5.31 - \\ 2.68 \\ \hline \end{array}$$

$$\begin{array}{r} 5.31 - \\ 2.68 \\ \hline 3 \end{array}$$

$$\begin{array}{r} 4.31 - \\ 2.68 \\ \hline 3 \end{array}$$

$$\begin{array}{r} 4.31 - \\ 2.68 \\ \hline .63 \end{array}$$

$$\begin{array}{r} 4.31 - \\ 2.68 \\ \hline 2.63 \end{array}$$

f 2.63 July, 20

