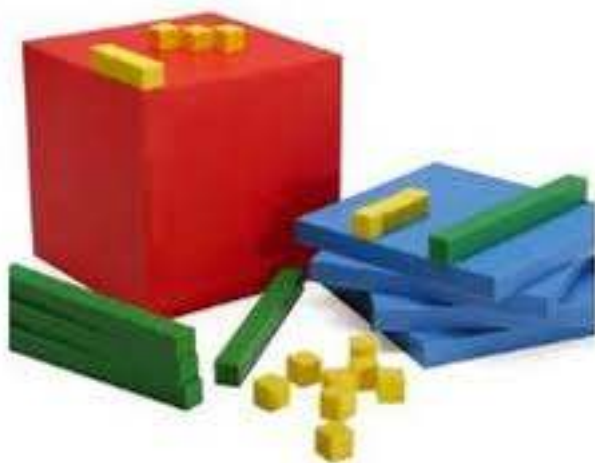


# Capturing Maths



## Calculation Policy



This policy has been designed to teach children through the use of concrete, pictorial and abstract methods. This calculation policy should be used to support children to develop a deep understanding of number and calculation.

## Background

This policy has been developed by Maths Coordinators with a specific interest in the use of Singapore methods to develop number awareness and fluency.

The policy only details the strategies; teachers must plan opportunities for pupils to apply these; for example, when solving problems, or where opportunities emerge elsewhere in the curriculum.

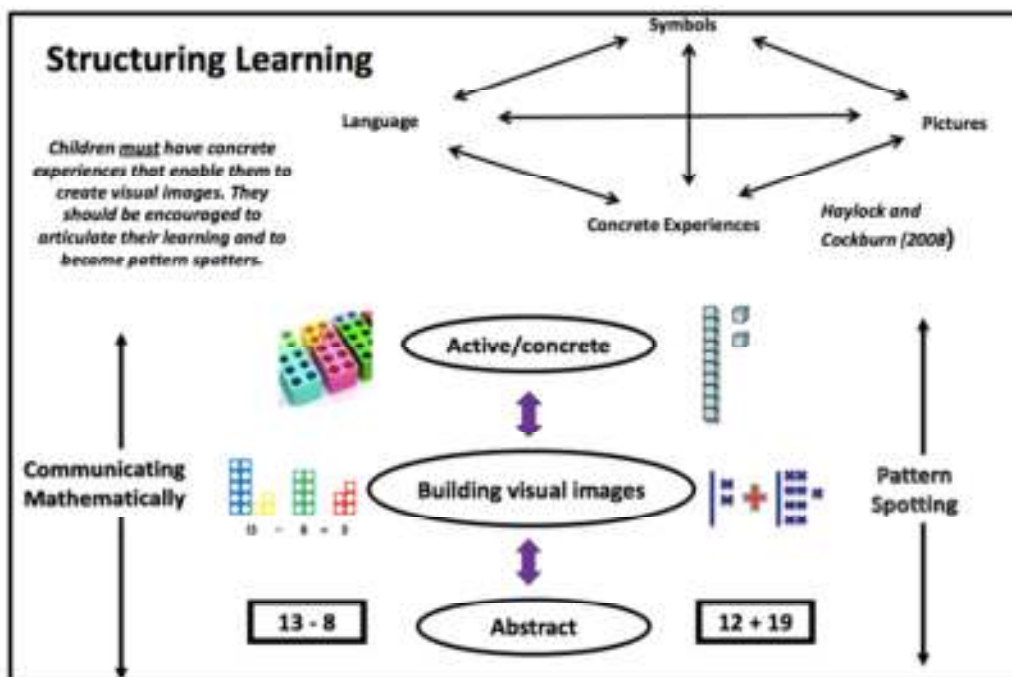
## Using the concrete-pictorial-abstract approach:

Children develop an understanding of a mathematical concept through the three steps (or representation) of concrete-pictorial-abstract approach. Reinforcement is achieved by going back and forth between these representations.

**Concrete representation** □ The enactive stage - a pupil is first introduced to an idea or a skill by acting it out with real objects. This is a 'hands on' component using real objects and it is the foundation for conceptual understanding.

**Pictorial representation** □ The iconic stage - a pupil has sufficiently understood the hands-on experiences performed and can now relate them to representations, such as a diagram or picture of the problem.

**Abstract representation** □ The symbolic stage - a pupil is now capable of representing problems by using mathematical notation, for example:  $12 \div 2 = 6$ .



## Guidance

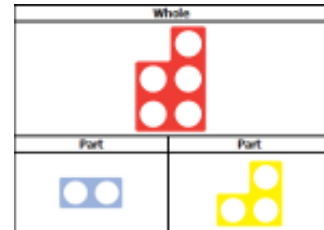
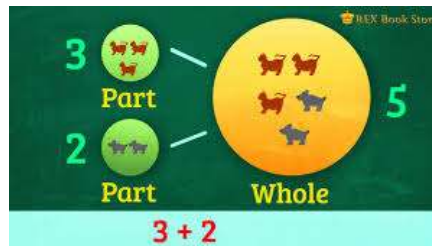
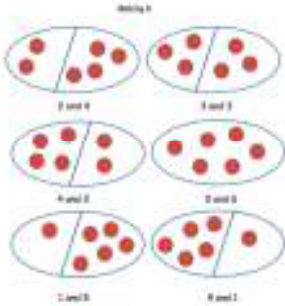
This document provides guidance and examples for key objectives for each year group but is not to be followed as a complete planning aid as not all objectives are exemplified.

# Reception

## Addition

Explore part part whole relationship

They should start of recording addition relationships



Using the ten frame to support addition of single digits – counting all/combining two groups

	$6 + 4 = 10$
	$4 + 4 = 8$
	$5 + 2 = 7$
	$2 + 4 = 6$

Solving problems using concrete and pictorial images.

