Policy No: 47

A POLICY FOR MATHEMATICS

Rationale

Mathematics is an integral part of everyday life at Alderley Edge Community Primary School (AECPS). We believe that children should enjoy maths and have the highest quality provision to prepare them for all maths experiences. The children have one hour of maths 5 days a week and 20 minutes of fluency 4 days a week as well as mathematical experiences in other subject areas.

Maths experiences should satisfy children's natural curiosity in an exciting and stimulating way.

"*Mathematical understanding is a journey... not a destination*"

Dr Yeap Ban Har

Curriculum Intent

At Alderley Edge Community Primary School we believe that the children deserve a broad and ambitious maths curriculum, rich in skills and knowledge, which ignites curiosity and prepares them well for future learning or employment. We aim to deliver a maths curriculum that is of outstanding quality to raise the progress and attainment of all our pupils. We believe every child can master an understanding and love of maths with the right kind of teaching and support. Our long-term aim is to produce an ambitious, connected curriculum accessible to all pupils in school right through from Reception to the end of Year 6. Our intention is that maths also fully supports our core drivers of academic excellence, life-long learning, possibilities and risks and social intelligence so that the children are equipped to carry on learning beyond their primary education. Through maths we will develop the children's creativity and cross curricular learning to engage children and enrich their experiences in school.

Curriculum Implementation - Introduction

Maths underpins our daily lives. It is a subject of vital importance as with the speed and scale of technological change, it makes mathematics increasingly essential. At AECPS we use the Singapore method of teaching maths which develops pupils' mathematical ability and confidence, making maths more engaging and interesting.

'Maths No-Problem!' textbooks and workbooks are used across years 1-6. 'Maths – No Problem!' is a series of textbooks and workbooks written to meet the requirements of the 2014 English National Curriculum.

The 'Maths No-Problem!' Primary Series has been assessed by the DfE's expert panel, which judged that it and one other text book (Power Maths) met the core criteria for a high-quality textbook to support teaching for mastery. As a result, the 'Maths – No Problem' primary series is only one of two recommended textbooks for schools on the maths mastery programme.

We follow the whole programme of Singapore Maths ensuring that every element is adhered to. Each lesson follows a pattern including; focus task which includes time to journal, exploring and sharing methods, lets learn and guided practice using text books and independent work using workbooks.

What is Maths Mastery?

Maths Mastery concentrates on problem solving skills – using equipment like building blocks to find answers. Under the Singapore system, teachers generally do not split their pupils into different ability groups. Instead, they wait for academically weaker pupils to reach basic standard in each topic before the class moves on to the next concept. The 'more able' pupils study the topic in greater depth gaining greater depth of knowledge. In addition, the Singapore system concentrates more on developing problem solving skills rather than mental arithmetic.

At AECPS, we believe the child must be at the centre of the learning process, important that they understand the processes they are using and are able to apply them in unfamiliar situations. They should become **fluent** in the fundamentals of mathematics so that they develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately. They need to be able to **reason mathematically** and **solve problems** by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication.

Transferring Pedagogy into Classroom Practice.

The Singapore Maths perspective approach to teaching ensures that all the concepts and skills are taught following the same format. Lessons follow the **concrete–pictorial-abstract** pedagogy. Clear and engaging visuals are used to present concepts, and to model solutions that allow pupils, regardless of language skills, to focus on the maths.

The concrete–pictorial–abstract sequence helps students build understanding of mathematical processes. Take a simple multiplication problem – for example 3 x 4.

- ✓ **Concrete**: Students count out with blocks or rods three lots of four. This stage is concrete and tangible.
- ✓ **Pictorial**: In this stage, rather than hold objects in their hands, children draw them in an exercise book, or on whiteboards.
- ✓ **Abstract**: Finally, the support is removed, and students start to perform the calculation in the abstract. This is when problem solving comes into play – students need to manipulate information quickly. If the problem is too difficult they can fall back on the pictorial; if that is also too hard they go right back to the concrete.

There are 4 key areas of learning in maths

- ✓ Using and Applying
- ✓ Number
- ✓ Shape and Space
- ✓ Data Handling

Children work in whole class, group and individual situations with support from adults and peers. There are many opportunities to problem solve, use real life situations and have hands on experiences to help children understand numerical concepts and learn to enjoy maths. At AECPS, children learn cooperatively. We promote, and teach, good learning partner work.

Children are assessed regularly and teaching and learning is based on what teachers know of the children's abilities. However, most importantly, children are encouraged to investigate, ask questions and enjoy their maths experience.

Aims of Singapore Maths at AECPS:

1. To ensure students develop their conceptual, procedural and higher-order thinking in every lesson through:
      (a) Emphasising visualisation and model drawing.
      (b) Introducing a structured approach to problem solving.

2. To improve the quality and consistency of maths teaching by:
      (a) Using research-based teaching materials and lesson plans.
      (b) Developing a new lesson structure to meet the needs of every child and implementing it across the school.
      (c) Improving Assessment for Learning.
      (d) Developing questioning, speaking and listening, and links with literacy.
      (e) Providing coaching and staff training.

Purpose

Maths is a creative and highly inter-connected discipline that has been developed over centuries. It is essential to everyday life, critical to science, technology and engineering, and necessary for financial literacy and most forms of employment.

Therefore, we will:

- ✓ equip children to think for themselves. This will be achieved by providing opportunities for the explanation of the order, pattern and relationships, which form the basis of maths learning.
- ✓ provide enjoyment and build enthusiasm, an appreciation of the beauty and power of maths, a sense of curiosity, confidence, and competence which are essential for being numerate.
- ✓ use practical activities and through their application to develop skills in calculation.
- ✓ ensure that children are guided and taught to select and use appropriate materials for their tasks.
- ✓ recognise that discussing maths is an activity in its own right, its purpose is to clarify and communicate ideas.
- ✓ provide mathematical experiences which are open ended and have a variety of approaches and outcomes. These offer a chance for all children to succeed.
- ✓ give continuity of experience for each child. We endeavor to evaluate their needs continuously and use many strategies for learning.

Early Years Foundation Stage

In the Early Years Foundation Stage (EYFS) your child will be working with numbers formally or informally every day and will start to explore ideas such as counting, measuring and using mathematical language. An interest in maths, numbers, and problem solving can be encouraged early in a child's life through maths games and fun activities. Often maths will be linked to real-life contexts. Children will use resources such as counters, beads and blocks to work out a calculation.

Maths in EYFS involves providing children opportunities to practice and improve their skills in counting numbers, calculating simple addition problems, and to describe shape, space and measures. It is organised to develop and promote vocabulary, social skills and mathematical understanding of young children through:
- ➤ stories
- ➤ rhymes and finger games
- ➤ board games
- ➤ sand and water
- ➤ construction on a large and small scale
- ➤ imaginative play and 'playground' games

- cooking and shopping
- two- and three-dimensional creative work with a range of materials
- observing numbers and patterns in the environment and daily routines

The Early Learning Goals have all been incorporated within the EYFS objectives. These objectives are all embedded within the Specific Areas of Learning: Numbers, Numerical Pattern and Measures, that form part of the EYFS Profile. Children still have exposure to shape, space and measure even though they are not part of the Early Learning Goal.

We will prepare children, by the end of EYFS, for the dedicated maths lesson of 1 hour plus 20 minutes of fluency, that is part of each day in year 1.

Key Stage 1 and 2 – See a Singapore approach in methods of calculation below.

