Calculation Policy

St Helens Primary School

For Reception to Year 6

Maths Calculation Policy

Progression within in each area of calculation is in line with the programme of study in the 2014 National Curriculum.

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

Concrete representation - 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 - 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 - a pupil is now capable of representing problems by using mathematical notation, for example: $12 \div 2 = 6$.

It is important that conceptual understanding, supported by the use of representation, is secure for all procedures. Reinforcement is achieved by going back and forth between these representations.

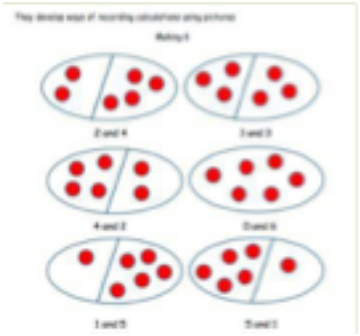
Reception

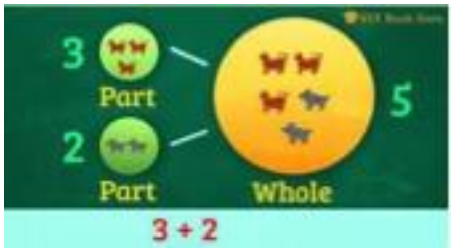
Addition

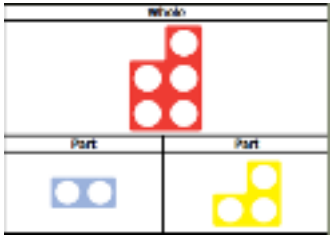
Explore part part whole relationship - Combining two parts to make a whole

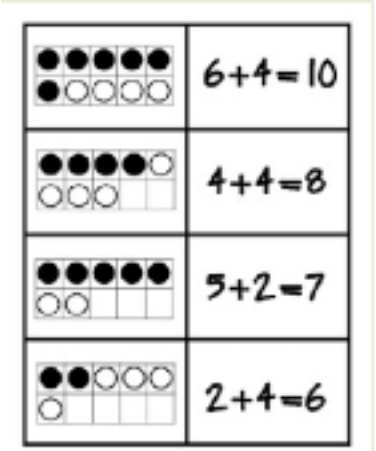
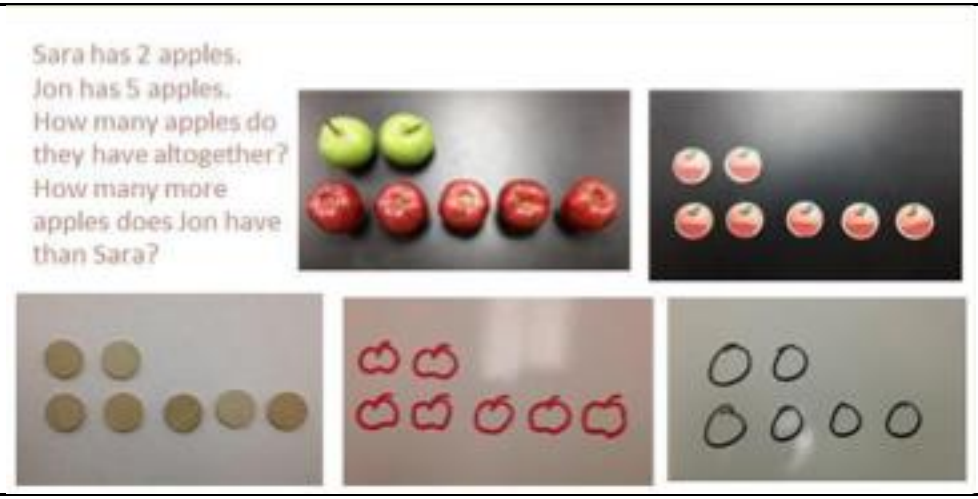
Using the ten frame/ egg boxes to support addition of single digits – counting all/combining two groups

Solving problems using concrete and pictorial

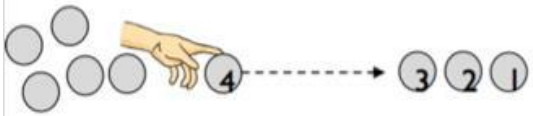
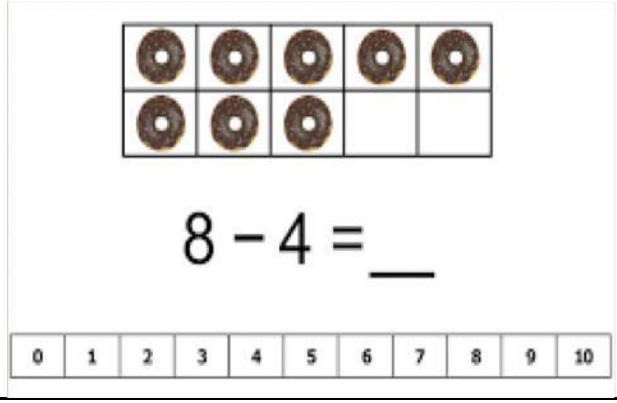


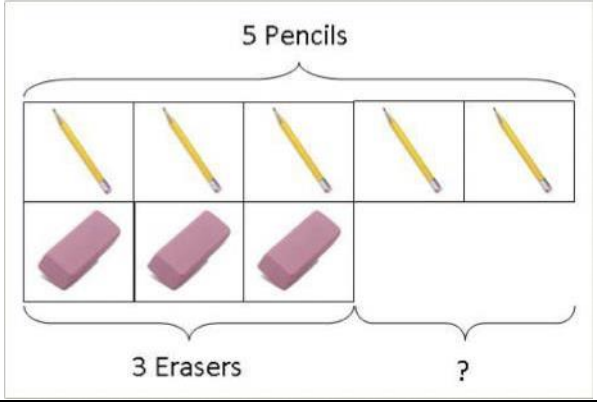
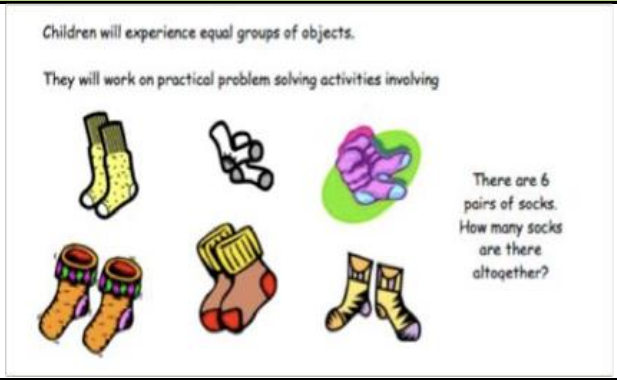
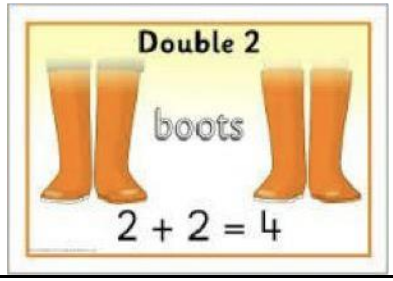


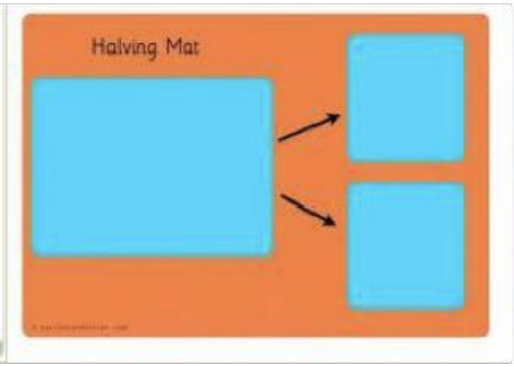


images	 

Subtraction

Using concrete strategies for counting. Using the ten frames to support subtraction by taking away. Peter has 5 pencils and 3 erasers. How many more pencils than erasers does	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. **Those who are ready** may record their own calculations 

he have? Solving problems using concrete and pictorial images.	
Multiplication	
Experiencing equal groups of objects. They will think about doubling when solving practical problems.	 
Division	

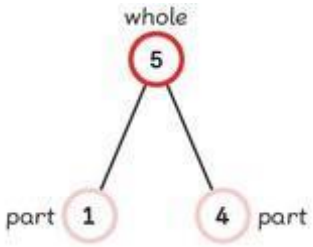
Sharing practical objects. Hearing and being exposed to language to describe half and seeing visual representatives.	 

Year 1

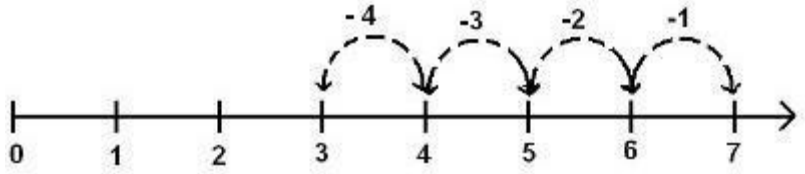
Addition

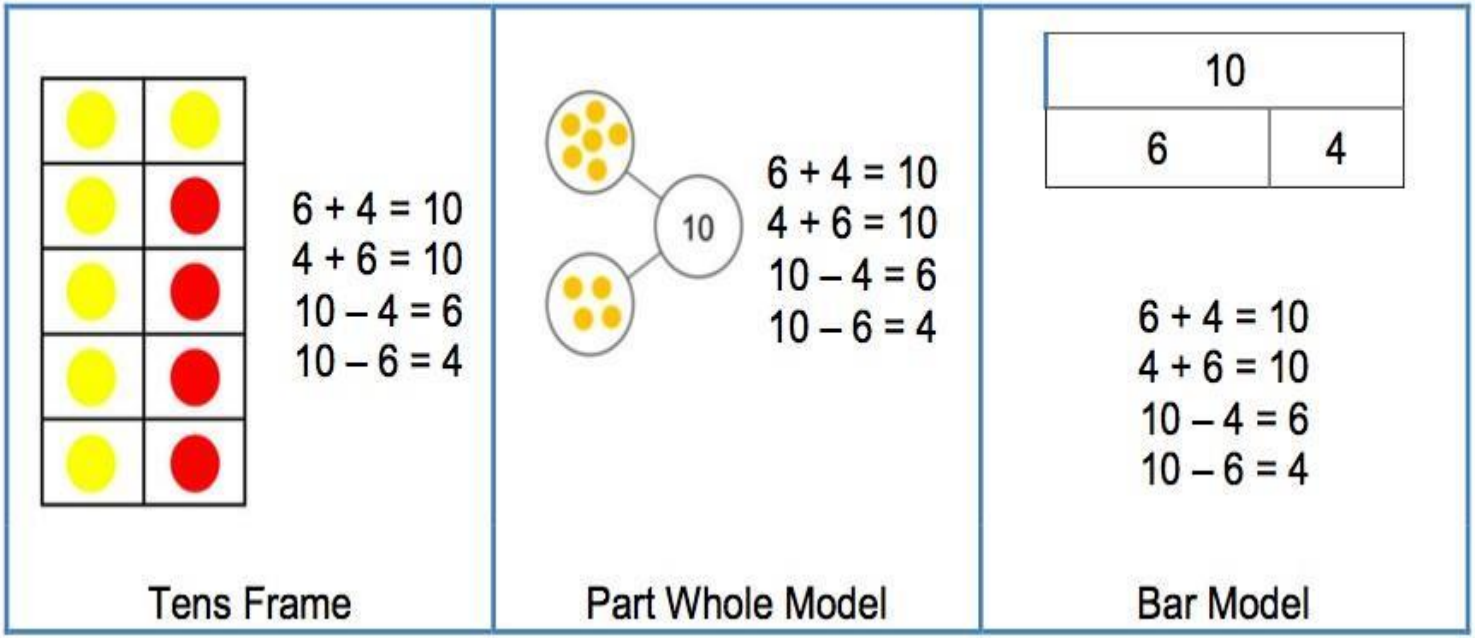
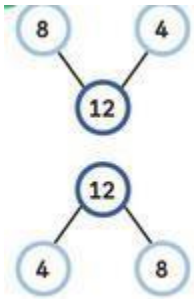
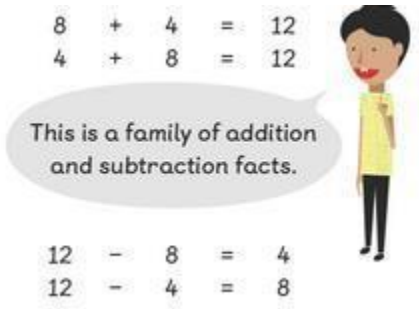
Combining two parts to make a whole: part- whole model. Joining two groups and then recounting all objects (lots of practice making 10 and numbers to 10