Sara has 2 apples.  
Jon has 5 apples.  
How many apples do they have altogether?  
How many more apples does Jon have than Sara?



## Subtraction

Taking away after counting out practical equipment. Children would be encouraged to physically remove these using touch counting.



By touch counting and dragging in this way, it allows children to keep track of how many they are removing so they don't have to keep recounting. They will then touch count the amount that are left to find the answer.

donut                  donuts



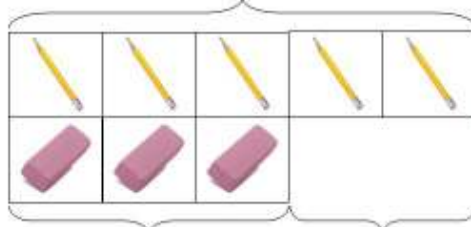
$$8 - 4 = \underline{\quad}$$

Those who are ready may record their own calculations



Using the ten frame to support subtraction by taking away

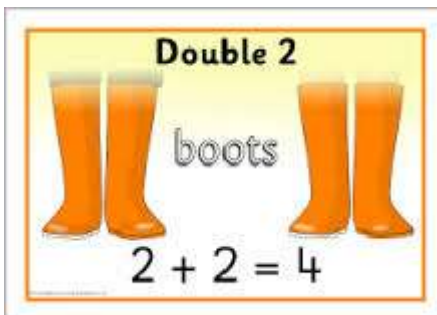
5 Pencils



Peter has 5 pencils and 3 erasers. How many more pencils than erasers does he have?

Solving problems using concrete and pictorial images.

## Multiplication



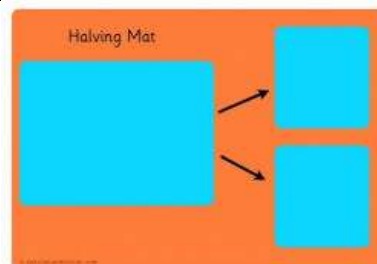
Children will experience equal groups of objects.

They will work on practical problem solving activities involving



There are 6 pairs of socks. How many socks are there altogether?

## Division

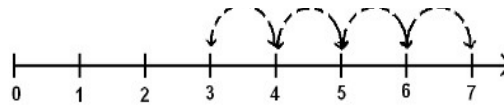
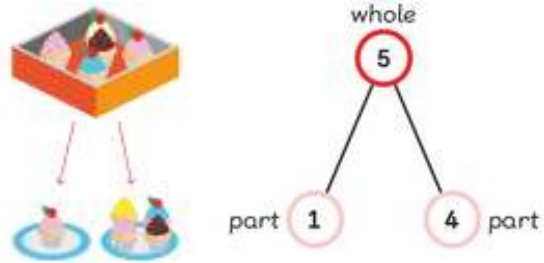
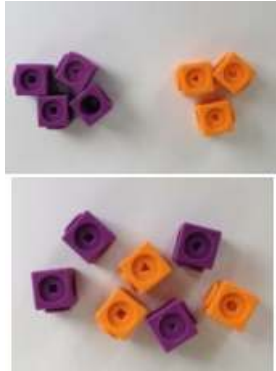


# Year 1

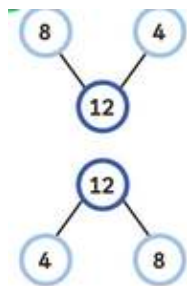
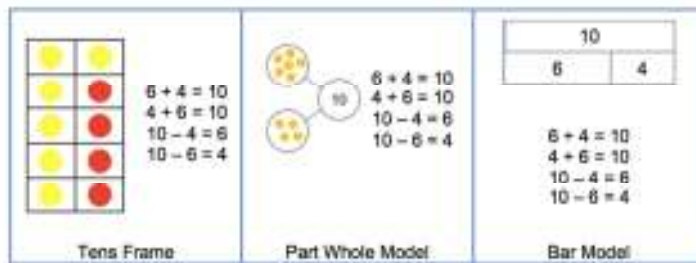
## Addition

Joining two groups and then recounting all objects using one-to-one Correspondence (lots of practice making 10 and numbers to 10 e.g.  $6 + 4 = 10$  or  $3 + 5 = 8$ )

$$3 + 4 = 7$$



Learn number bonds to 20 and demonstrate related facts  
*Teach addition and subtraction alongside each other as pupils need to see the relationship between the facts.*



$$8 + 4 = 12$$

$$4 + 8 = 12$$

This is a family of addition and subtraction facts.

$$12 - 8 = 4$$

$$12 - 4 = 8$$



Add and subtract one digit numbers and two digit numbers to 20, including zero

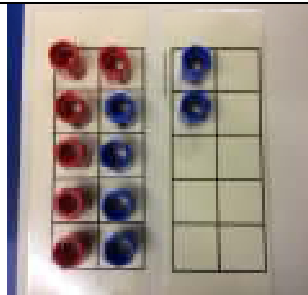
$$8 + 1 = 9$$



### Bridging 10

Use ten frames, Singapore bars, egg boxes and number lines to practice.

*Chn should start with the larger number and add the smaller number seeing what makes ten and what is left over.*



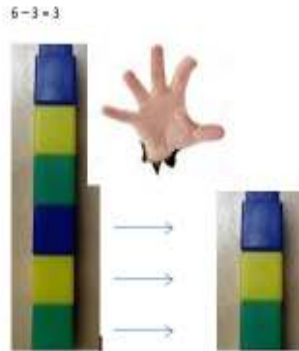
$$6 + 6 = 12$$



Make 9 in one and 3 in the other. Take one from the 3 to make the 9 into a ten.... $10 + 2 = 12$

# Subtraction

Taking away should begin with **physical objects**: objects, cubes, Dienes etc



Subtraction by counting back

**Let's Learn**

**Subtract by Counting Back**

Count back 3 steps from 15.