Teaching Time

The daily maths lesson lasts 1 hour in KS1 and KS2 for 5 days a week with a 20-minute fluency session 4 mornings a week. There is also 15-minute intervention session 5 days a week for selected pupils.

Homework

Weekly homework is set in both key stages 1 and 2 to extend opportunities provided in class. The homework policy gives guidance in this matter. Where appropriate, teachers will set 'MyMaths' for homework.

'MyMaths' is an interactive online teaching and homework subscription website for schools that builds pupil engagement and consolidates maths knowledge. Approximately four million students use it in over 70 countries each year! 'MyMaths' has proven to be a popular resource for teachers and children at AECPS.

On other occasions teachers will set individual, targeted homework with particular reference to the 'Maths No-Problem!' workbook, this will enable the children to consolidate specific learning from the classroom.

Expectations
The 1-hour maths lesson per day is structured into 3 main parts as outlined below –

Part 1 – Anchor/Journal 30 minutes
10 minutes - concrete/exploring
10 minutes - methods on the flip chart
10 minutes - journaling with learning partner

Part 2 – Text Book 10 minutes
10 minutes 'Let's Learn'

Part 3 – Practice guided and independent 20 minutes
10 minutes - guided, text book
10 minutes - independent, work book

Language

It is important that the language of maths is consistent throughout the school 'sums' should be used only when children are adding. All other strategies should be talked of as calculations or equations.

In EYFS, these will also be referred to as number/story sentences.

Ones will be used in place value instead of the term Units and recorded as O's, and 'place holder' used when multiplying and moving digits.

Assessment

Assessment should exist at 3 levels:
1. Short term assessment
2. Medium term assessment
3. Long term assessment

Assessment

Short-term assessments are an informal part of every lesson. They are closely matched to the learning objectives. There are two main ways to make them:

➢ During every lesson, when teachers react to children's responses.
➢ At intervals, to supplement daily observations.

Children should be given some responsibility for their own assessments. Peer assessment and self-assessment is also an effective learning tool child use traffic lights next to WALTs to indicate their understanding.

Short-term assessments need to be recorded through annotations of the Short-Term plans. Teachers need to keep their own informal jottings.

Marking

Marking should be in line with our marking policy. Teachers should mark in time for the next lesson for the benefit of the children. If verbal feedback is given to a child, *VF* should be noted on their work. There is evidence that verbal feedback is the most powerful tool for learning.

Medium term assessments are to:

➢ Review and record the progress children are making over time in relation to the key objectives, what they know and can do, whether they can apply their skills in a new context, and whether any weaknesses remain.
➢ They identify children's progress against specific individual targets.
➢ They provide information to feed into end-of-year assessments.

Teachers use classroom monitor curriculum grids as a record of progress and attainment levels. These records are passed on to the next teacher at the end of the year.

Long-term assessments are important in each year group, not just at the end of each key stage.

Their purpose is to…

➢ assess pupils work against the key objectives for the year
➢ assess pupil's work against national standards at the end of a key stage

- ➢ give supplementary information about individual children's attainment and progress so that we can report to parents and the child's next teacher
- ➢ help the school set targets for the National Curriculum tests in future years.

NFER Assessments

NFER child-friendly resources offer an age-appropriate level of challenge and have been standardised with over 60,000 pupils to ensure accurate benchmarking data. NFER Tests reflect the style and format of the national curriculum tests to help build pupils' familiarity with more formal assessment. At AECPS we conduct these NFER assessments in Years 1-6 during the terms spring 1 and summer 2. (See assessment policy for more details).

Conclusion

Maths provides a way of viewing and making sense of the world. It is used to analyse and communicate information and ideas and to tackle a range of practical tasks and real-life problems.

We will enable each child to develop a positive and confident attitude to mathematics, an ability to think clearly and logically, and to gain an understanding of mathematics through the formation of secure concepts based on:

- Appropriate practical activities
- The process of enquiry and investigation
- Maths skills and knowledge and a quick recall of basic facts
- An ability to identify patterns and relationships in maths
- An awareness of the uses and applications of maths in everyday situations
- The ability the express ideas concisely using accurate mathematical language
- The ability to select and use a range of maths tools
- An enjoyment of mathematics for its own sake

Please see a Singapore maths approach, progression of calculation below.

Policy Review – reviewed every 3 years

Next review – May 2027

AECPS

A SINGAPORE MATHS APPROACH

PROGRESSION IN METHODS OF CALCULATION

Children must have a secure understanding of number bonds:

Children learn and **master** number bonds *before* any work on addition and subtraction takes place. They learn to find many **parts** of the **whole.**

They must explore patterns and relationships using **concrete tools.**
To begin children use:

- Concrete - unifix to build, explore and separate
- Diennes rods
- Straw bundles
- Everyday_ counting tools _ dinosaurs, fish etc
- Number frames using colored counters to record

There are 7 cubes in all

Four are red

3 are yellow
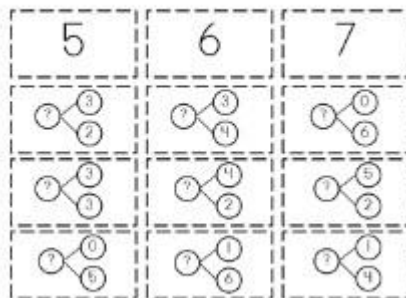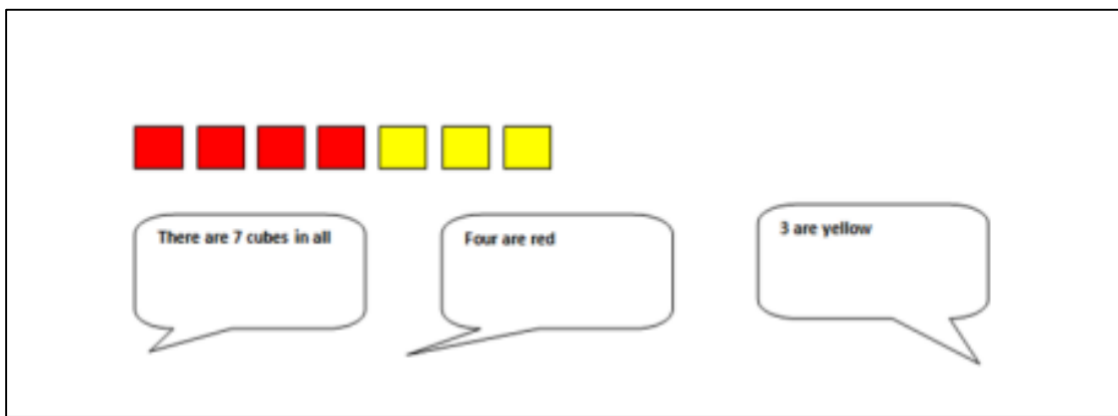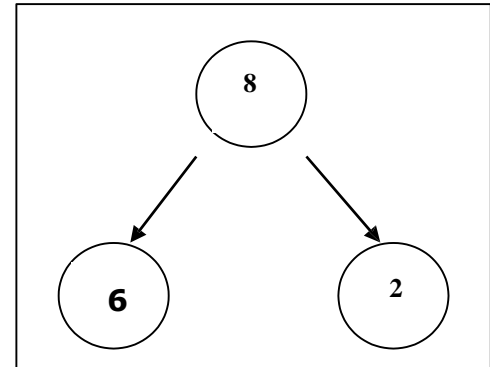
This way, children learn the various **parts** that make the **whole.**

They recognise that these are interchangeable yet give the same **whole.**

This then prepares them for the acquisition of addition/subtraction facts which in turn leads to formal algorithm and mental strategies.