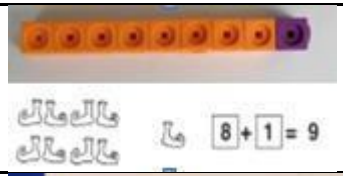
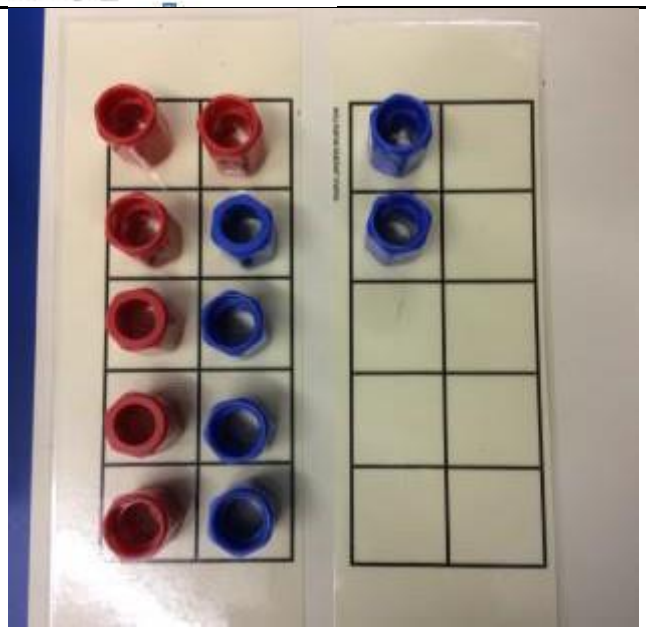
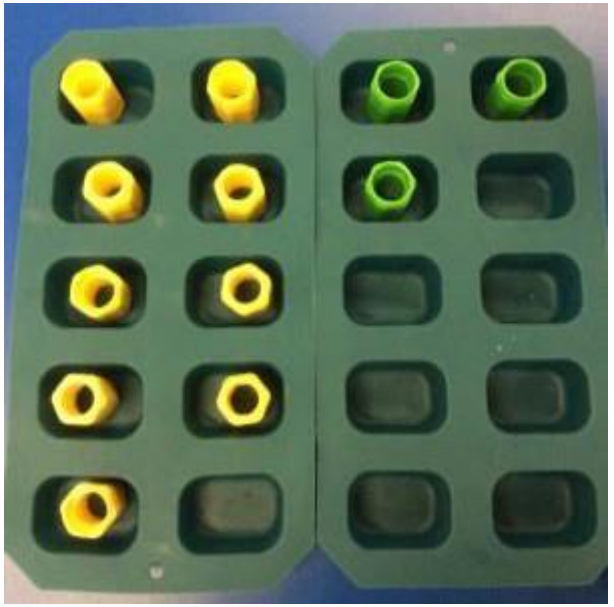
e.g.6 +4=10or3+5= 8)



3+4 =7

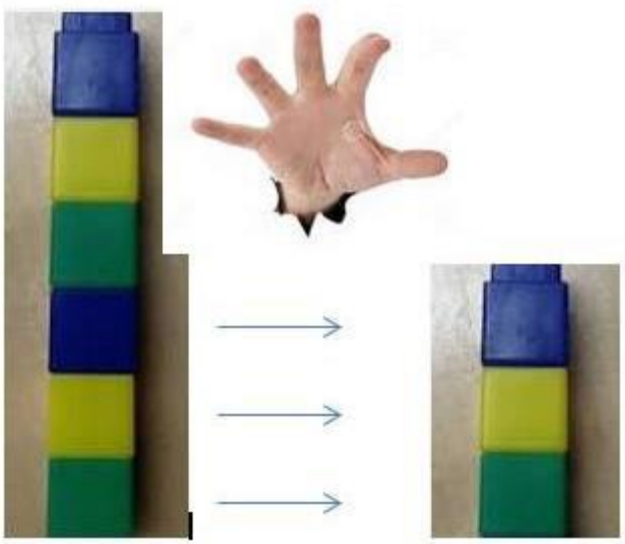


Number Bonds Learn number bonds to 20 and demonstrate related facts. Addition and subtraction taught alongside each other as pupils need to see the relationship between the facts.	  
Add and subtract one digit numbers and two digit	8+1=9

numbers to 20, including zero	
Bridging 10; use ten frames, Singapore bars, egg boxes and number lines to practice. Children should start with the larger number and add the smaller number seeing what makes ten.	  $6 + 6 = 12$ Make 9 in one and 3 in the other. Take one from the 3 to make the 9 into a ten....10+2 = 12

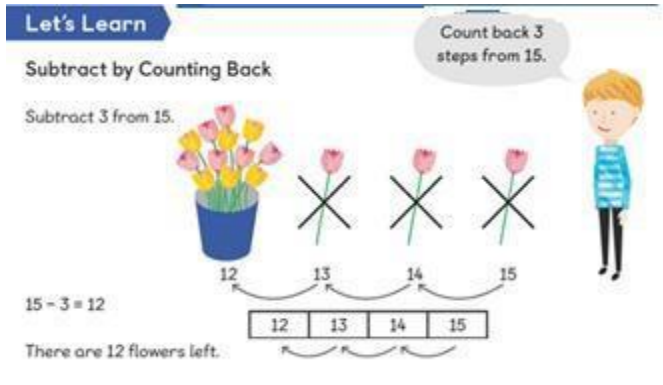
Subtraction

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



6 -3=3

Subtraction by counting back

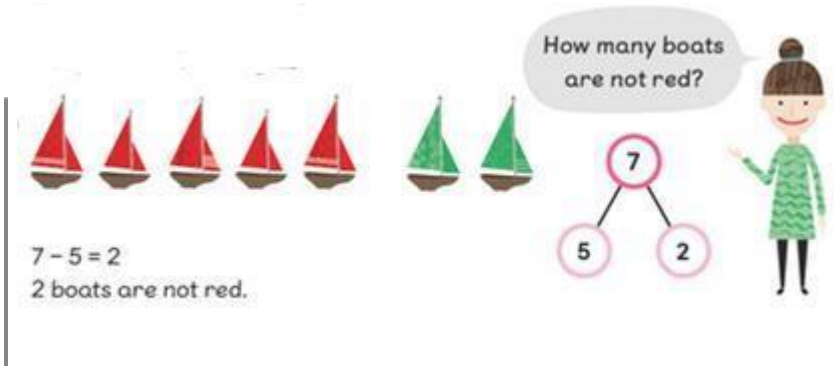


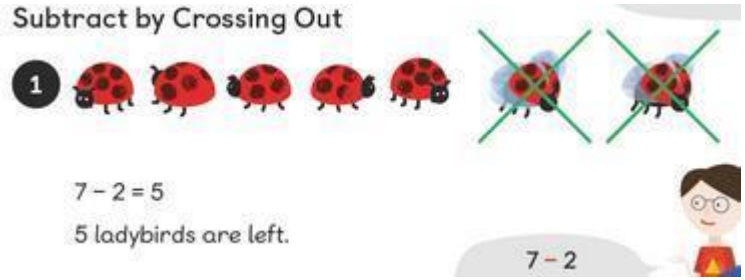
Subtracting a single digit number from a single digit number and a single digit from a two digit by

crossing out pictures

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

?-5=2





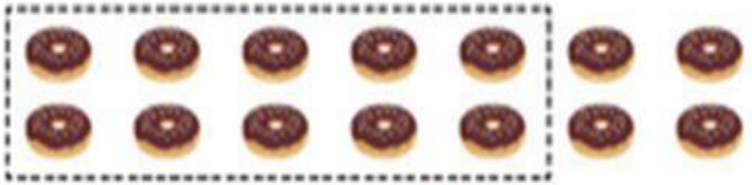
Subtraction by subtracting from 10 Children subtract from 10 and not from ones	14-8=?

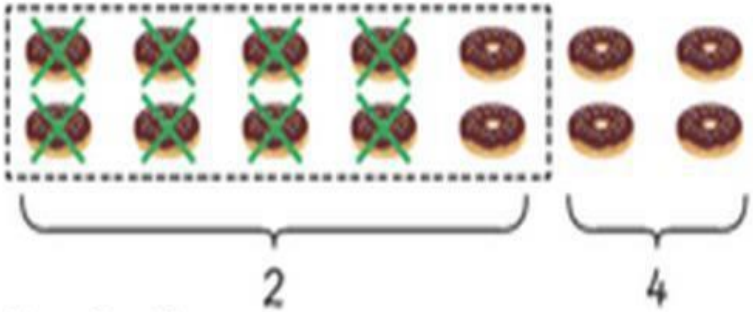
Let's Learn

Subtract from 10

14 − 8 = ?