Subtract 3 from 15.

$15 - 3 = 12$

There are 12 flowers left.

Subtracting a single digit number from a single digit number and a single digit from a two digit by crossing out pictures

**Subtract by Crossing Out**

$7 - 2 = 5$

5 ladybirds are left.

Subtracting using the part part whole (include problem solving with missing digits).

$? - 5 = 2$

How many boats are not red?

$7 - 5 = 2$

2 boats are not red.

Subtraction by subtracting from 10

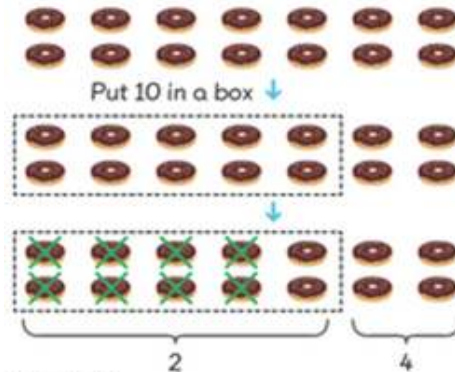
*Children subtract from 10 and not from ones*

$14 - 8 = ?$

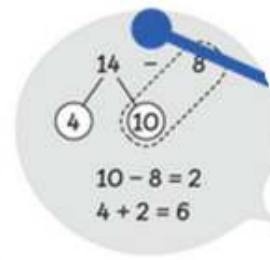
**Let's Learn**

Subtract from 10

$14 - 8 = ?$



$14 - 8 = 6$   
Sam has 6 doughnuts left.



When subtracting using Dienes children should be taught to regroup a ten rod for 10 ones and then subtract from those ones



$20 - 4 = 16$

Subtracting multiples of 10

*Using the vocabulary of 1 ten, 2 tens etc alongside 10, 20, 30 is very important here as pupils need to understand that it is a 10 not a 1 that is being taken away*

$40 = 60 - 20$



6 tens - 2 tens = \_\_\_\_\_ tens  
 $60 - 20 = \underline{\quad}$

$38 - 10 = 28$



$38 - 10 = \square$

## Multiplication

Counting in multiples of 2, 5 and 10 from zero

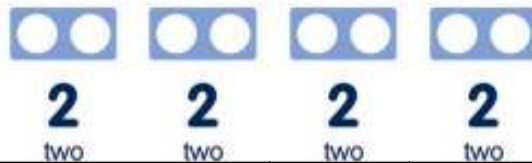
Children should count the number of groups on their fingers as they are skip counting.

2 4 6 8

4 groups of 2 = 8



$$2 \times 4 = 8$$

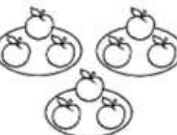
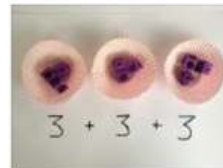


When moving to pictorial/written calculations the vocabulary is important



This image represents two groups of 4 or 4 twice

Solving multiplication problems using repeated addition



How many apples are there altogether?

$$3 + 3 + 3 = 9$$

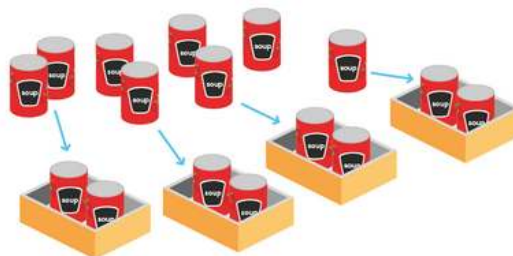
## Division

Pupils should be taught to divide through working practically and the sharing should be shown below the whole to familiarize children with the concept of the whole.

The language of whole and part part should be used.

$$10 \div 2 = 5$$

1 There are 8 cans.



There are 4 boxes of 2 cans.

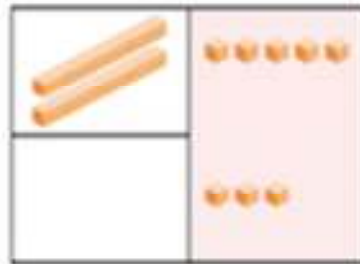
$$8 \div 4 = 2$$



# Year 2

## Addition

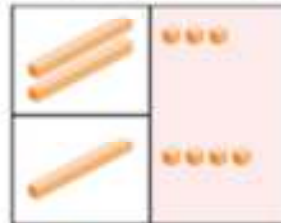
Using concrete objects and pictorial representations to add a 2 digit number with a 1 digit number.



	tens	ones
	2	5
+		3
	2	8
	2	8

Using concrete objects and pictorial representations to add a 2 digit number and 10s number.

Step 1 Add the ones.  
3 ones + 4 ones = 7 ones



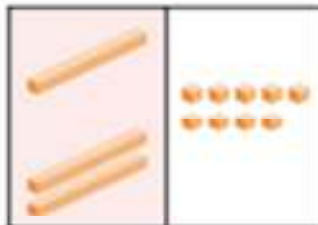
	tens	ones
	2	3
+	1	4
	3	7
	3	7

Step 1 Add the ones.



	tens	ones
	1	9
+	2	0
	3	9
	3	9

Step 2 Add the tens.  
1 ten + 2 tens = 3 tens

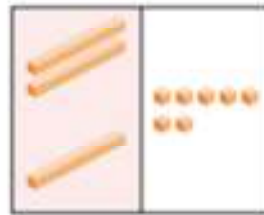


	tens	ones
	1	9
+	2	0
	3	9
	3	9

$19 + 20 = 39$

Using concrete objects and pictorial representations to add a 2 digit numbers.