Once children have explored making different totals they begin to forge relationships between bonds to 10. They use a number of concrete tools to support this process.

Egg boxes and 10s frames feature heavily and represent the base 10. Children explore and learn the number of different ways to make 10 using the base 10 frame

9 + 1 = 10
1 + 9 = 10

Nine and one
Ballooning fun!

8 + 2 = 10
2 + 8 = 10

Two and eight
Love to skate!

7 + 3 = 10
3 + 7 = 10

Seven and three
Love to climb
trees!

6 + 4 = 10
4 + 6 = 10

Four and six
Skateboard tricks!
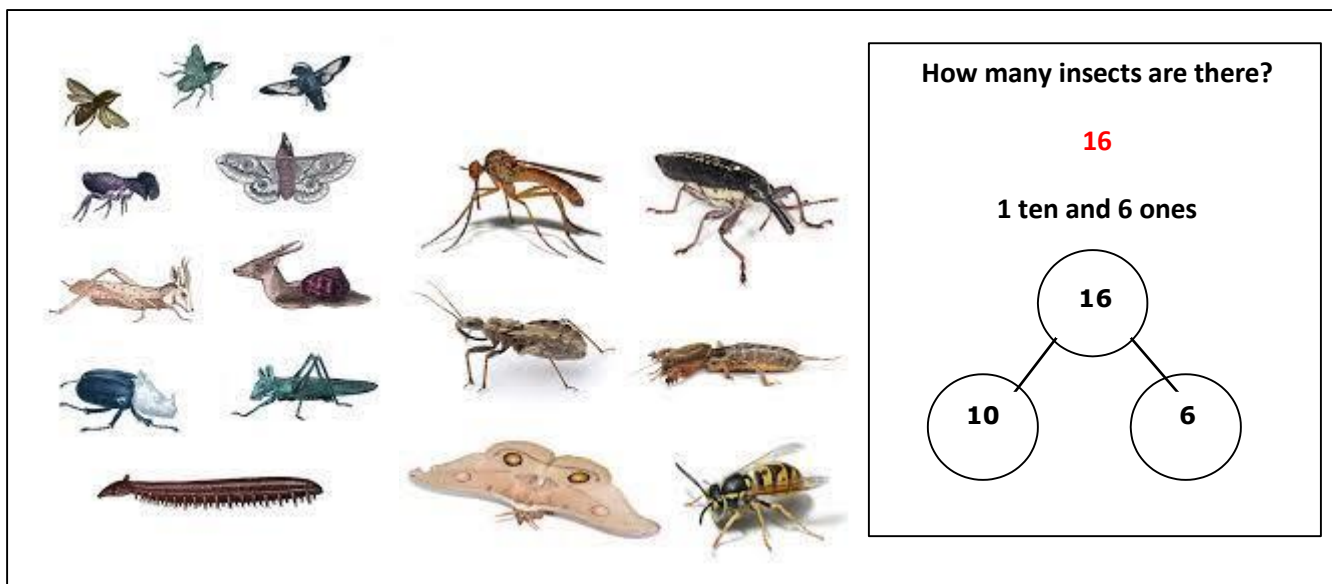
5 + 5 = 10
5 + 5 = 10

Five and five
Swim and dive!

This then progresses to being able to split two digit numbers into tens and ones, partitioning using the circle frame to record the two parts.

In Year One children use both concrete and pictorial representations to explore totals.

Children are encouraged to circle and group the tens, leaving the ones remaining. This is a crucial stage of being able to **regroup** and **renaming.**

How many insects are there?

16

1 ten and 6 ones

Children are immersed with opportunities to explore and investigate numbers using concrete everyday objects, moving to realistic pictorial representations before less realistic representations are introduced.

At all stages of number work it is important to use ongoing assessment for learning to determine children's understanding. They must **master** skills, knowledge and understanding before moving on to other concepts. Children must continue to have access to resources to support learning if required.

17 + 22 =

10   7

Children begin to record their observations using the place value charts.

16
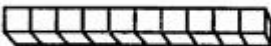
Tens	Ones
1	6

They learn to understand the value of each digit and what it represents.

What number can you see?
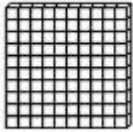
Tens	Ones

This enables them to effectively order and compare numbers successfully.
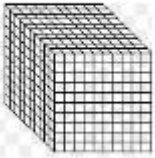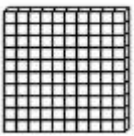
Tens	Ones

Which number has more? How many more can you see?

In Year Two children are introduced to three digit numbers using this model:

Hundreds	Tens	One
1	**3**	**9**

And then in Year Three, are introduced to thousands, hundreds, tens and ones:
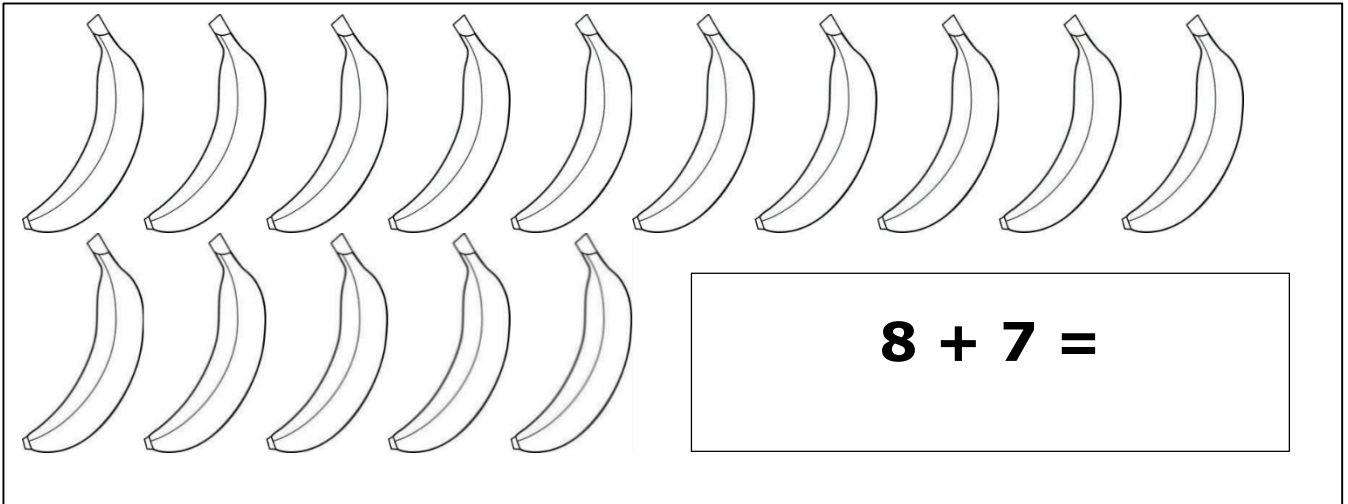
Thousands	Hundreds	Tens	Ones

Children learn to count on using this frame, exploring adding one more, ten more and so on. This supports a secure understanding of the value of each digit and begins to support the notion of exchange.