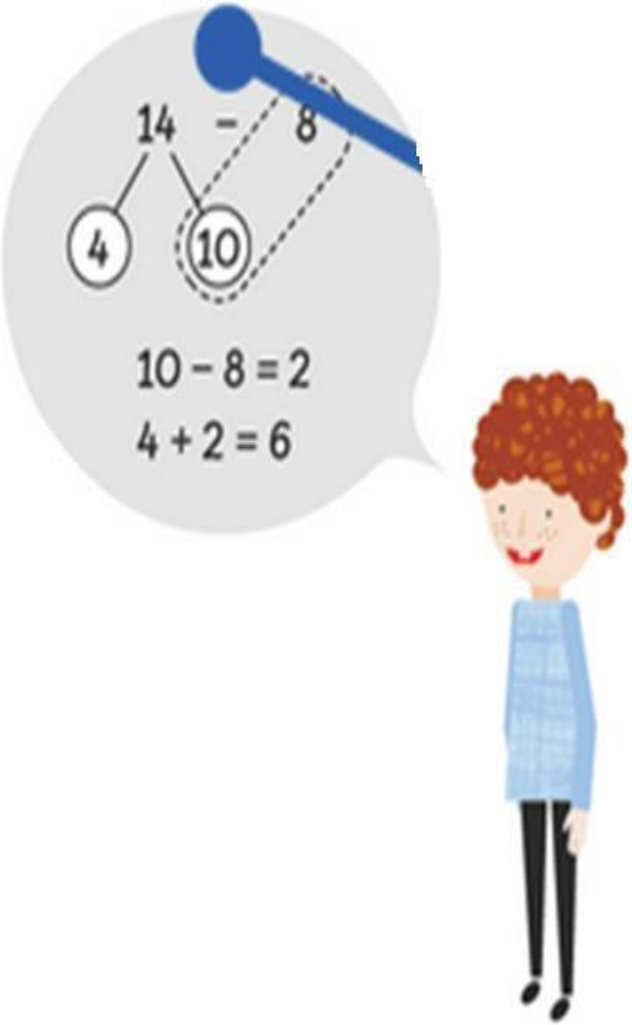
Put 10 in a box ↓

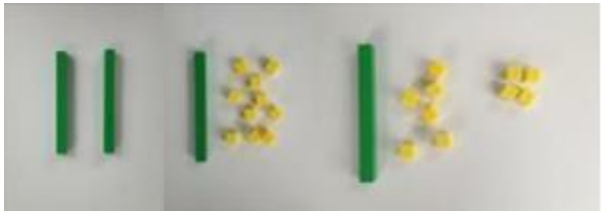
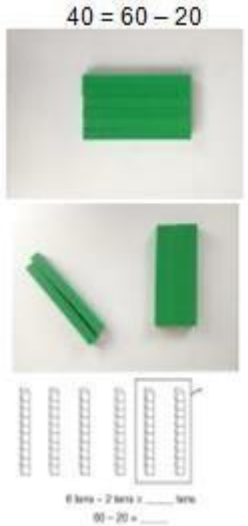
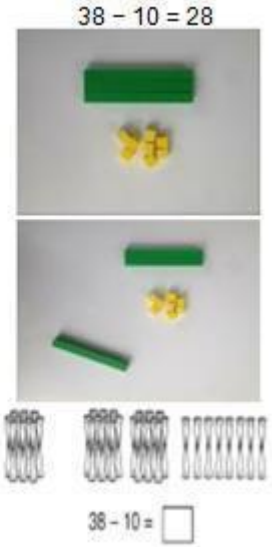




14 − 8 = 6

Sam has 6 doughnuts left.



When subtracting using Dienes children should be taught to regroup (rename) 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	 

Multiplication

Counting in multiples of 2, 5 and 10 from zero

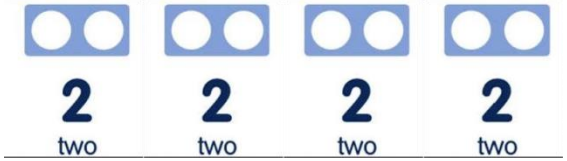
Children should count

the number of groups on their fingers as they are skip counting

2 × 4 = 8

2468

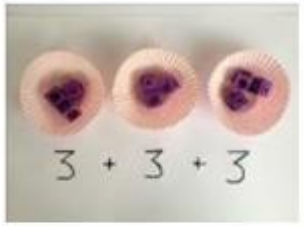
4 groups of 2 = 8 4x2=8

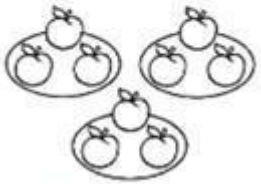


When moving to pictorial/written calculations the vocabulary is important

This image represents two groups of 4 or 4 twice

Solving multiplication problems using repeated addition





3 + 3 + 3 = 9

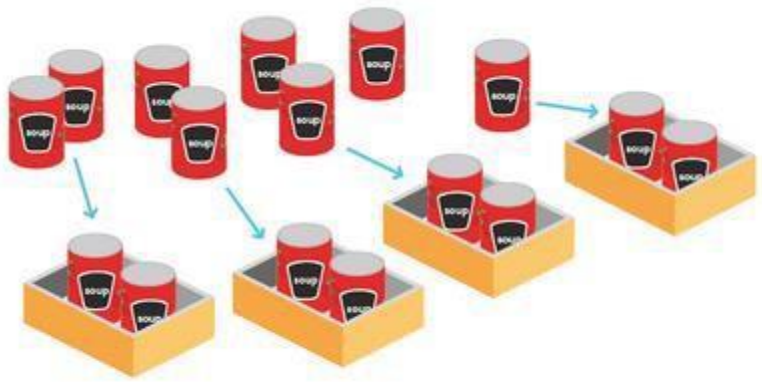
Division

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

$10 \div 2 = 5$

1 There are 8 cans.



There are 4 boxes of 2 cans.

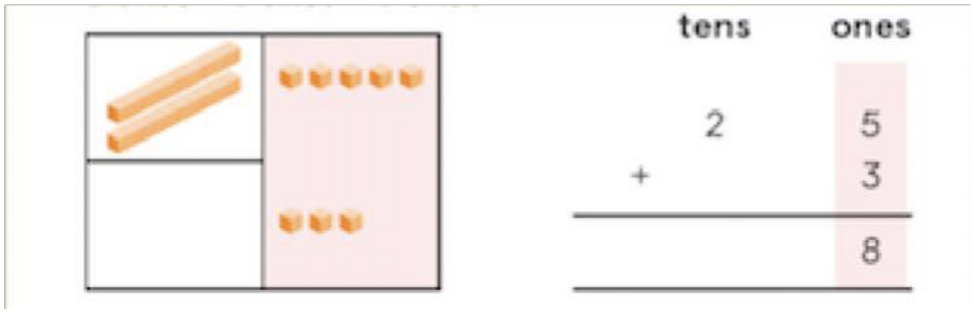
II.

Year 2

Addition

Using concrete objects

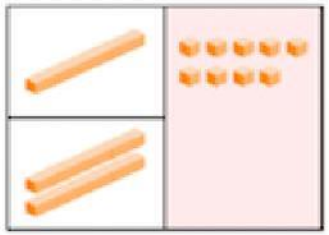
and pictorial representations to add a 2 digit number with a 1 digit number.



	tens	ones
	2	5
+		3
		8

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

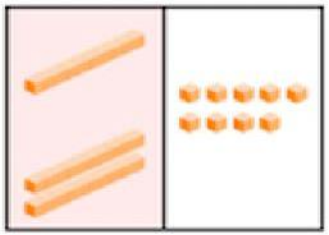
Step 1 Add the ones.



	tens	ones
	1	9
+	2	0
		9

Step 2 Add the tens.

1 ten + 2 tens = 3 tens



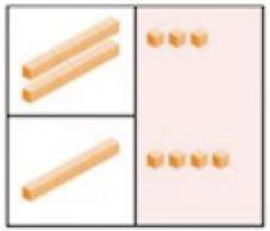
	tens	ones
	1	9
+	2	0
	3	9

19 + 20 = 39

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

Step 1 Add the ones.

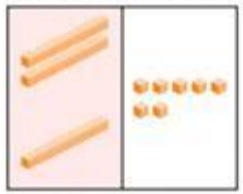
3 ones + 4 ones = 7 ones



	tens	ones
	2	3
+	1	4
		7

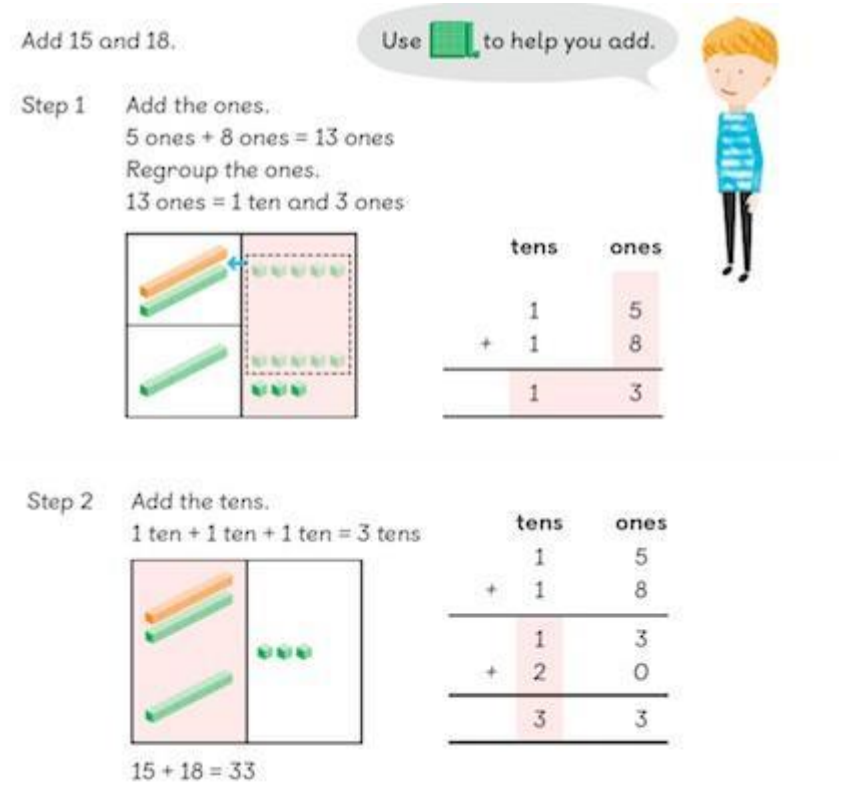
Step 2 Add the tens.

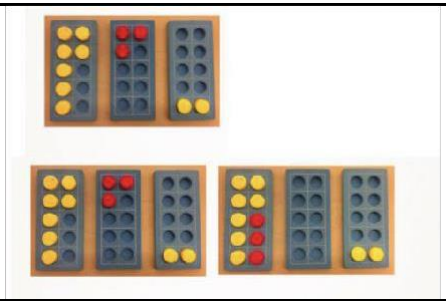
2 tens + 1 ten = 3 tens

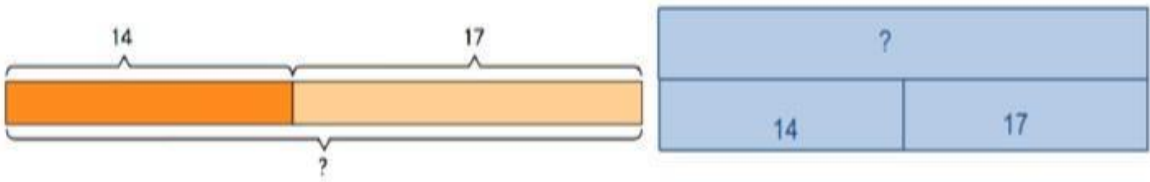


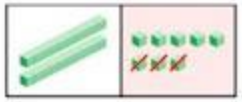
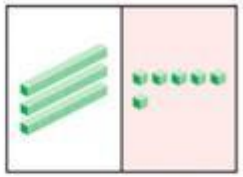
	tens	ones
	2	3
+	1	4
	3	7

23 + 14 = 37

	Adding with renaming 
Using concrete objects and pictorial representations to add 3 single digit numbers.	7+3+2 = leads to 10 + 2 =

<table>
<tr><td></td><td>  </td></tr>
<tr><td>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.</td><td>Helen has 14 bread-sticks. Her friend has 17. How many do they have altogether?
 