Step 2 Add the tens.  
2 tens + 1 ten = 3 tens



$$23 + 14 = 37$$

	tens	ones
	2	3
+	1	4
<hr/>		
	3	7

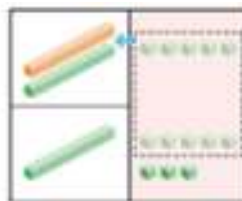
### Adding with renaming

Add 15 and 18.

Use  to help you add.

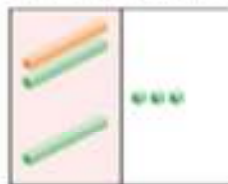


Step 1 Add the ones.  
5 ones + 8 ones = 13 ones  
Regroup the ones.  
13 ones = 1 ten and 3 ones



	tens	ones
	1	5
+	1	8
<hr/>		
	1	3

Step 2 Add the tens.  
1 ten + 1 ten + 1 ten = 3 tens



$$15 + 18 = 33$$

	tens	ones
	1	5
+	1	8
<hr/>		
	1	3
+	2	0
<hr/>		
	3	3

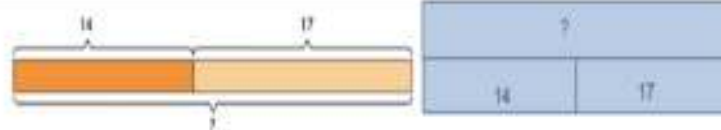
Using concrete objects and pictorial representations to add a 3 single digit numbers.

$$7 + 3 + 2 = \quad \text{leads to } 10 + 2 =$$



Using the bar to find missing digits.  
*It is important for children to use the bar in this way to encourage the use of it to aid with problem solving.*

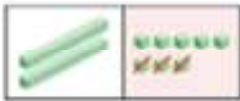
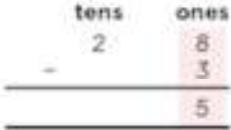
Helen has 14 breadsticks. Her friend has 17. How many do they have altogether?




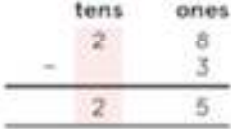
# Subtraction

Using concrete objects and pictorial representations to subtract a 1 digit number from 2 digit number.

Step 1 Subtract the ones.  
8 ones - 3 ones = 5 ones



Step 2 Subtract the tens.



$28 - 3 = 25$

Using concrete objects and pictorial representations to subtract a 10s number from 2 digit number.

Step 1 Subtract the ones.

Step 2 Subtract the tens.  
3 tens - 2 tens = 1 ten






$36 - 20 = 16$


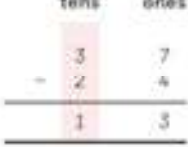
Using concrete objects and pictorial representations to subtract a 2 digit number from 2 digit number.

Subtract 24 from 37.


Step 1 Subtract the ones.  
7 ones - 4 ones = 3 ones





Step 2 Subtract the tens.  
3 tens - 2 tens = 1 ten

$37 - 24 = 13$

Use  to help you subtract.



Recognise and use the inverse relationship between addition and subtraction

?	
23	53

76	
23	?

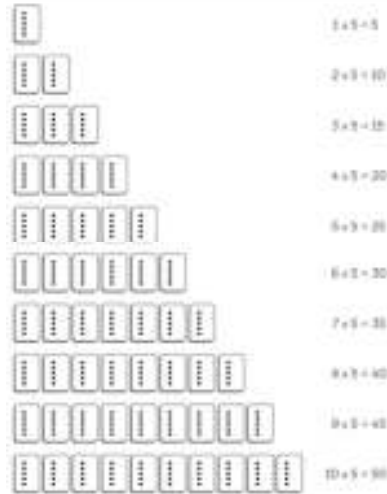
Use this to check calculations and solve missing number problems.

# Multiplication

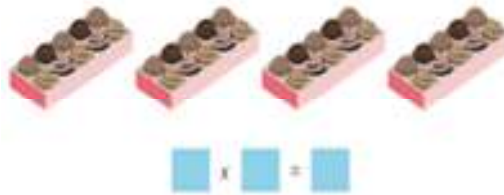
**Skip counting in multiples of 2, 3, 5, 10 from 0**



Recall and use multiplication facts for the multiplication tables 2, 5 and 10.



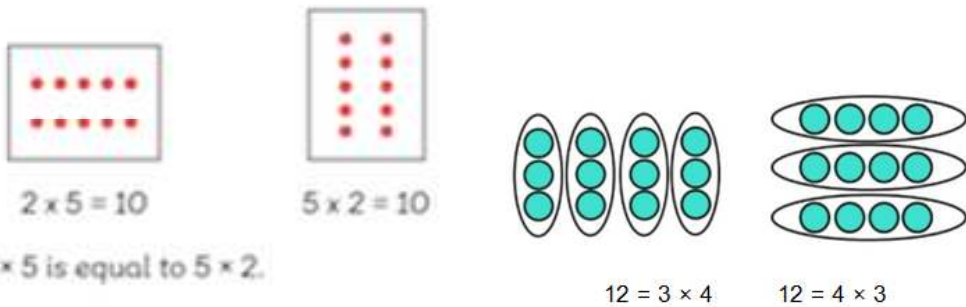
I can use multiplication (x) and equal (=) sign when writing out my times tables.



**Multiplication is commutative**

*Pupils should understand that an array can represent different equations and that, as multiplication is commutative, the order of the multiplication does not affect the answer.*

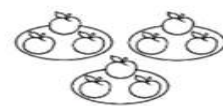
How many dots are there?