Calculation – addition:
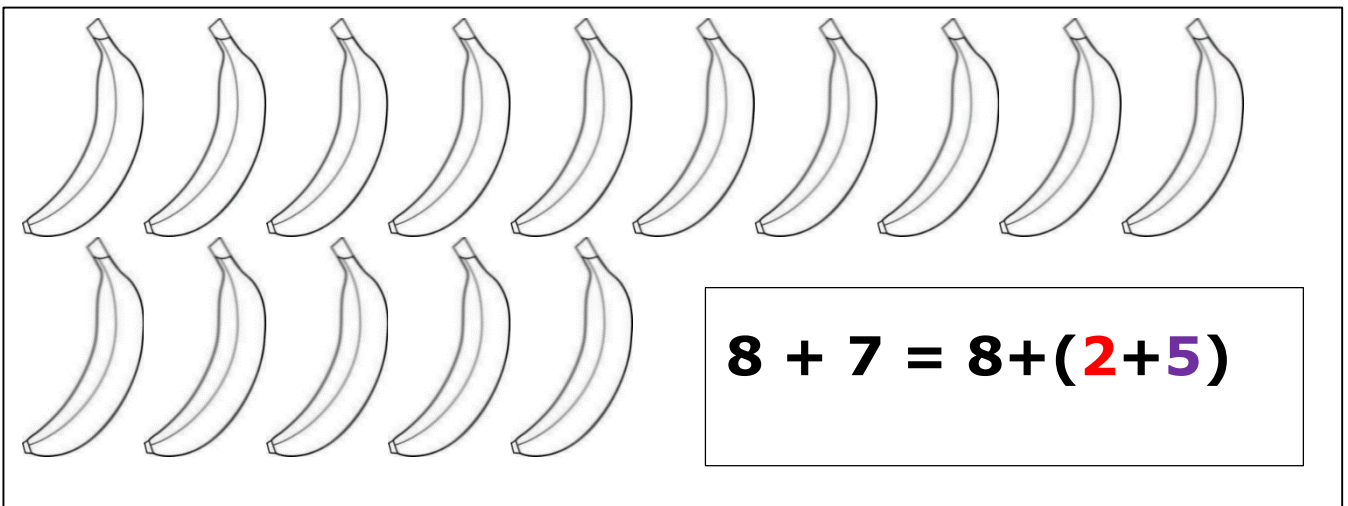
In **Year One** children use their knowledge of number bonds, having split whole numbers into two parts using a number of resources (including egg boxes)

They learn to use everyday objects to count on.

When children are secure with 1:1 correspondence and are able to estimate, group and count successfully, they progress to **regrouping** objects into tens and ones.

O	O	O	O	O
O	O	O		

O	O	O	O	O
O	O			

8 + 7 = 15

O	O	O	O	O
O	O	O	O	O

O	O	O	O	O

This becomes 10 and 5 = 15

The children **make 10** to help them identify the total

This is also true when the children add two digit and single digit numbers together. They learn to split and regroup the two digit into tens and ones to help them recombine.

6 + 5 =   9 + 5 =

3 + 8 = __11__

2   1
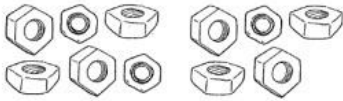
__8__ + __2__ = __10__

__10__ + __1__ = __11__

Regroup the numbers into tens and ones.
Then add.

$12 + 5 = \underline{\ 17\ }$

In **Year Two**, children progress to adding within 1000 using three digit numbers. They learn to use their secure knowledge of place value to partition and recombine successfully.

This moves to the more formal algorithm and written method of calculation.

First, add the ones.

```
  1 2 3
+     5
-------
      8
```

3 ones + 5 ones
= 8 ones

Then, add the tens.

```
  1 2 3
+     5
-------
    2 8
```

2 tens + 0 tens
= 2 tens

Lastly, add the hundreds.

```
  1 2 3
+     5
-------
  1 2 8
```

1 hundred + 0 hundreds
= 1 hundred

It is essential that the children **master** key skills, knowledge and understanding with number *before* any calculation work takes place.

6 271 + 27 = ?

Hundreds	Tens	Ones

271

27

First, add the ones.

```
  2 7 1
+   2 7
      8
```

1 one + 7 ones
= 8 ones

Then, add the tens.

```
  2 7 1
+   2 7
    9 8
```

7 tens + 2 tens
= 9 tens

Lastly, add the hundreds.

```
  2 7 1
+   2 7
  2 9 8
```

2 hundreds + 0 hundreds
= 2 hundreds

Once children have mastered this skill, they are then introduced to calculation s that require regrouping.

1 347 + 129 = ?

Hundreds	Tens	Ones

347

129

476

So, 347 + 129 = 476.

First, add the ones.

```
  3 ¹4 7
+ 1 2 9
      6
```

7 ones + 9 ones
= 16 ones

Regroup the ones.
16 ones = 1 ten 6 ones

Then, add the tens.

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

4 tens + 2 tens + 1 ten
= 7 tens

Lastly, add the hundreds.

```
  3 ¹4 7
+ 1 2 9
  4 7 6
```

3 hundreds + 1 hundred
= 4 hundreds

The children begin with the ones.

Where the total of ones is above ten they are required to regroup the ones as tens and ones.

In this example 7 and 9 = 16
This is regrouped as 1 additional ten and 6 ones remaining.

There are now **5** tens to add to 2 tens, instead of 4 tens + 2 tens.

1 182 + 93 = ?
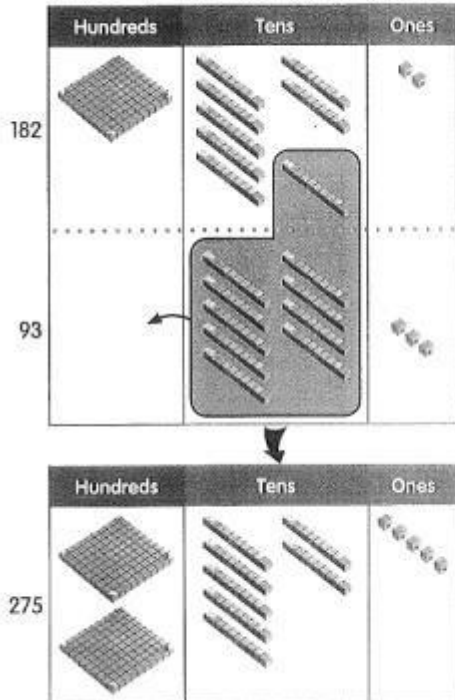
First, add the ones.

2 ones + 3 ones
= 5 ones

Then, add the tens.

8 tens + 9 tens
= 17 tens

Regroup the tens.
17 tens
= 1 hundred 7 tens

Lastly, add the hundreds.

1 hundred + 1 hundred
= 2 hundreds

So, 182 + 93 = 275.

Similarly children follow this procedure when required to regroup in tens, hundreds and beyond.

Children use the **place value** chart to help them calculate formal column additions

Write 361 + 170 in this way. Then add.

3 6 1
+ 1 7 0
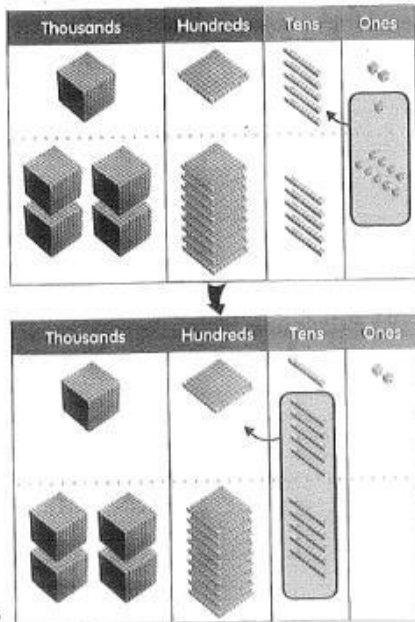
First, add the ones.

3 ones + 9 ones
= 12 ones
= 1 ten 2 ones

Next, add the tens.