</td></tr>
<tr><td colspan="2">Subtraction</td></tr>
</table>

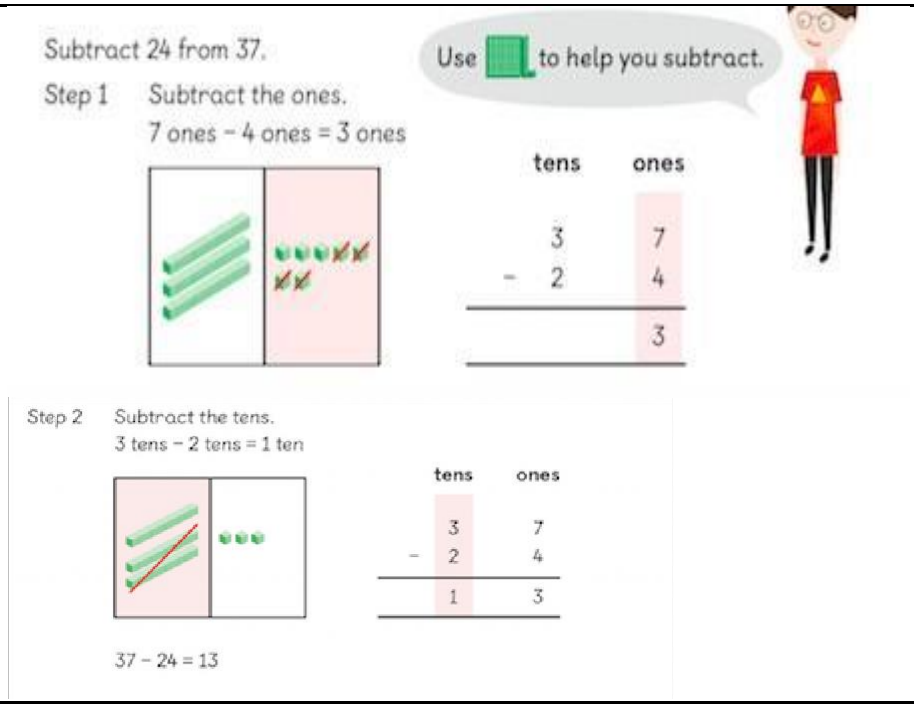
Using concrete objects and pictorial representations to subtract a 1 digit number from 2 digit number.	Step 1 Subtract the ones. 8 ones − 3 ones = 5 ones  Step 2 Subtract the tens.  28 − 3 = 25
Using concrete objects and pictorial representations to subtract a 10s number from 2 digit number.	Step 1 Subtract the ones.  Step 2 Subtract the tens. 3 tens − 2 tens = 1 ten  36 − 20 = 16

	tens	ones
	2	8
−		3
		5

	tens	ones
	2	8
−		3
	2	5

	tens	ones
	3	6
−	2	0
		6

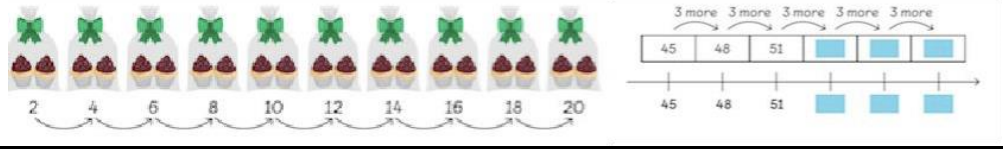
	tens	ones
	3	6
−	2	0
	1	6

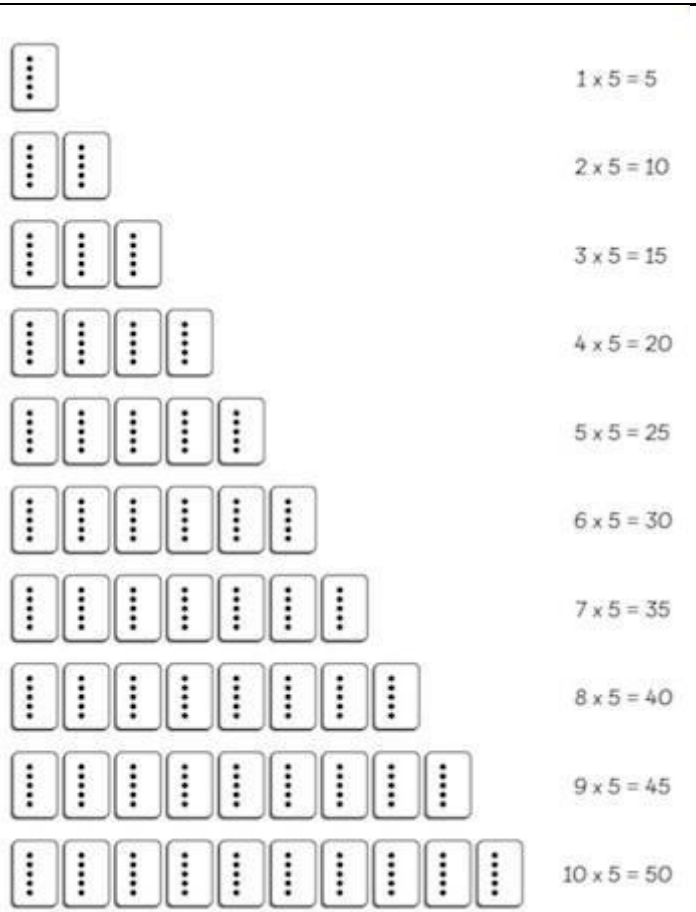
Using concrete objects and pictorial representations to subtract a 2 digit number from 2 digit number.	

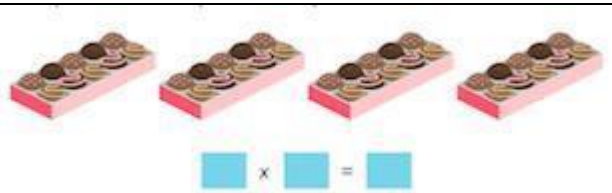
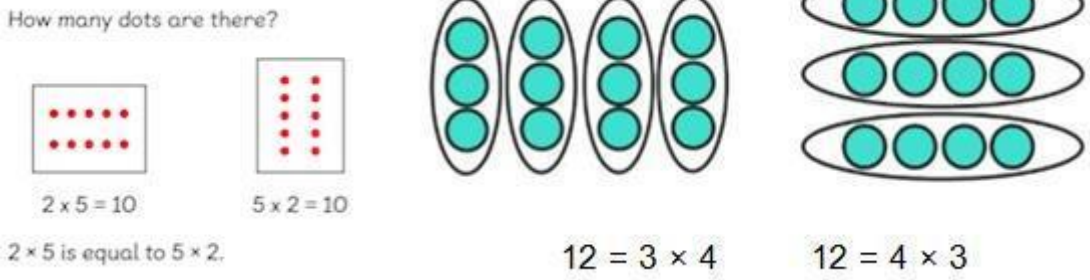
Recognise and use the inverse relationship between addition and subtraction.

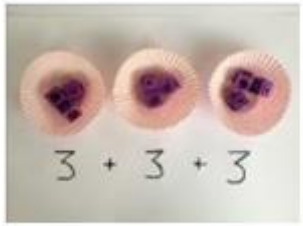
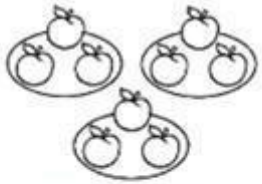
Use this to check calculations and solve missing number problems.

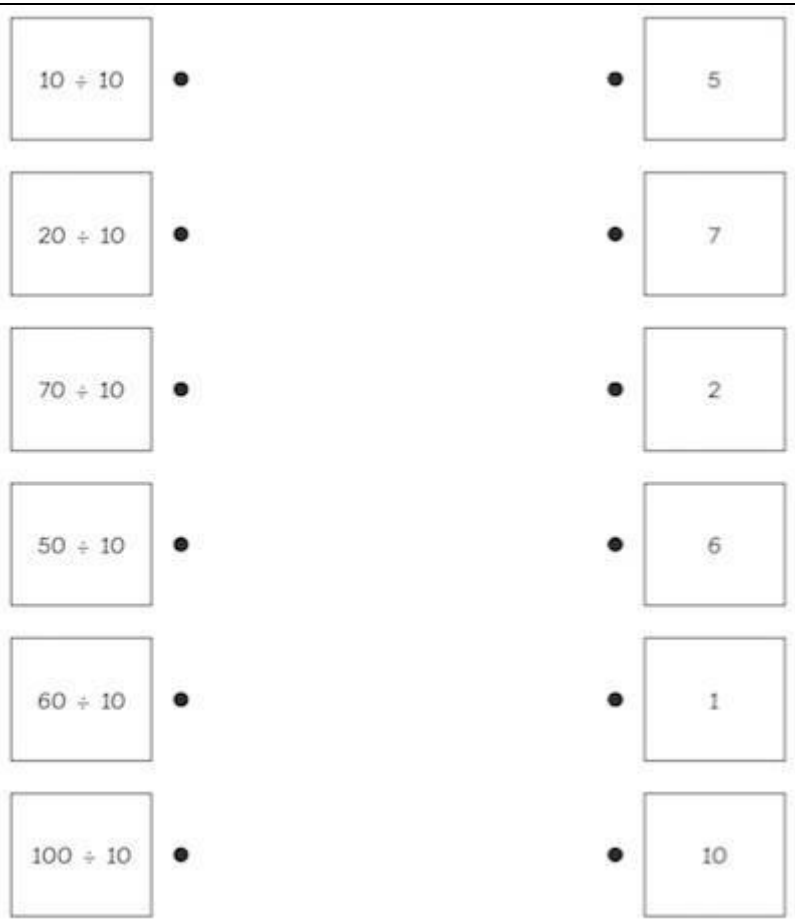
Multiplication

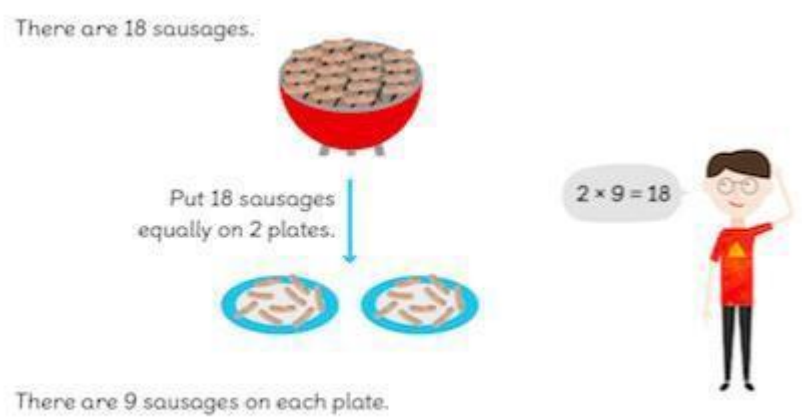
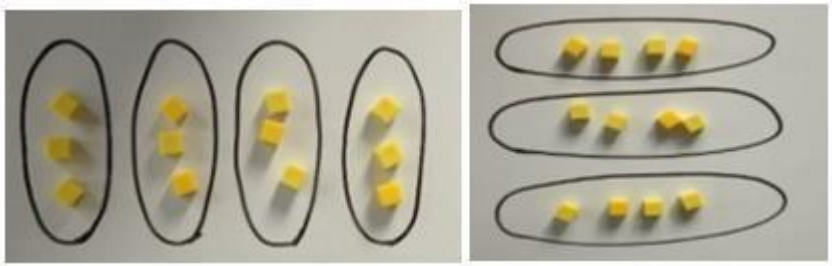
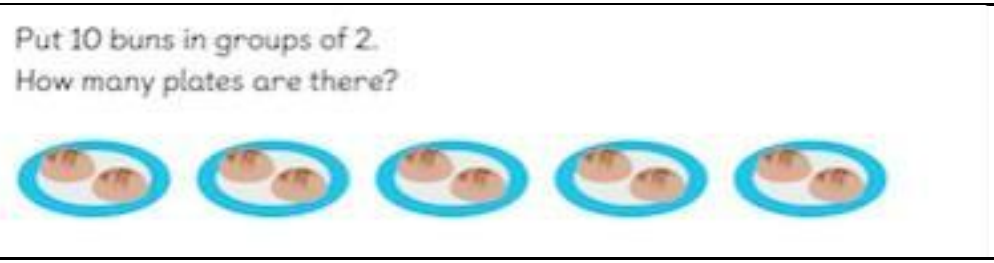
Skip counting in multiples	

of 2, 3, 5, 10 from 0	
Recall and use multiplication facts for the multiplication tables 2, 5 and 10.	