Solve multiplication problems in context using arrays and repeated addition






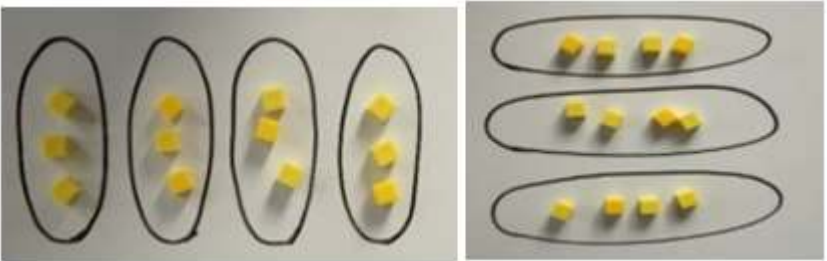

$3 \times 5 = \square$   
 $5 \times 3 = \square$



How many apples are there altogether?

$3 + 3 + 3 = 9$

# Division

<p>Recall and use division facts for the multiplication tables 2, 5 and 10.</p>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: left;"> <p>20 ÷ 10 =</p> <p>20 ÷ 10 =</p> <p>20 ÷ 10 =</p> <p>10 ÷ 20 =</p> <p>10 ÷ 20 =</p> <p>100 ÷ 20 =</p> </div> <div style="text-align: right;"> <p>•</p> <p>•</p> <p>•</p> <p>•</p> <p>•</p> <p>•</p> </div> <div style="text-align: right;"> <p>•</p> <p>•</p> <p>•</p> <p>•</p> <p>•</p> <p>•</p> </div> </div>
<p>Solve division problems in context using concrete objects by sharing</p>	<p>There are 18 sausages.</p>  <p>Put 18 sausages equally on 2 plates.</p>  <p>There are 9 sausages on each plate.</p> <p><math>18 \div 2 = 9</math></p> <div style="display: flex; justify-content: center; align-items: center; margin-top: 20px;"> <div style="border: 1px solid gray; border-radius: 50%; padding: 5px; margin-right: 10px;"> <math>2 \times 9 = 18</math> </div>  </div>
<p>Solve division problems in context using arrays</p>	
<p>I can solve division as grouping.</p>	<p>Put 10 buns in groups of 2. How many plates are there?</p> 

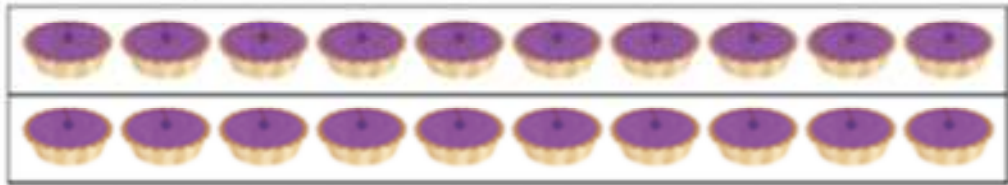


Put into groups of 5.  
There are  groups.

I can use the inverse.

This should be taught alongside both multiplication and division.

Make a family of multiplication and division facts.



$$2 \times 10 = 20 \quad \text{—————} \quad 20 \div 10 = \text{$$

$$10 \times 2 = 20 \quad \text{—————} \quad 20 \div 2 = \text{$$

## Year 3

### Addition

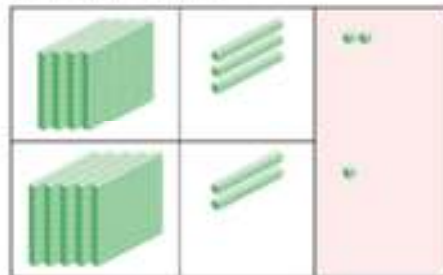
Add two three digit numbers.

*Children need to use equipment first to support their understanding of place value.*

*Children to word gradually to three digit + three digit starting without carrying and gradually moving towards carrying.*

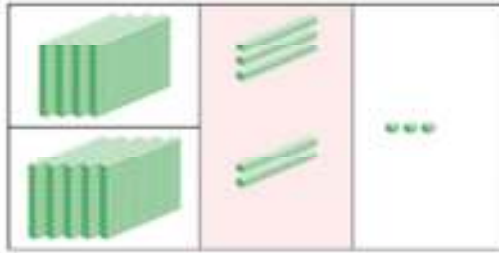
$$432 + 521 =$$

Step 1 Add the ones.  
2 ones + 1 one = 3 ones



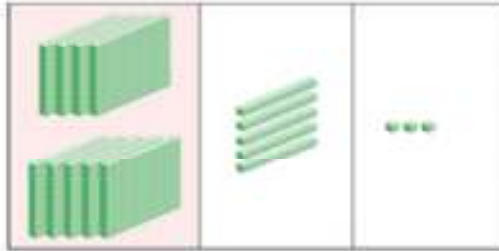
	h	t	o
	4	3	2
+	5	2	1
			3
			3

Step 2 Add the tens.  
 $3 \text{ tens} + 2 \text{ tens} = 5 \text{ tens}$



	h	t	o
	4	3	2
+	5	2	1
		5	3

Step 3 Add the hundreds.  
 $4 \text{ hundreds} + 5 \text{ hundreds} = 9 \text{ hundreds}$