5 tens + 5 tens + 1 ten
= 11 tens
= 1 hundred 1 ten

Children continue to work using this method of regrouping and exchange to calculate with larger numbers.

3 6 2 8
+ 1 7 9 5

Calculation – subtraction:

In **Year One** children use every day real life objects and concrete resources to subtract. They learn to remove objects, subtracting from the total and counting those remaining.

Having children cross off the pictorial representations supports their understanding of what is 'left' after having 'taken away.'

O	O	O		
O	O	O	O	O

$$8 - 5 =$$

O	O	O		

$13 - 2 = \underline{11}$	Once children are confident subtracting within ten they progress to subtracting from 2 digit numbers using regrouping.
$12 - 1 = \underline{11}$ $\underline{2} - \underline{1} = \underline{1}$ $\underline{10} + \underline{1} = \underline{11}$	They learn to represent the calculation in ones, then tens

In **Year Two** children progress to using the **place value chart** to support calculations.

	Children subtract the ones, then tens and finally from the hundreds. Children use concrete resources alongside written methods to demonstrate their mastery of knowledge and understanding.
	This later progresses to having to regroup and exchange, taking one ten and exchanging for ten ones. In this example, you cannot subtract 8 ones from 2 ones. You are therefore required to exchange one of the four tens. You now have 200, 30 and 12. It is now possible to subtract the 8 ones from the 12 ones.

The **place value charts** help the children to understand the process of calculation.

Children discuss and explain each stage of their workings.

At each stage of regrouping is it essential that children understand what they are doing and why.

Children must understand that when a digit moves to a new column in the place value chart it is exchanged.

In this example to be able to subtract from the ones you must first exchange one of the two hundreds into ten tens. From here you can then exchange one ten for ten ones, in order to subtract 8 ones.

The mathematical language and explanation of what is happening is important.

Children should be encouraged to provide their explanation and reasons to describe the process.
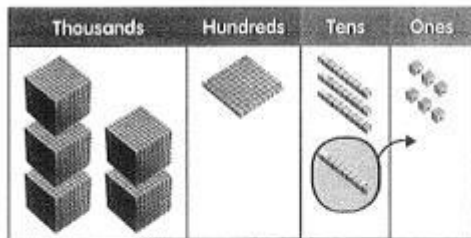
Regroup.
4 tens 6 ones
= 3 tens 16 ones
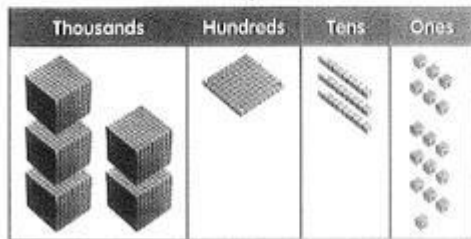
5146 − 2598 = ?

5146

2598   ?
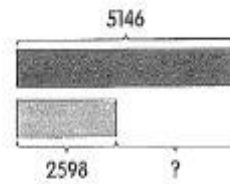
Children continue to use this method when working with larger numbers, regrouping and exchanging accordingly.

We cannot subtract 8 ones from 6 ones. So, we regroup the tens and ones.

Calculation – multiplication:

Children are introduced to multiplication in **Year One**. They learn to sort objects into equal groups, exploring simple repeated addition.

How many buffaloes are there? They would see that in this pictorial representation there are 3 **groups** of 5 buffalo. So 5 + 5 + 5 = 15 This then progresses to using the mathematical language 'lots of' or 'groups of' There are 3 equal groups of 5, so 5 is multiplied by 3. 3 **x 5** = 15	In Year One children learn to recall multiplication facts for the 2, 5 and 10 times tables. They count by rote using number rhymes, action songs and games. Children would begin to explore multiplication as repeated addition 5 + 5 + 5 = 15 using their knowledge of the various multiples covered.
In **Year Two** the children continue to explore the relationship between multiplication: 3 plates of 2 = 3 lots of 2 = 6	

Children spend time learning multiplication 'times table' facts discretely. Children use concrete and pictorial aids to support this process.

Children will be able to count in 2's
There are two skate scooters in each group. How many scooters in 10 groups?

Ali has 7 bags.
There are 2 pineapples in each bag.
How many pineapples does he have altogether?

7 groups of 2 pineapples

7 x 2 = ?
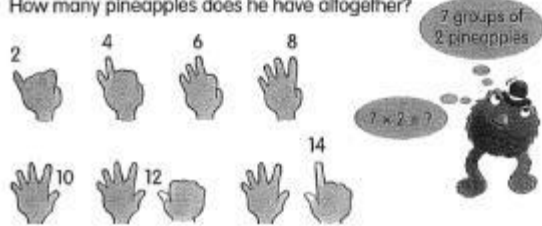
Children use their fingers to represent the groups. 7 fingers, 7 groups of 2 = 14.

I count in twos.
2, 4, 6, 8, 10, 12, 14

Ali has 14 pineapples altogether.
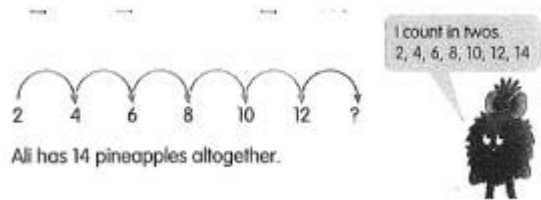
The various pictorial aids support children's understanding of the calculation.

Once the children are secure using the concrete and pictorial tools to count groups of they then begin to represent using arrays.
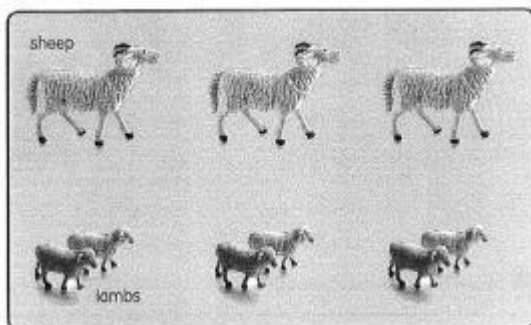
sheep

lambs

Each **sheep** has **two lambs** each.

Each sheep has 2 lambs.
How many lambs will 3 sheep have altogether?
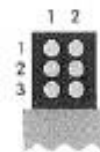
$3 \times 2 = 6$
3 sheep will have 6 lambs altogether.

There are 3 **lots of** 2 lambs.
This is represented as 3 rows of 2.
2 + 2 + 2 = 6

Sam has 4 bundles of colour pencils.
How many colour pencils does he have altogether?

$4 \times 2 =$

Sam has [ ] colour pencils altogether.
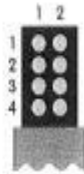
Each boy collected 2 stamps.
How many stamps did the 5 boys collect altogether?

$5 \times 2 =$

The 5 boys collected [ ] stamps altogether.

There are 6 pairs of socks on a washing line.
How many socks are there altogether?.

$6 \times 2 =$

There are [ ] socks altogether.
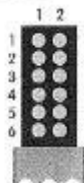
Children are then able to make links between the arrays that they have learnt and their times tables knowledge:

$6 \times 2 = ?$
Start with 5 groups of 2.

$5 \times 2 = 10$

$6 \times 2 = 10 + 2$
$= 12$

6×2 is the same as adding 1 group of 2 to 5×2

$7 \times 2 = ?$
Start with 5 groups of 2.