Use multiplication (x) and equal (=) sign when writing out times tables.	
Understanding 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.	

Solve multiplication problems in context using arrays and repeated addition	  3 + 3 + 3 = 9  3 x 5 = ☐ 5 x 3 = ☐
Division	

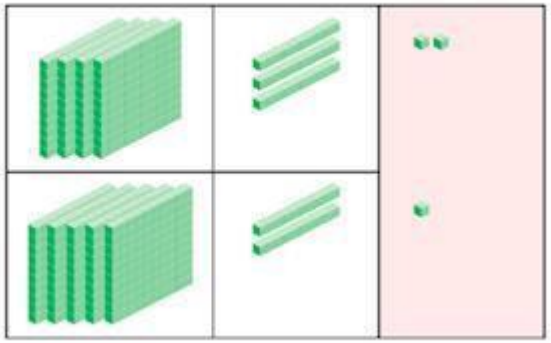
Recall and use division facts for the multiplication tables 2, 5 and 10.	

Solve division problems in context using concrete objects by sharing	
Solve division problems in context using arrays	
Solve division as grouping.	

	 Put into groups of 5. There are ☐ groups.
use the inverse This should be taught alongside both multiplication and division.	Make a family of multiplication and division facts.  2 x 10 = 20 ——— 20 ÷ 10 = ☐ 10 x 2 = 20 ——— 20 ÷ 2 = ☐

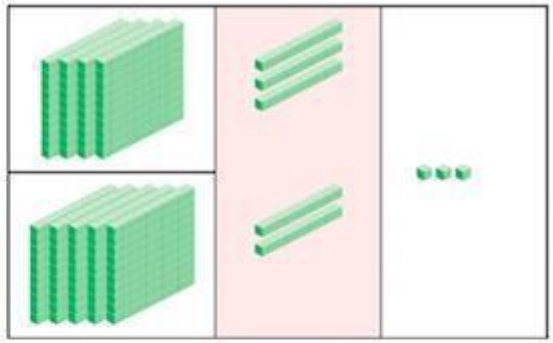
Year 3

Addition	
Add two three digit numbers. Children need to use equipment first	432 + 521 =

to support their understanding of place value. Starting without renaming and gradually moving towards renaming.	Step 1 Add the ones. 2 ones + 1 one = 3 ones  h t o 4 3 2 + 5 2 1 3

Step 2 Add the tens.

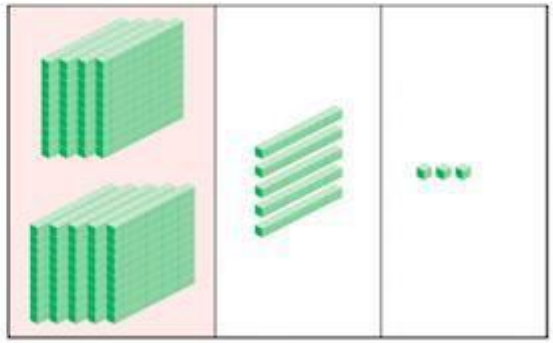
3 tens + 2 tens = 5 tens



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

Step 3 Add the hundreds.

4 hundreds + 5 hundreds = 9 hundreds

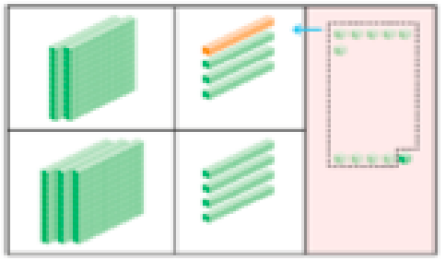


	h	t	o
	4	3	2
+	5	2	1
	9	5	3

432 + 521 = 953

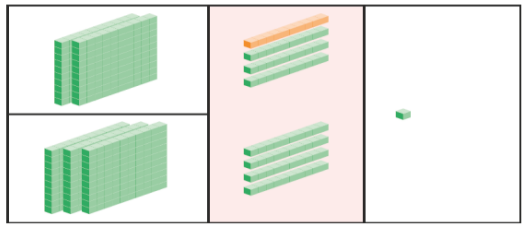
There are 953 flowers altogether.

236 + 345 =



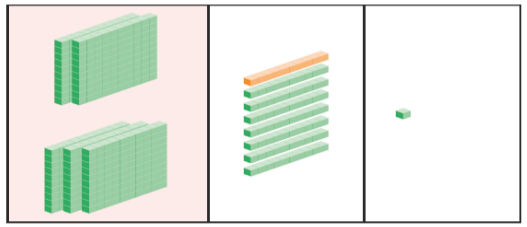
	h	t	o
	2	1 3	6
+	3	4	5
			1

Step 2 Add the tens.
1 ten + 3 tens + 4 tens = 8 tens



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

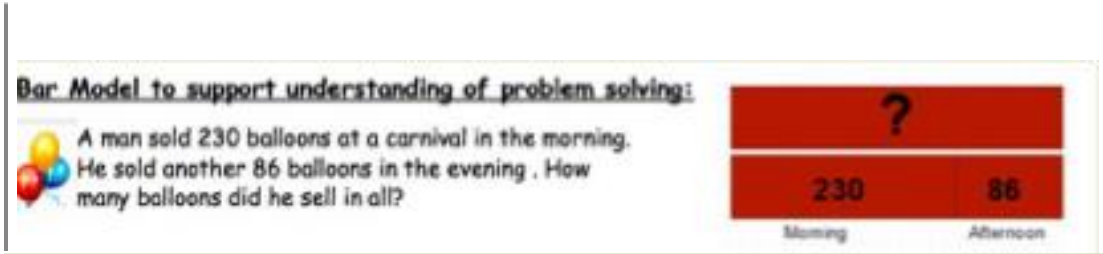
Step 3 Add the hundreds.
2 hundreds + 3 hundreds = 5 hundreds



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

236 + 345 = 581

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

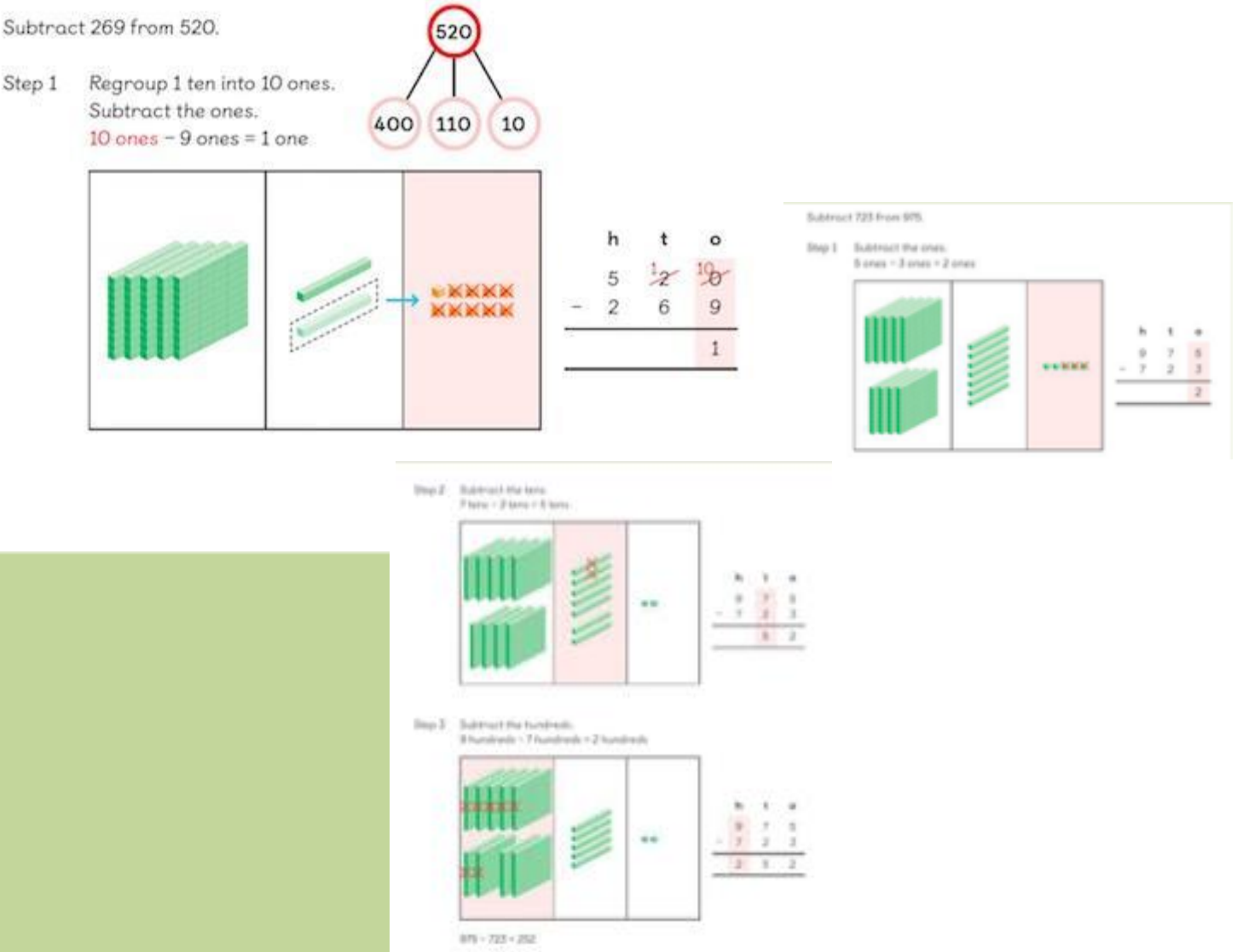


Subtraction

Subtract up to 3 digits from 3 digits.

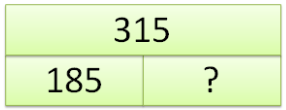
Very important for children to use dienes equipment along with a place value chart to support.

Only when secure with the method should exchanging be introduced.



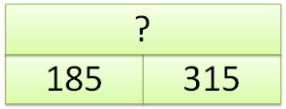
Using the bar to find missing number.

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 = ?

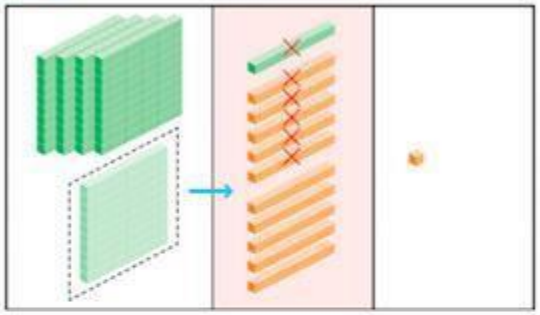
185 + ? = 315



185 + 315 = ?