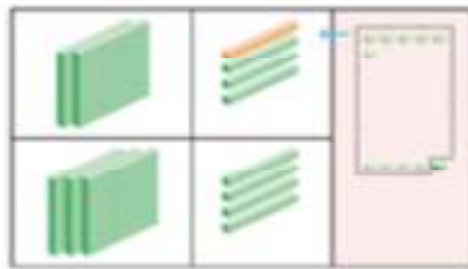


	h	t	o
	4	3	2
+	5	2	1
	9	5	3

$$432 + 521 = 953$$

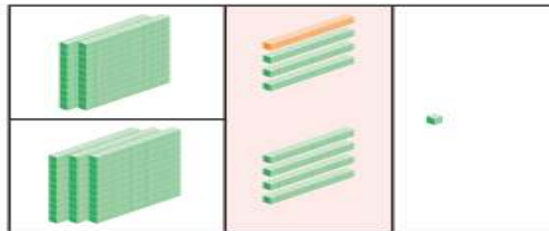
There are 953 flowers altogether.

$$236 + 345 =$$



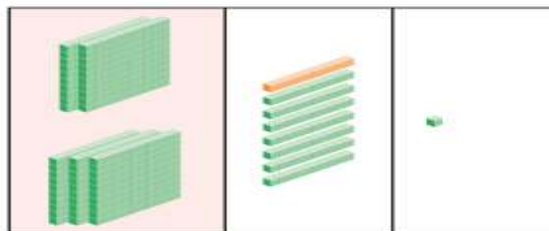
	h	t	o
	2	3	6
+	3	4	5
			1

Step 2 Add the tens.  
 $1 \text{ ten} + 3 \text{ tens} + 4 \text{ tens} = 8 \text{ tens}$



	h	t	o
	2	3	6
+	3	4	5
		8	1

Step 3 Add the hundreds.  
 $2 \text{ hundreds} + 3 \text{ hundreds} = 5 \text{ hundreds}$



	h	t	o
	2	3	6
+	3	4	5
	5	8	1

$$236 + 345 = 581$$

Using the bar to find missing digits. It is important for children to use the bar in this way to encourage the use of it to aid with problem solving.

**Bar Model to support understanding of problem solving:**



A man sold 230 balloons at a carnival in the morning. He sold another 86 balloons in the evening. How many balloons did he sell in all?



**Subtraction**

Subtract up to 3 digits from 3 digits.

Very important for children to use dienes equipment along with a place value chart to support.

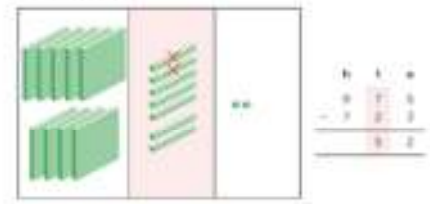
Only when secure with the method should exchanging be introduced.

Subtract 723 from 905.

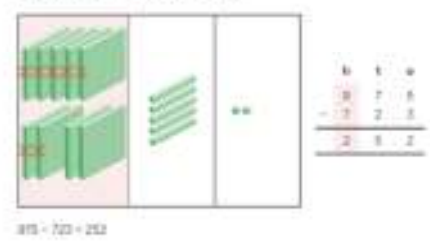
Step 1 Subtract the ones.  
5 ones - 3 ones = 2 ones



Step 2 Subtract the tens.  
7 tens - 2 tens = 5 tens

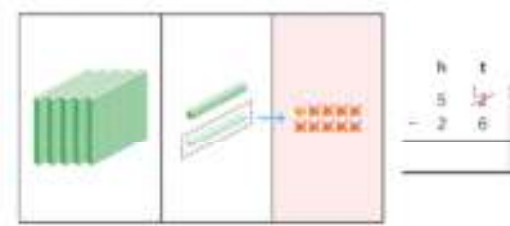
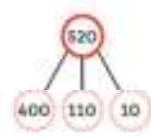


Step 3 Subtract the hundreds.  
8 hundreds - 7 hundreds = 1 hundred



Subtract 269 from 520.

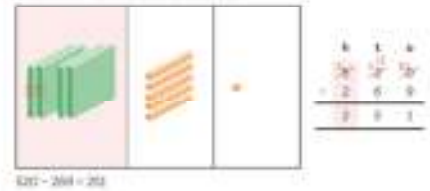
Step 1 Regroup 1 ten into 10 ones.  
Subtract the ones.  
10 ones - 9 ones = 1 one



Step 2 Regroup 1 hundred into 10 tens.  
Subtract the tens.  
11 tens - 6 tens = 5 tens



Step 3 Subtract the hundreds.  
4 hundreds - 2 hundreds = 2 hundreds





Using the bar to find missing digits.

It is important for children to use the bar in this way to encourage the use of it to aid with problem solving.

315	
185	?

$315 - 185 = ?$

$185 + ? = 315$

?	
185	315

$185 + 315 = ?$

$? - 185 = 315$

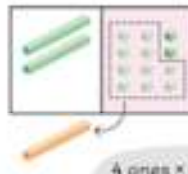
## Multiplication

Children should be able to recall the 2, 5, 10, 3, 4 and 8 times tables.

Multiply a two digit number by a one digit.

### Let's Learn

- 1 There are 4 groups of 23 fish. How do we multiply 23 by 4?



4 ones  $\times$  3 = 12 ones  
12 ones = 1 ten 2 ones

Step 1 Multiply the ones by 4.

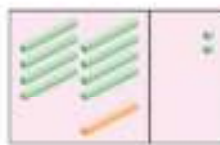
$$\begin{array}{r} \text{t} \quad \text{o} \\ 23 \\ \times 4 \\ \hline 12 \end{array}$$



2 tens  $\times$  4 = 8 tens

Step 2 Multiply the tens by 4.

$$\begin{array}{r} \text{t} \quad \text{o} \\ 23 \\ \times 4 \\ \hline 80 \end{array}$$



12 + 80 = 92

Step 3 Add the products.

$$\begin{array}{r} \text{t} \quad \text{o} \\ 23 \\ \times 4 \\ \hline 12 \\ + 80 \\ \hline 92 \end{array}$$

$23 \times 4 = 92$

There are 92 fish in 4 tanks.