$5 \times 2 = 10$

$7 \times 2 = 10 +$
$=$
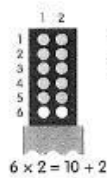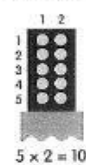
7×2 is the same as adding 2 groups of 2 to 5×2
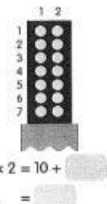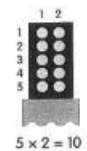
In Singapore mathematics the children learn 'top tips' to support with recall.
For example, when learning the 9 times tables:

1 × 9 = 9
1 × 9 = 9

2 × 9 = 18
2 × 9 = 18

3 × 9 =
Bend your third finger.
3 × 9 =
3 × 9 = 27

Here in another way of multiplying using the finger counting method.

This method is only used for the multiplication table of 9 only.

In **Year Three** children learn move to more formal written methods of multiplication, yet heavily scaffolded with the use of dienes rods and the **place value chart.**

Multiplication **without regrouping**

The children record as a column multiplication.

They multiply the **ones** first.
So, in this example, 3 **lots of** 2 = 6

12 × 3 = ?

First, multiply the ones by 3.

```
  1 2
×   3
─────
    6    2 ones × 3 = 6 ones
```

Then, multiply the tens by 3.

```
  1 2
×   3
─────
  3 6    1 ten × 3 = 3 tens
```

The next stage is to multiply by the **tens.**
So, 3 **lots of** 10 = 30

341 × 2 = ?

Hundreds	Tens	Ones
		⬤
		⬤

First, multiply the **ones** by 2.

   3 4 1
×   2
―――――
     2

1 one × 2 = 2 ones

Hundreds	Tens	Ones
	▨	⬤
	▨	⬤

Then, multiply the **tens** by 2.

   3 4 1
×   2
―――――
  8 2

4 tens × 2 = 8 tens

Hundreds	Tens	Ones
▦▦	▨	⬤
▦	▨	⬤

Lastly, multiply the **hundreds** by 2.

   3 4 1
×   2
―――――
 6 8 2

3 hundreds × 2 = 6 hundreds

So, 341 × 2 = 682.

Children follow the same method when multiplying larger numbers by a 1 digit number.

Each stage is recorded using the dienes rods and place value chart.

Children learn the value of the digit that is being multiplied.

In this example there is still no need for regrouping.

34 × 2 = ?

First, multiply the ones by 2.
4 ones × 2 = [ ] ones

Then, multiply the tens by 2.
3 tens × 2 = [ ] tens

So, 34 × 2 = [ ].

  3 4
×   2
―――――

  3 4
×   2
―――――

As children become confident with this method they are then less reliant on concrete/pictorial aids.

Multiplication **with regrouping**

Children always begin multiplying the **ones** first.

In this example when the 8 is multiplied by 2, the number exceeds 10.

Children are required to regroup the **16 ones** into 1 ten and 6 ones.

Then, multiply the **tens** by 2.

6 tens × 2 = 12 tens

Add the tens:
12 tens + 1 ten = 13 tens

Regroup the tens:
13 tens = 1 hundred 3 tens

So, 68 × 2 = 136.

Again, where the **7 tens** are multiplied by 2 the total exceeds 10 tens.

6 tens x 2 = 12 tens
+ 1 ten =13 tens

Children are required to regroup the **13 tens** into 1 hundred and 3 tens.
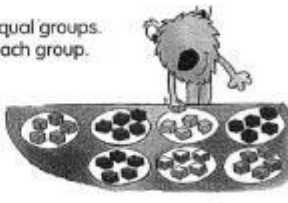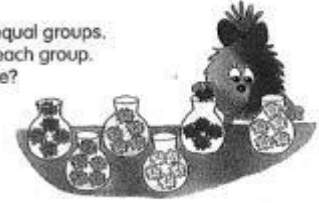
Calculation – division:

In **Years One and Two** children use concrete, everyday objects to investigate and sort into equal groups

Divide 15 counters into 5 equal groups.
How many counters are there in each group?

$15 \div 5 = ?$

$5 \times 3 = 15$
So, $15 \div 5 = 3$.

There are 3 counters in each group.

Divide 24 buttons into 4 equal groups.
How many buttons are there in each group?

$24 \div 4 = ?$

$4 \times = 24$
So, $24 \div 4 =$

There are ___ buttons in each group.

In both of these examples the children are required to identify the number of **objects** in each group by sharing the objects on to the number of given plates (groups)

Divide 35 pieces of jelly into equal groups.
There are 5 pieces of jelly in each group.
How many groups are there?

$35 \div 5 = ?$

$7 \times 5 = 35$
So, $35 \div 5 = 7$.

There are 7 groups.

Divide 30 paper stars into equal groups.
There are 5 paper stars in each group.
How many groups are there?

$30 \div 5 = ?$

$ \times 5 = 30$
So, $30 \div 5 =$

There are ___ groups.

In both of these examples the children are required to identify the number of **groups** there are by sharing the objects equally.

Divide 56 paper stars into equal groups.
There are 8 paper stars in each group.
How many groups are there?

Think of multiplication:
$7 \times 8 = 56$
So, $56 \div 8 = 7$.
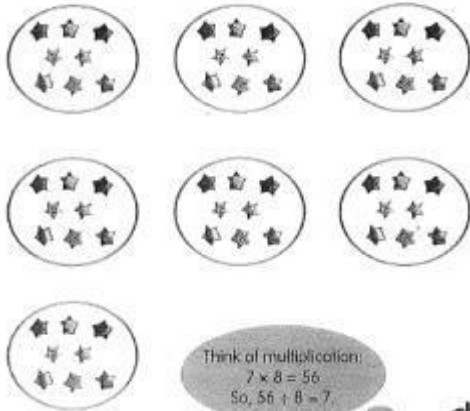
$56 \div 8 = 7$

There are 7 groups.

2 Divide 54 biscuits into equal groups.
There are 6 biscuits in each group.
How many groups are there?

$54 \div 6 =$

There are _____ groups.

Think of multiplication:
$\square \times 6 = 54$
So, $54 \div 6 =$
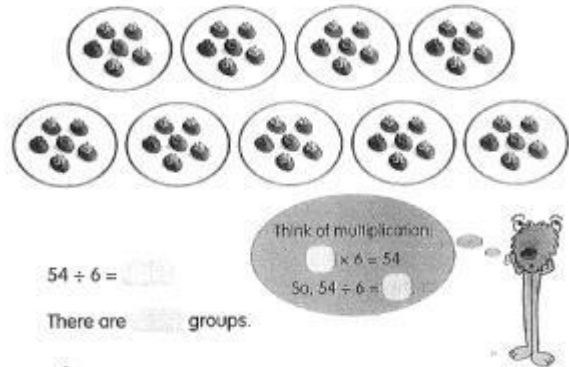
In **Year Three** children begin to explore quotients and their remainders.
They begin to use formal methods of recording (bus stop) to divide a 1 digit number by a 1 digit number.

2 furries had some pails with them.
They collected some seashells and starfishes from the beach.

The 2 furries divided 8 pails equally among themselves.

(a) How many pails did each furry receive?

(b) How many pails were left?

(a) $8 \div 2 = ?$
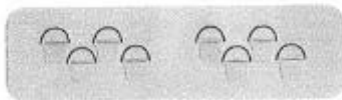
8 ones $\div$ 2 = 4 ones with no remainder
Quotient = 4 ones
Remainder = 0 ones

$$\begin{array}{r} 4 \\ 2\overline{)8} \\ 8 \\ \hline 0 \end{array}$$

Each furry received 4 pails.

(b) There were no pails left.

Division **with remainders**

$11 \div 4 = ?$

Divide the 11 seashells into 4 equal groups.