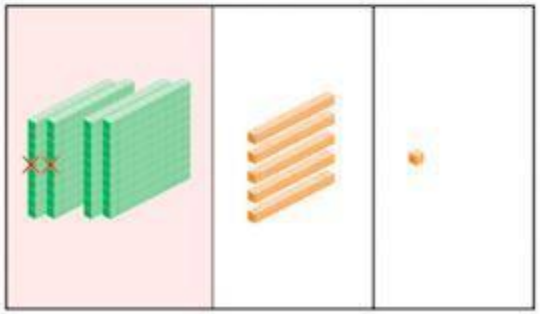
? – 185 = 315

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



	h	t	o
	~~4~~ 5	1 ~~2~~ 11	~~10~~ ~~0~~
−	2	6	9
		5	1

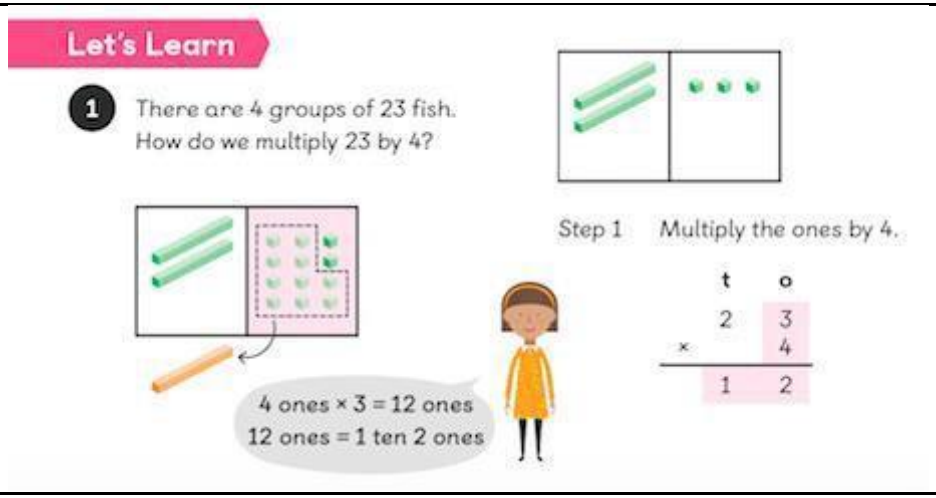
Step 3 Subtract the hundreds.
4 hundreds − 2 hundreds = 2 hundreds

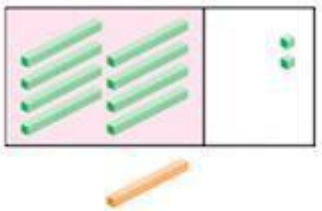


	h	t	o
	~~4~~ 5	1 ~~2~~ 11	~~10~~ ~~0~~
−	2	6	9
	2	5	1

520 − 269 = 251

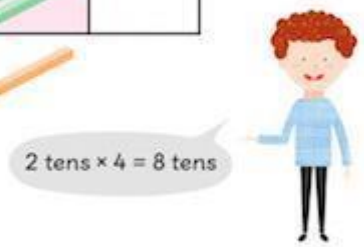
Multiplication

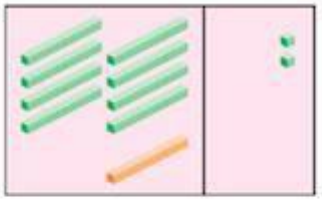
Children should be able to recall the 2, 5, 10, 3, 4 and 8 times tables. Multiply a two digit number by a one digit.	



Step 2 Multiply the tens by 4.

	t	o
	2	3
×		4
	1	2
	8	0



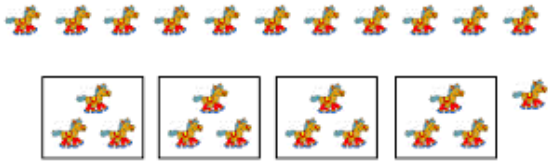
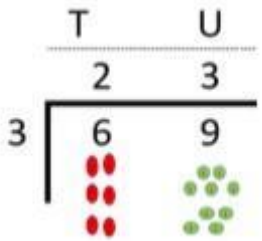


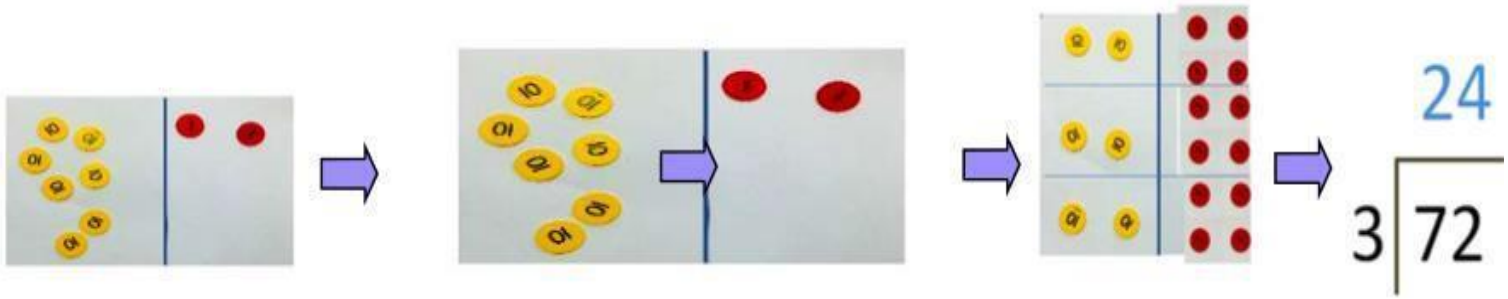
Step 3 Add the products.

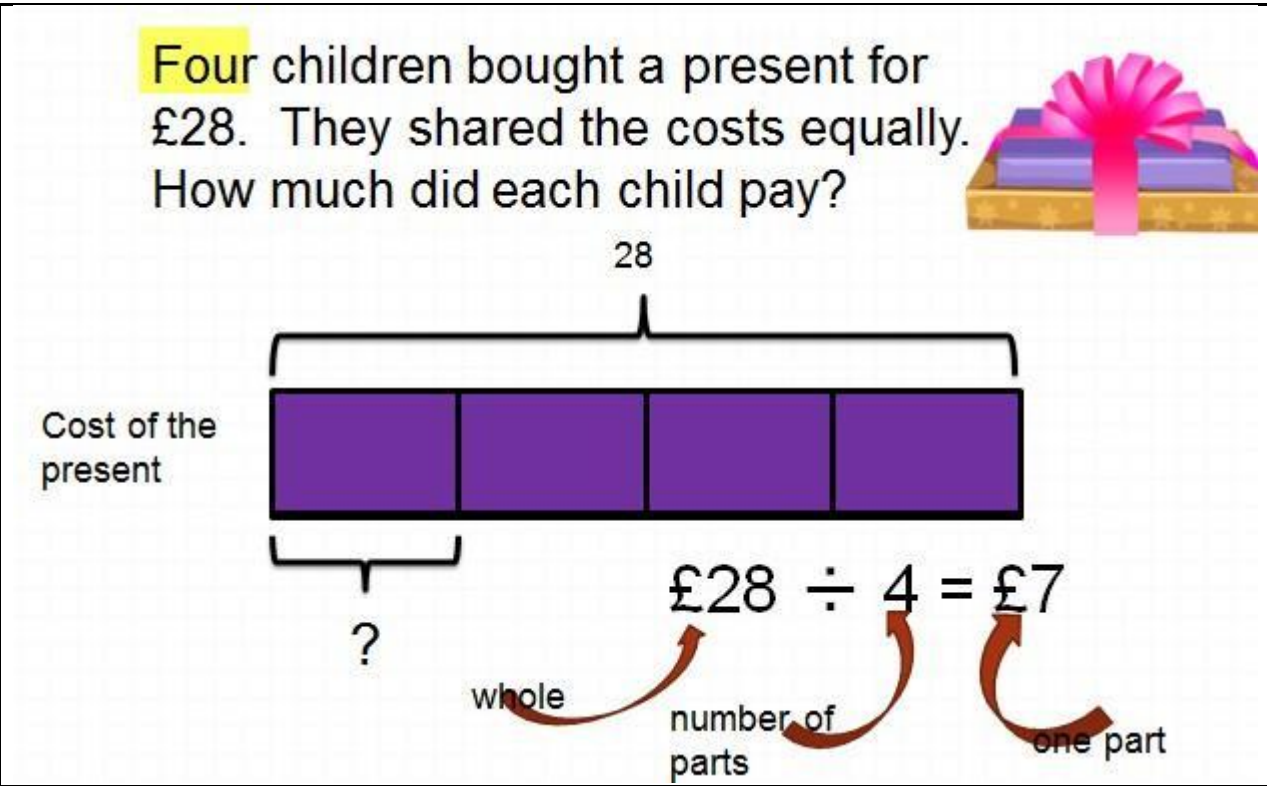
	t	o
	2	3
×		4
	1	2
+	8	0
	9	2

23 × 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 
Division	
Dividing by grouping understanding the concept of remainders.	Start with using the real objects-or objects that represent the calculation.  13 ÷ 4 = 3 Remainder 1
Dividing using short division. Once children are secure with division	
as grouping and	**Remind children of correct place value, that 69 is equal to 60 and 9, but in short**

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.	**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÷3), and be taught to 'carry' the remainder onto the next digit. 

Using the bar to aid the solving of division problems.	

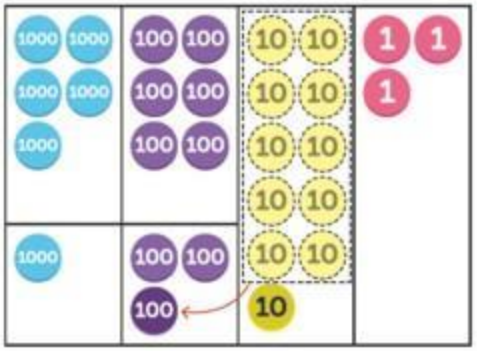
Year 4

Addition

Adding numbers with up to 4 digits.

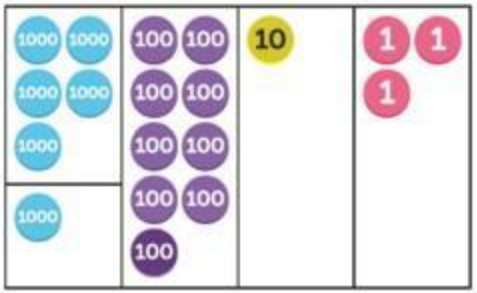
Again this should start with the children using dienes to support them with lots of discussion about the value of each digit.