Using the bar to solve multiplication problems.

4 children go to the cinema. They each pay £15. How much do they spend altogether?

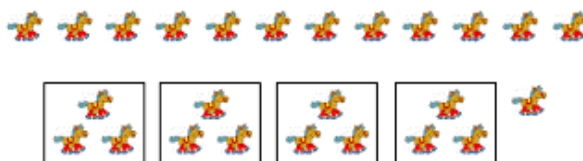
Whole unknown

?			
15	15	15	15

# Division

Dividing by grouping  
 understanding the concept of remainders.

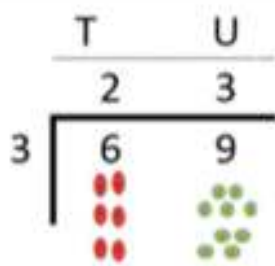
Start with using the real objects-or objects that represent the calculation.



$$13 \div 4 = 3 \text{ Remainder } 1$$

Dividing using short division.

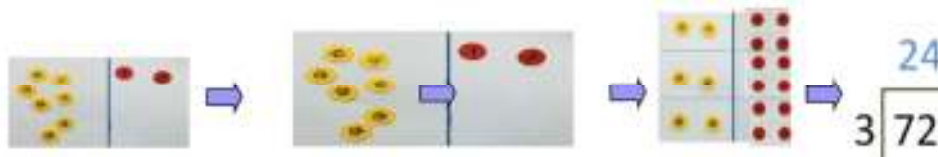
Once children are secure with division as grouping and demonstrate this using number lines, arrays etc., **short division** for larger 2-digit numbers should be introduced, initially with carefully selected examples requiring no calculating of remainders at all. Start by introducing the layout of short division by comparing it to an array.



Remind children of correct place value, that 69 is equal to 60 and 9, but in short division, pose:

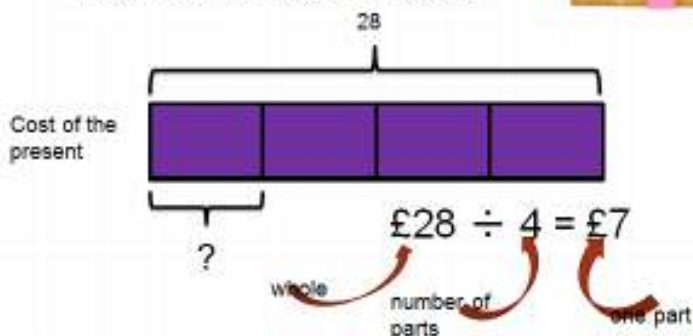
- How many 3's in 6? = 2, and record it above the **6 tens**.
- How many 3's in 9? = 3, and record it above the **9 ones**.

Once children demonstrate a full understanding of remainders, and also the short division method taught, they can be taught how to use the method when remainders occur within the calculation (e.g.  $72 \div 3$ ), and be taught to 'carry' the remainder onto the next digit.



Using the bar to aid the solving of division problems.

Four children bought a present for £28. They shared the costs equally. How much did each child pay?



# Year 4

## Addition

Adding numbers with up to 4 digits.

Again this should start with the children using dienes to support them with lots of discussion about the value of each digit.

2 3 1 4	
+ 4 2 4 0	
6 5 5 4	

Step 1 Add the ones.  
4 ones + 0 ones = 4 ones


Step 2 Add the tens.  
1 tens + 4 tens = 5 tens

Step 3 Add the hundreds.  
3 hundreds + 2 hundreds = 5 hundreds

Step 4 Add the thousands.  
2 thousands + 4 thousands = 6 thousands


2314 + 4240 = 6554

Step 2 Add the tens. 7 tens + 3 tens + 1 ten = 11 tens  
Renome the tens. 11 tens = 1 hundred and 1 ten




5	1	7	8
+ 1	2	3	5
	1	3	

Step 3 Add the hundreds.  
6 hundreds + 2 hundreds + 1 hundred = 9 hundreds



5	1	7	8
+ 1	2	3	5
	9	1	3

Step 4 Add the thousands.  
5 thousands + 1 thousand = 6 thousands



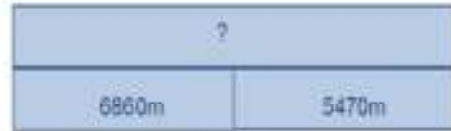
5	1	7	8
+ 1	2	3	5
6	5	5	4

Using the bar to find missing digits.

It is important for children to use the bar in this way to encourage the use of it to aid with problem solving.

This is not a form of getting the correct answer but helping to guide children to the correct operation.

Alison jogs 6,860 metres and Calvin jogs 5,470 metres. How far do they jog altogether?



## Subtraction

To subtract with numbers up to four digits including exchanging when children are secure.

Again children need to use dienes to support their learning.

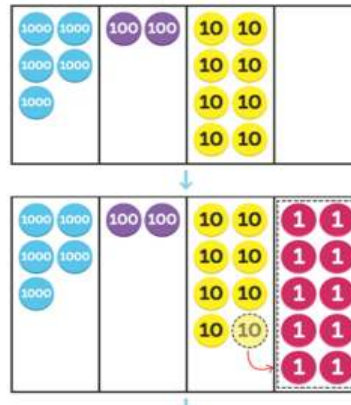
3 4 3 7	
- 2 0 1 6	
1 4 2 1	

Step 1 Subtract the ones.  
7 ones - 6 ones = 1 one

Step 2 Subtract the tens.  
3 tens - 1 ten = 2 tens

Step 3 Subtract the hundreds.  
4 hundreds - 0 hundreds = 4 hundreds

Step 4 Subtract the thousands.  
3 thousands - 2 thousands = 1 thousand



There aren't enough ones.