$4 \times 2 = 8$
8 is less than 11.
$4 \times 3 = 12$
12 is more than 11.
Choose 2.

11 ones ÷ 4 = 2 ones with remainder 3 ones
= 2 R3

Quotient = 2 ones
Remainder = 3 ones

Each furry received 2 seashells.

3 seashells were left.
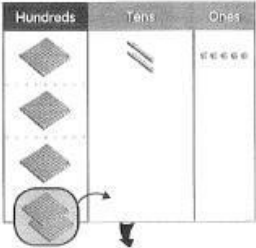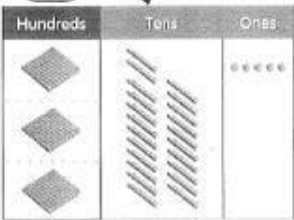
Division **without remainders and regrouping**

The children divide the tens by 3. So, 6 tens divided by 3 = 2 tens	They then divide the ones by 3. So, 3 ones divided by 3 = 1 one.

Division **with regrouping in tens and ones**

$52 \div 2 = ?$ First, divide the **tens** by 2. 5 tens ÷ 2 = 2 tens with remainder 1 ten	In this example the children divide 52 by 2. They begin with dividing the tens by 2. There are only 2 tens within ten so 1 ten is remaining.
Regroup the remainder ten: 1 ten = 10 ones Add the ones: 10 ones + 2 ones = 12 ones	This ten must be regrouped as ten ones. So now the children would divide 12 ones by 2. The children subtract the 2 tens from the 5 tens and record underneath.
Then, divide the **ones** by 2. 12 ones ÷ 2 = 6 ones So, 52 ÷ 2 = 26. Each boy got 26 fishes.	They then bring the 2 ones down, as the 1 ten is regrouped as 12 ones. This is then divided by 2 = 6. The 12 ones is subtracted from the 12 ones, which leaves no remainder.

Division **with regrouping in hundreds, tens and ones**

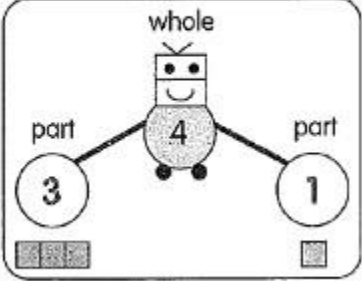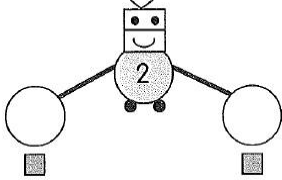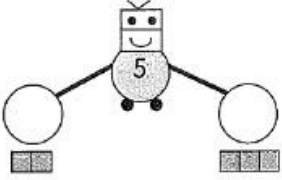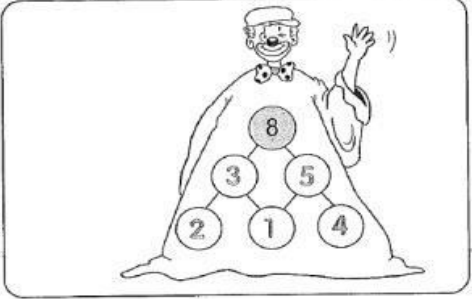|	
	525 ÷ 3 = Children follow the same method. The calculation is set out as a 'bus stop'. The calculation is completed from left to right. First the hundreds are divided by 3.
	5 hundreds divided by 3 = 1 hundred with 2 hundred remaining. The 3 is subtracted from the 5 hundred (as there are 3 hundreds possible in 5 hundred) This leaves 2 hundred remaining. The two hundreds need to be regrouped as 20 tens.
	The 2 tens are added to the 20 tens that have been regrouped. This calculation is now underneath as the 'tens' have been brought down. 22 tens ÷ 3 = 7 tens (as 3 x 7 tens =21 tens)
	This one ten must then be regrouped into ten ones and added to the 5 ones already in the calculation. There are now 15 ones to divide by 3.

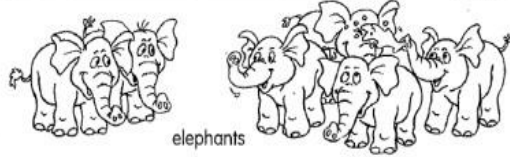The final stage of the calculation would be to divide 15 ones by 3 = 5

This 15 (3x5) is subtracted underneath to leave no further remainder.

This method is the same as the long division method previously taught. However the **place value chart** supports a more secure understanding of what the children are doing and why.

Problem Solving – bar model method:

Children are introduced to the bar model method in **Year One**. They learn to use visual bars and models as representations of given totals to support their calculations.

When exploring number bonds children split the whole into two parts in various ways.

This model using the bars to represent 1 unit, support the children's understanding of the value of number.

The circle frame is used regularly to record these 'parts'.

They explore problems where they are required to use and apply their understanding of key concepts:

In this problem, children are required to use the numbers 1-10 to complete the number bond puzzle.

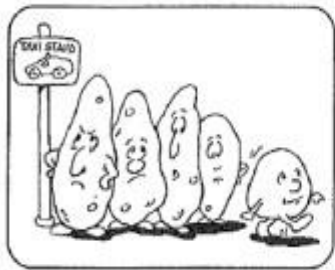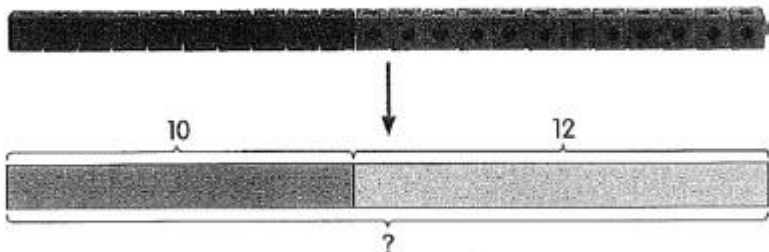|	
	Children use number stories, rhymes and songs to explore the relationship between number. Learning is always supported by both concrete and visual aids.
	The visual models support children's understanding of the operation performed.

Googol baked 10 gingerbread men.
Aida baked 12 gingerbread men.
How many gingerbread men did they bake altogether?

10   12

?

10 + 12 = 22

They baked 22 gingerbread men altogether.

Huixin has 14 breadsticks.
Her friend has 17 breadsticks.
How many breadsticks do they have altogether?

14   17

?

☐ + ☐ = ☐
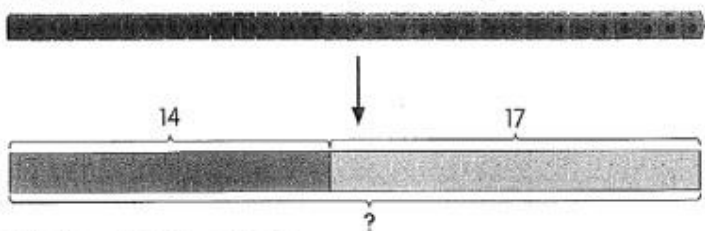
They have ☐ breadsticks altogether.

In **Year One** children begin to exchange concrete tools with bar models. The bar represents the total, rather than the individual unit of measurement.

In this example the word problem can be represented with two bars 10 and 12. The question for children to calculate is the total length of the bar using both parts of the whole. Children see the bar as representing the total number of cubes.

In **Year Two** the children begin to calculate differences, finding unknown values using given information.

Children are required to interpret and deduce which calculation is required and why. They must be able to access and understand the mathematical language.

In this example the children are required to find three parts of the whole. They are given the information required within the word problem but must understand which calculation to perform and why.

The three part bars joined side by side represent the total.