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



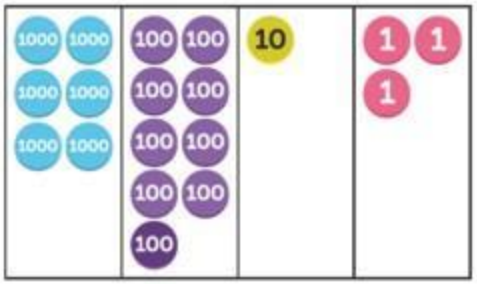
$$\begin{array}{r} {\scriptstyle 1}\ {\scriptstyle 1} \\ 5\ 6\ 7\ 8 \\ +\ 1\ 2\ 3\ 5 \\ \hline 1\ 3 \end{array}$$

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

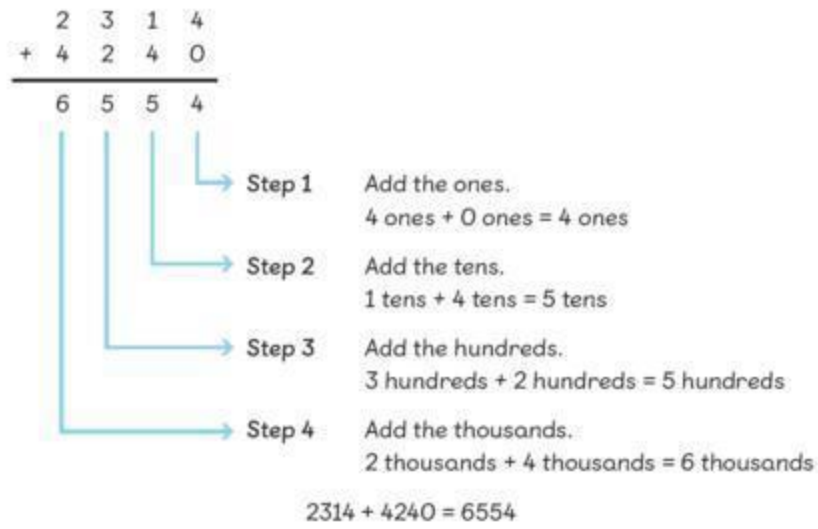


$$\begin{array}{r} {\scriptstyle 1}\ {\scriptstyle 1} \\ 5\ 6\ 7\ 8 \\ +\ 1\ 2\ 3\ 5 \\ \hline 9\ 1\ 3 \end{array}$$

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



$$\begin{array}{r} {\scriptstyle 1}\ {\scriptstyle 1} \\ 5\ 6\ 7\ 8 \\ +\ 1\ 2\ 3\ 5 \\ \hline 6\ 9\ 1\ 3 \end{array}$$

<table>
<tr>
<td></td>
<td>


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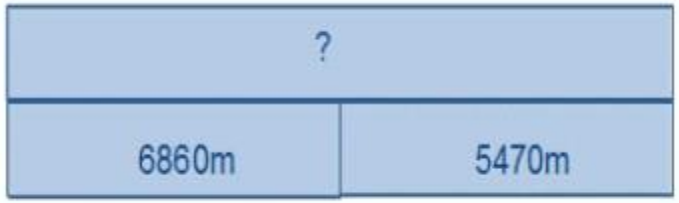
<tr>
<td>Using the bar to find missing digits.

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

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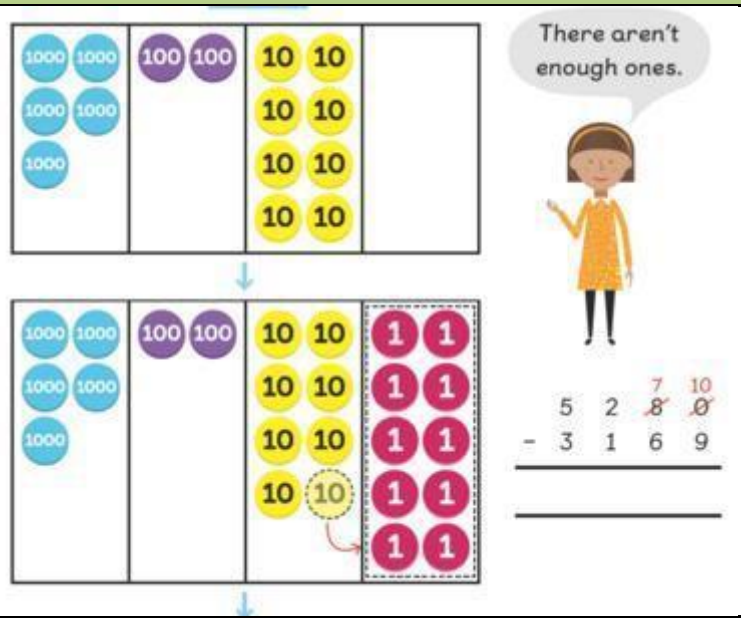
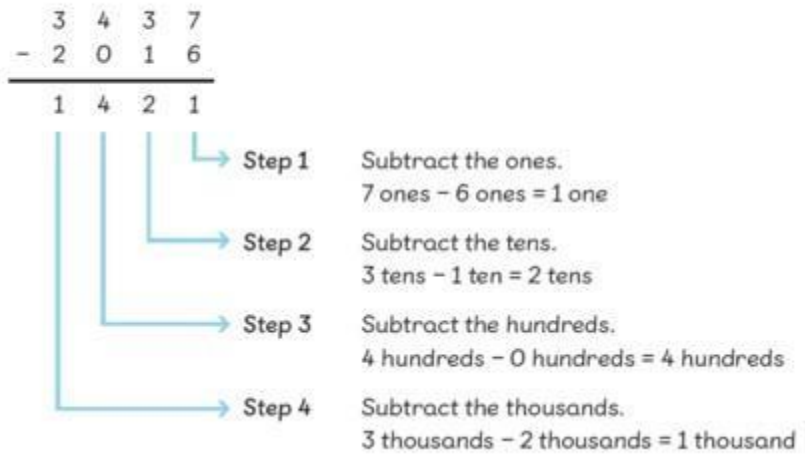
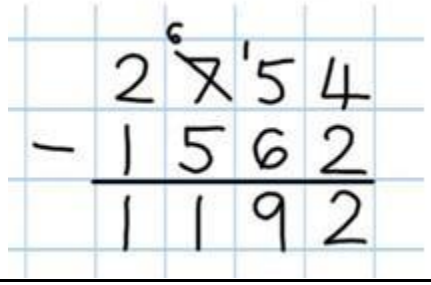
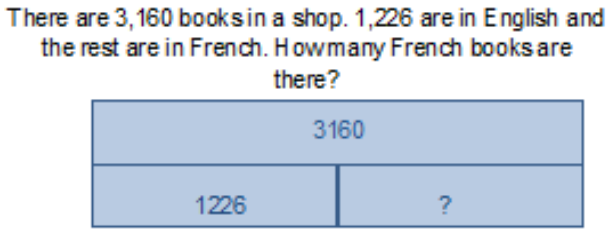
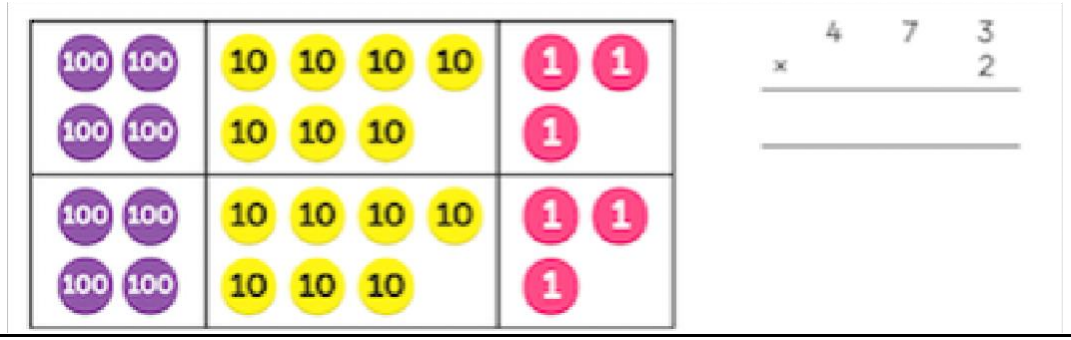
Subtraction

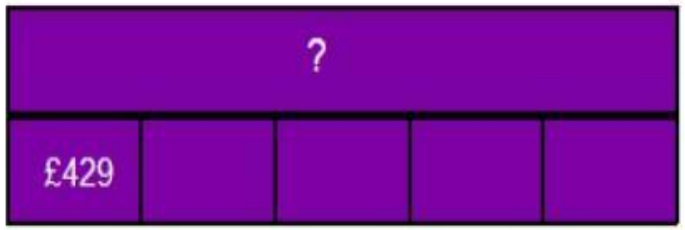
Subtract with numbers up to four digits including exchanging when children are secure.

Again children need to use dienes to support their learning.



	
	
Using the bar to find missing digits. It is important for children to use the bar in this way to encourage the use of	

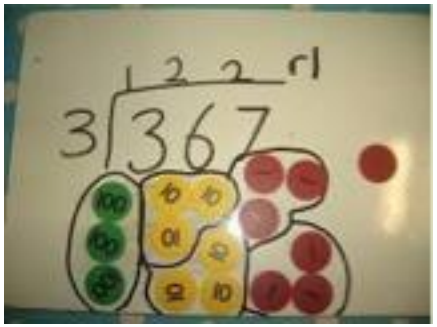
it to aid with problem solving.	
Multiplication	
Children to know all times tables to 12 x 12. Ladder method to be used with children multiplying both two and three digits by a one digit number.	3 1 4 × 3 1 2 (3 x 4) 3 0 (3 x 10) + 9 0 0 (3 x 300) 9 4 2  4 7 3 × 2

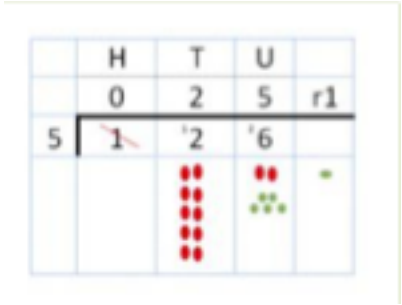
Multiplying using the bar.	A computer costs 5 times as much as a television. The television costs £429. How much does the computer cost? Cost of the computer 

Division

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

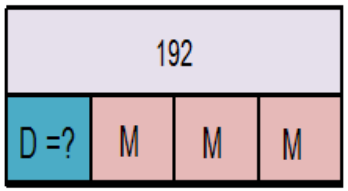
Only when the children are secure with dividing a two- digit number should they move onto a 3- digit number.





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?



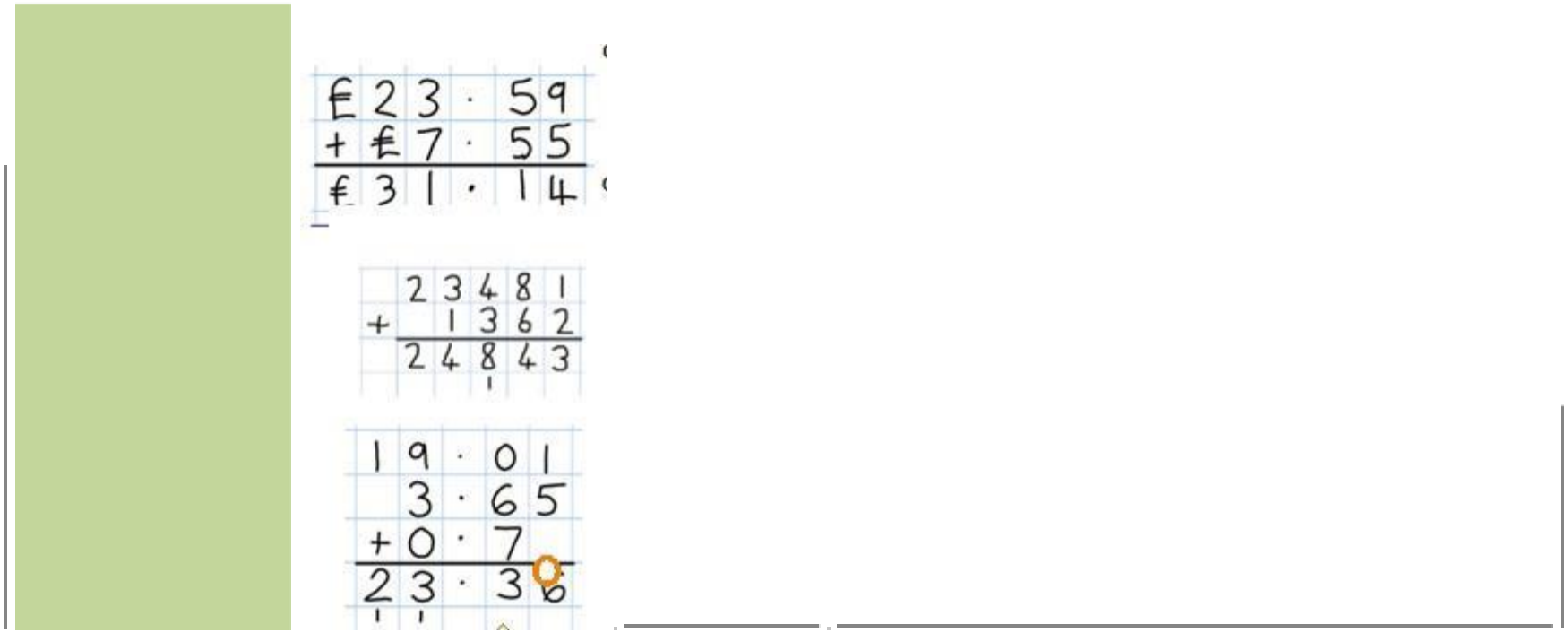
Year 5

four digit numbers

Addition

Adding numbers with more than 4 digits including decimals

Using place value charts are key to this as well as place value counters to help with the decimals