5	2	7	10
- 3	1	6	9
	2	1	1



## Division

Dividing up to three digit numbers by a one digit number using short division.

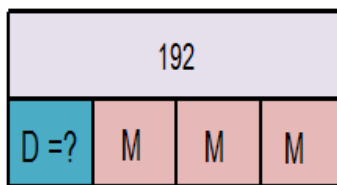
Only when the children are secure with dividing a two digit number should they move onto a 3 digit number.



	H	T	U	r1
	0	2	5	
5	1	2	6	
		•••••	•••••	=

Dividing using the bar.

Desmond and Melissa collect cards. They have 192 cards in all. Melissa has three times as many cards as Desmond. How many cards does Desmond have?



### Early Years:

**Key vocabulary for Addition:** add, addition, more than, plus, and, make, balances, altogether, total, sum, equal to, equals, double, most, count on, number line, digit, tens, ones, part-part whole, ten frame

**Key vocabulary for Subtraction:** minus, subtract, less than, take away, left, one less, count back, equal to, number sentence, part-part whole, ten frame

**Key vocabulary for Multiplication:** double, equals, groups of, lots of, times, altogether

**Key Vocabulary for Division:** share, share between, share equally, one each, two each, groups, halve

### YEAR 1

**Key vocabulary for Addition:** add, addition, more than, plus, and, make, balances, altogether, total, sum, equal to, equals, double, most, count on, number line, digit, tens, ones, part-part whole, ten frame, greater/greatest, partition, operation, inverse, number sentence, calculation, number family

**Key vocabulary for Subtraction:** minus, subtract, less than, take away, left, one less, count back, equal to, number sentence, part-part whole, ten frame leaves, difference between, how many more, how

many fewer / less than, most, least, smaller/smallest, how many left, how much less is?, inverse, calculation, operation, number family

**Key vocabulary for Multiplication:** double, equals, groups of, lots of, times, altogether multiply, count, array, multiple

**Key Vocabulary for Division:** share, share between, share equally, one each, two each, group, equal groups of, halve, groups of, lots of, array

## YEAR 2

**Key vocabulary for Addition:** add, addition, more than, plus, and, make, balances, altogether, total, sum, equal to, equals, double, most, count on, number line, digit, tens, ones, part-part whole, ten frame, greater/greatest, partition, operation, inverse, number sentence, calculation, number family, column, tens boundary, bar model

**Key vocabulary for Subtraction:** minus, subtract, less than, take away, left, one less, count back, equal to, number sentence, part-part whole, ten frame leaves, difference between, how many more, how many fewer / less than, most, least, smaller/smallest, how many left, how much less is?, inverse, calculation, operation, number family, strategy, partition, target ten, bar model

**Key vocabulary for Multiplication:** double, equals, groups of, lots of, times, altogether multiply, count, array, multiple, multiplied by, repeated addition, column, row, commutative, sets of, equal groups, times as big as, once, twice, three times..., bar model

**Key Vocabulary for Division:** share, share between, share equally, one each, two each, group, equal groups of, halve, groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, remainder, bar model

## YEAR 3

**Key vocabulary for Addition:** add, addition, more than, plus, and, make, balances, altogether, total, sum, equal to, equals, double, most, count on, number line, digit, tens, ones, part-part whole, ten frame, partition, operation, inverse, number sentence, calculation, number family, column, tens boundary, bar model, bridging tens boundary, bridging hundreds boundary, increase, vertical, 'carry', expanded, compact,

**Key vocabulary for Subtraction:** minus, subtract, less than, take away, left, one less, count back, equal to, number sentence, part-part whole, ten frame leaves, difference between, how many more, how many fewer / less than, most, least, how many left, how much less is?, inverse, calculation, operation, number family, strategy, partition, target ten, bar model, exchange, decrease, hundreds, value, digit

**Key vocabulary for Multiplication:** double, equals, groups of, lots of, times, altogether multiply, count, array, multiple, multiplied by, repeated addition, column, row, commutative, sets of, equal groups, times as big as, once, twice, three times, bar model, partition, grid method, multiple, product, tens, units, value, inverse

**Key Vocabulary for Division:** share, share between, share equally, one each, two each, group, equal groups of, halve, groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, remainder, bar model, inverse, short division, 'carry', multiple, chunking, short division,

## **YEAR 4**

**Key vocabulary for Addition:** add, addition, more than, plus, and, make, balances, altogether, total, sum, equal to, equals, double, most, count on, number line, digit, tens, ones, part-part whole, ten frame, partition, operation, inverse, number sentence, calculation, number family, column, tens boundary, bar model, bridging tens boundary, bridging hundreds boundary, increase, vertical, 'carry', expanded, compact, thousands, inverse, decimals, decimal places, decimal point, tenths, hundredths,

**Key vocabulary for Subtraction:** minus, subtract, less than, take away, left, one less, count back, equal to, number sentence, part-part whole, ten frame leaves, difference between, how many more, how many fewer / less than, most, least, how many left, how much less is?, inverse, calculation, operation, number family, strategy, partition, target ten, bar model, exchange, decrease, hundreds, value, digit

**Key vocabulary for Multiplication:** double, equals, groups of, lots of, times, altogether multiply, count, array, multiple, multiplied by, repeated addition, column, row, commutative, sets of, equal groups, times as big as, once, twice, three times, bar model, partition, grid method, multiple, product, tens, units, value, inverse, inverse

**Key Vocabulary for Division:** share, share between, share equally, one each, two each, group, equal groups of, halve, groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, remainder, bar model, inverse, short division, 'carry', multiple, chunking, short division, divisible by, factor