Subtraction

Denise had 98 stalks of flowers.
She gave some stalks of flowers away.
She had 28 stalks of flowers left.
How many stalks of flowers did she give away?
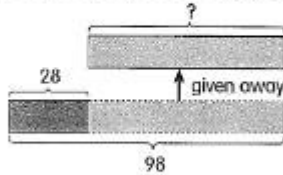
$$98 - 28 = 70$$

Denise gave away 70 stalks of flowers.

Florence had 401 pieces of *nonya kueh* in her shop.
She sold 212 pieces of *nonya kueh*.
How many pieces of *nonya kueh* did she have left?

She had ⬚ pieces of *nonya kueh* left.

Children use the bar models to support calculation and problem solving using all four of the mathematical operations.
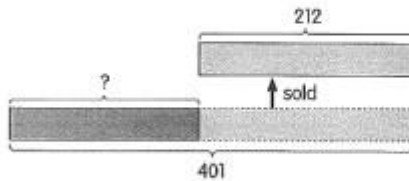
In these problems the children are given the **whole**, they know the total length of the bar is 98 (or 401 in example 2)

They must then remove (take away/subtract) the part given away or spent.

This leaves them with the remaining 'part' of the whole.

The visual representation allows children to visually see what is happening and explore the accompanying calculation.

Comparisons with two sets:

1 Meili had 213 chickens on her farm.
Farid had 78 more chickens on his farm.
How many chickens did Farid have on his farm?

| | 213 | 78 |

Meili

Farid

?
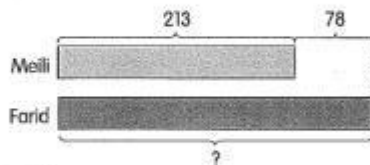
213 + 78 = 291

Farid had 291 chickens on his farm.

305 children went to the zoo on Saturday.
278 more children went to the zoo on Sunday than on Saturday.
How many children went to the zoo on Sunday?

| | 305 | 278 |

Saturday

Sunday

?

[ ] + [ ] = [ ]
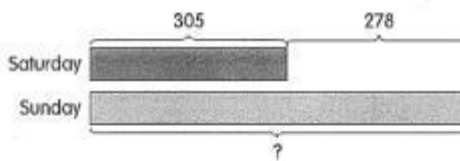
[ ] children went to the zoo on Sunday.

In these examples children are required to use more than one bar in order to represent the given information and calculate totals.

The children represent the number of chickens with bars for the two characters. It is clear from the given information that Farid's bar would be longer, as he has '78 more'. It is important for the children to draw the model in order to help them to understand the operation required.

This model of representing and comparing two amounts can be applied to many similar word problems.
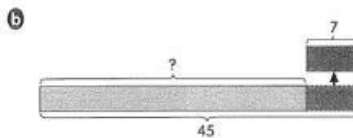
Two step word problems

① There were 26 boys and 19 girls in a class.
Later, 7 pupils left the class.

ⓐ How many pupils were there in the class at first?
ⓑ How many pupils were there in the class in the end?

ⓐ

26   19

?
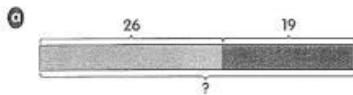
$26 + 19 = 45$

There were 45 pupils in the class at first.

ⓑ

7

?

45

$45 - 7 = 38$

In some problems the children may be required to perform a number of steps in order to achieve the answer.

Children have to first calculate the total number of pupils in example one, adding the number of boys/girls, before then subtracting 7 from this total.

The use of various bars to represent the data supports children's understanding of each stage.

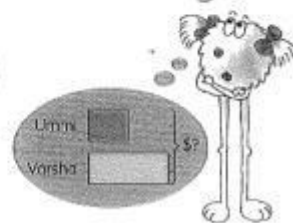
Ummi has $341.
Varsha has $279 more than Ummi.

ⓐ How much does Varsha have?
ⓑ How much do they have altogether?

$ $

Ummi $?
Varsha
$?

ⓐ $ $ = $
Varsha has $.

Ummi
Varsha
$?

ⓑ $ $ = $
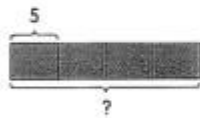They have $ altogether.
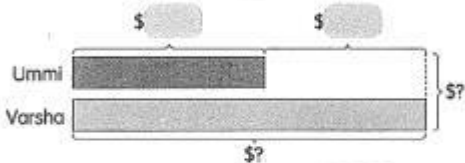
Ummi
Varsha
$?

In this example the children can first calculate how much money Varsha has before combining with Ummi's 341.

The total amount of money is the combination of both bars.

Multiplication:

Googol puts 5 biscuits into each packet.
He has 4 packets in all.
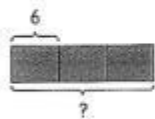How many biscuits does he put into the 4 packets?

5

4 groups of 5 biscuits

?

4 × 5 = 20

Googol puts 20 biscuits into the 4 packets.

Farid counted 3 nests on a tree.
There were 6 birds in each nest.
How many birds were there altogether?

6

3 groups of 6 birds

?

_____ × _____ = _____

There were _____ birds altogether.

The bar model method is an excellent tool for all calculation work.

Here the children can calculate totals multiplying the same amount repeatedly. This also supports their understanding of the relationship between multiplication and repeated addition.
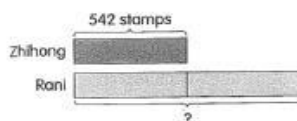
Having the bars as equal groups clearly demonstrates the calculation.

Multiplication: One-step Word Problems

**1** Zhihong had 542 stamps. Rani had twice as many stamps as Zhihong. How many stamps had Rani?

542 stamps

Zhihong

Rani

?

Twice is 2 times.

[ ] stands for 542 stamps.

So, [ ] stands for 542 stamps × 2.

542 × 2 = 1084
Rani had 1084 stamps.

---

2 Matthew sold 750 flowers. Peter sold 3 times the number of flowers Matthew sold. How many flowers did Peter sell?
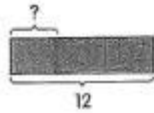
750 flowers

Matthew

Peter

_____ flowers

[ ] stands for 750 flowers.

So, [ ] stands for 750 flow

_____ × _____ = _____
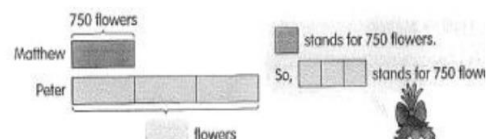
Peter sold _____ flowers.

Division:

Barry buys 12 cakes.
He puts an equal number of cakes into 3 boxes.
How many cakes are there in each box?

?

12

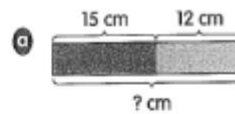Barry puts 12 cakes into 3 boxes.

$3 \times 4 = 12$

$12 \div 3 = 4$

There are 4 cakes in each box.

Googol makes 5 shapes with 30 straws.
He uses the same number of straws for each shape.
How many straws does Googol use to make each shape?

?

30

I divide straws into 5.

$5 \times \boxed{} = 30$

$30 \div 5 = \boxed{}$

Googol uses [blank] straws to make each shape.

④ Nurul has a cloth 45 cm long.
She cuts it into three pieces.
One piece is 15 cm long.
The second piece is 12 cm long.

ⓐ Find the total length of the first and second pieces.

ⓑ What is the length of the third piece?

ⓐ

| 15 cm | 12 cm |

? cm

$15 + 12 = 27$

The total length of the first and second pieces is 27 cm.

The bar models represent a clear relationship between multiplication and division.