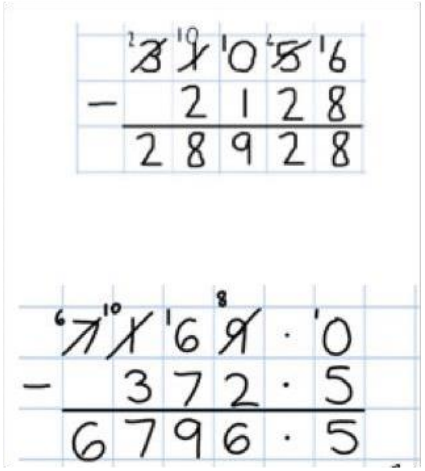
Using the bar model to find missing digits. It is important for children to use the bar in this way to encourage the use of it to aid with problem solving.

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

MacDonalds sold £9957.68 worth of hamburgers and £1238.5 worth of chicken nuggets. How much money did they take altogether?

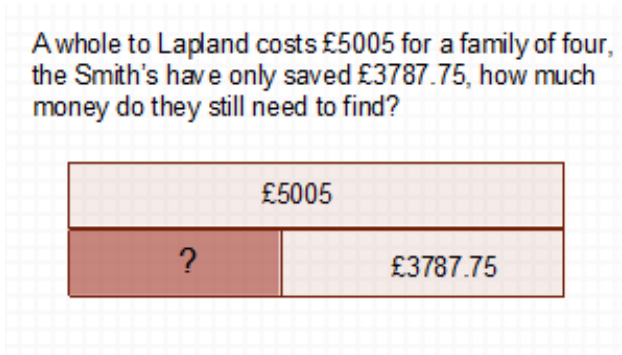
Subtraction

Subtract with decimal values, including mixtures of integers and decimals, aligning the decimal point.

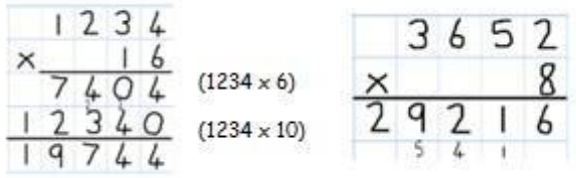
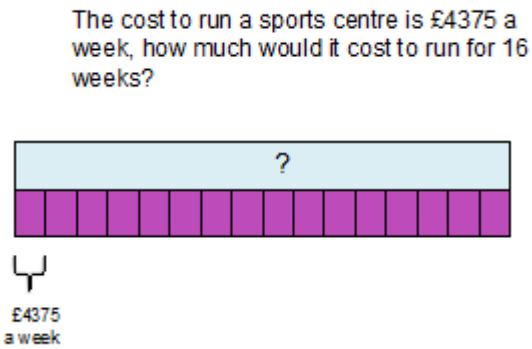


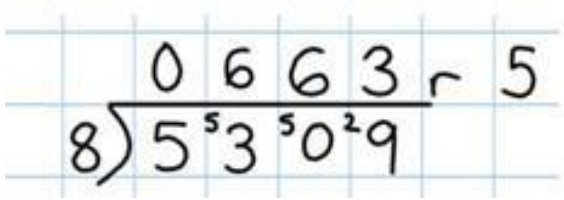
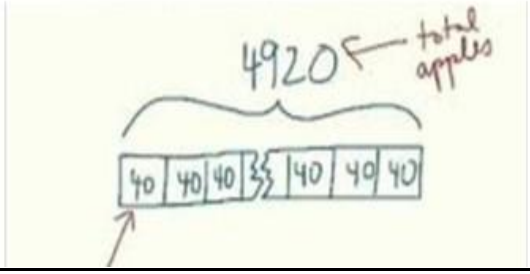
including two decimal places

Include money, measures and decimals ensuring that children do this practically before the abstract.

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.	
Multiplication	
Multiplying up to four digit numbers by two digits using long	56 X 27 392 (56x7) 1120 (56x20) 1512 Explain that first we are multiplying the top number by 7 starting with the

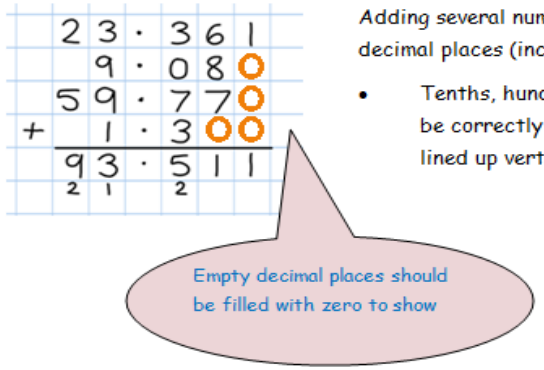
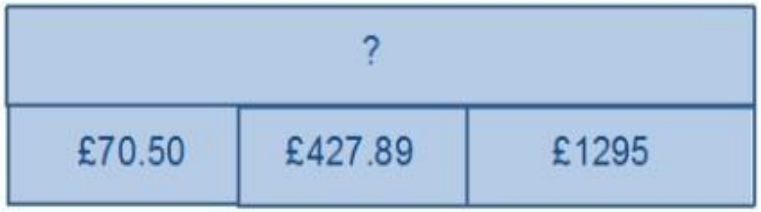
multiplication. Children need to be taught to approximate first, e.g. for **72 x 38,** **they will use rounding:** **72 x 38** is approximately 70 x 40 = **2800**, and use This approximation to check the	units. (any carrying needs to be done underneath the numbers). ____ ____

reasonableness of their answer.	· Now explain that we need to put a 0 underneath—explain that this is because we are multiplying the number by 20.. (2 tens) which is the same as multiplying 10 and 2. · Now add the 2 numbers together to give you the answer. · This will need lots of modelling to show the children. 
Using the bar to support multiplication.	
Division	

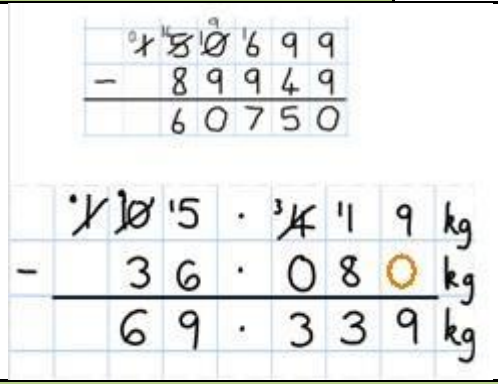
Diving with up to four digit numbers by one digit including numbers where remainders are left.	 **Short division with remainders:** Now that pupils are introduced to examples that give rise to remainder answers, division needs to have a real life problem solving context, where **pupils consider the meaning of the remainder and how to express it,** ie. as a fraction, a decimal, or as a rounded number or value , depending upon the context of the problem.
Using the bar to support division problems.	**Bar Model to support understanding of problem solving:** Frank has 4920 apples. He needs to put them into baskets of 40. How many baskets does he need? 

Year 6

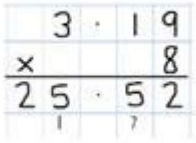
Addition

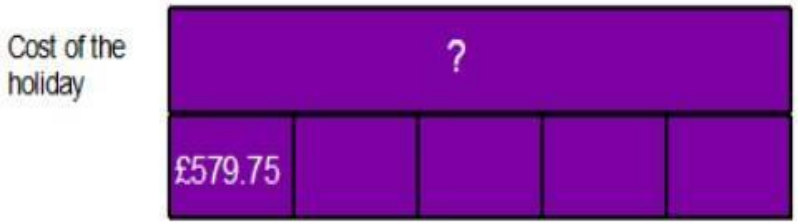
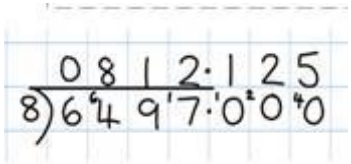
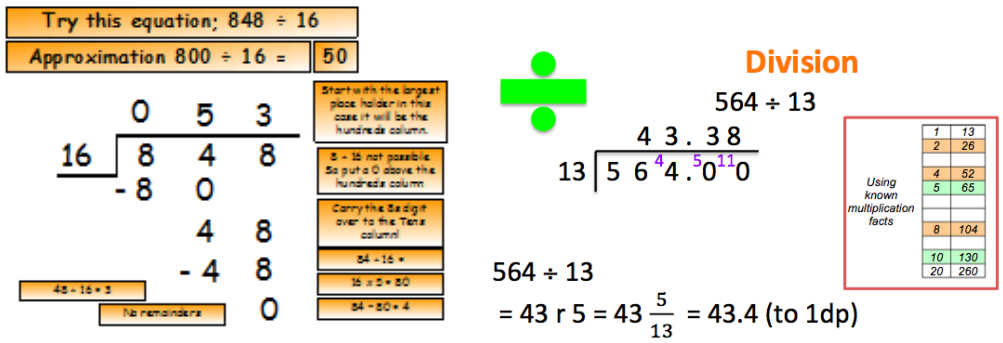
Adding several numbers with up to three decimal places.	 Adding several numbers with different numbers of decimal places (including money and measures): • Tenths, hundredths and thousandths should be correctly aligned, with the decimal point lined up vertically including in the answer row.
Adding using the bar.	Jack went on holiday. His flight cost £70.50, the hotel £1295 and spending money £427.89. How much did Jack spend on his holiday? 
Subtraction	
Subtracting with increasingly large and more complex numbers and decimal values.	Very important to use in a range of contexts- measures and money.

Using the bar for subtraction.	Chloe wants to buy a new car for £6450. She has £4885.87 in her savings account. Her Dad gives her £150 for her birthday. How much more money does she need to save? £6450 £4885.87 | £150 | ?



Multiplication

Short and long multiplication with up to two decimal places.	

Using the bar to help with multiplication.	If 5 friends went on holiday and each paid £579.75 what was the total cost of the holiday? 
Division	
digits by both single digit and 2 digit numbers. (including decimal numbers and quantities)	**Short division with remainders:** Pupils should continue to use this method, but with numbers to at least 4 digits, and understand how to express remainders as fractions, decimals, whole number remainders, or rounded numbers. Real life problem solving contexts need to be the starting point, where pupils have to consider the most appropriate way to express the remainder. 
Long division this is for when dividing by two digit numbers.	

Using the bar to help divide.	Paul and David hire a car together at a cost of £297.50. Paul pays 6 times more than David. How much does David pay?