Little London Academy- Maths Calculation Policy

Little London Academy

Part of GORSE

Aim:

We aim to foster positive attitudes in our pupils towards mathematics, recognising its creativity and the relevance of it in everyday life. Our aim is that all children will reach their full potential—every child can and will achieve in maths. We deliver a high-quality mathematics education, providing our pupils with firm foundations to understand the world and reason mathematically.

Rationale:

The aim of our approach to mathematics at Little London is to build a resilience and a bank of solid mathematical foundations for all our pupils before they leave for the next stage of their education. Mathematics at our school develops pupils' ability to challenge all learners to reach their potential in the subject and apply mathematical concepts in other subjects in the wider curriculum and in the real world.

During the Early Years, it is vital children develop a strong conceptual understanding of the numbers to 10 and are able to notice and use these across a range of opportunities both inside and outside of the provision. As pupils move through school, the focus is around learning being embedded (mastery approach) through carefully sequenced lessons to ensure consolidation. We know, to create successful mathematicians, it is important that we allow pupils make mistakes, identify them and explore a range of methods to tackle a single problem. This will provide our pupils with the best start in mathematics, both academically and emotionally, building resilience and an attitude to problem solve.

Our Calculation policy is in pace to embed a foundation of methods as pupils move through our school, ensuring consistency and progression. Each calculation begins with a concrete way to represent it, moving on to then pictorially showing this calculation and finally, pupils being able to use written methods and to locate the calculation they need in a more abstract way through reasoning or/and problem solving,.

Manipulatives:

Manipulatives are an integral part of the calculation policy and should be used in conjunction to aid and support any written method.

Little London Academy

Maths Calculation Policy

Addition

Part of GORSE

EYFS

Children find the total number of items in two groups by counting all of them.

3 + 2 = 5

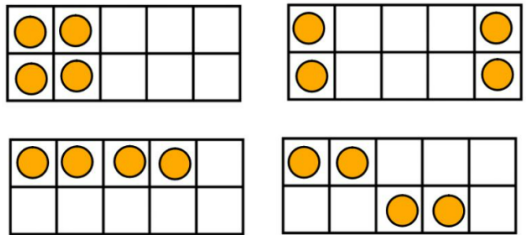
2 + 5 = 7

Record ○○○ + ○○ is 5 leading to 3 + 2 = 5

There are 2 cars in a garage, 3 more arrive.

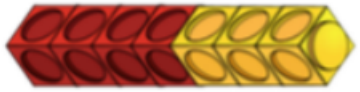
Pictorial track or practically on number track using counters.

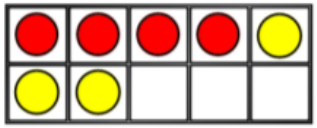
Use tens frames to practise subitising.



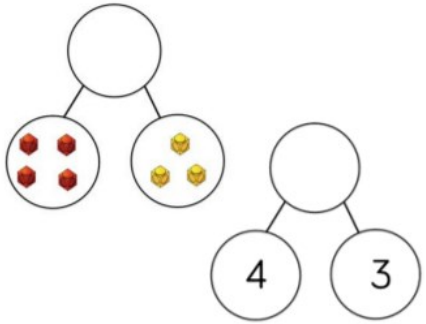
YEAR 1

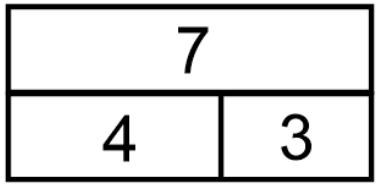
Add 1- digit numbers within 10

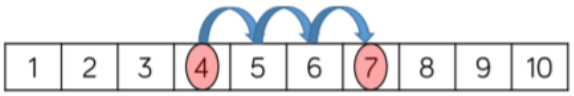




$$4 + 3 = 7$$







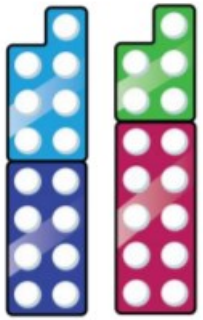
4 + 3 = 7

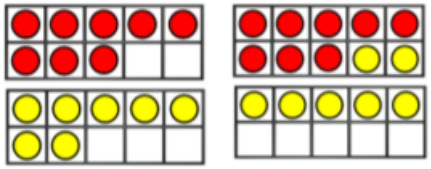
Pupils can explore both aggregation and augmentation. Part whole models and the bar model helps Aggregation. The number line supports augmentation. Other manipulatives can be used to support either method

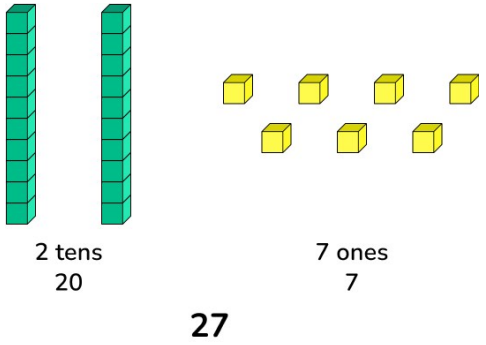
YEAR 1/2

Add 1 and 2-digit numbers to 20

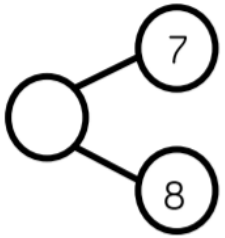
$8 + 7 = 15$



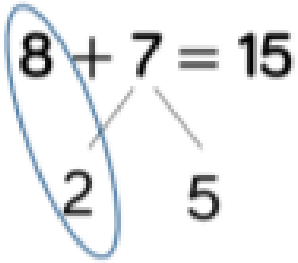




15	
8	7



8 + 7 = 15

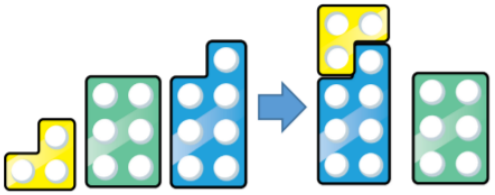


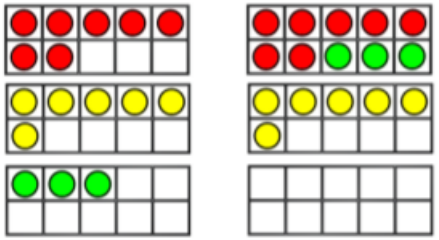
Very important to stress looking for number bonds to 10 to aid this addition. Also, very important to highlight the importance of ten ones equalling one ten. Use concrete resources alongside number lines to support children is seeing how to partition their intervals. All additions using number lines should show jumps above the number line.

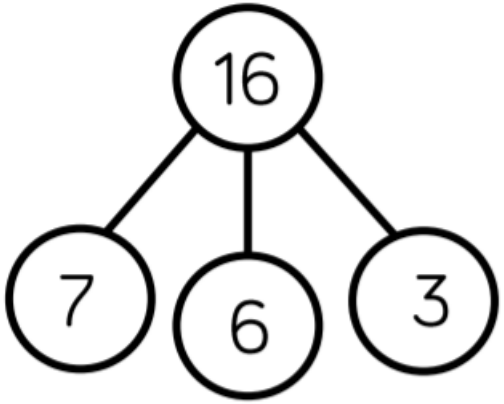
YEAR 2

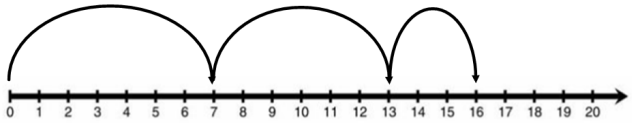
Add three 1-digit numbers

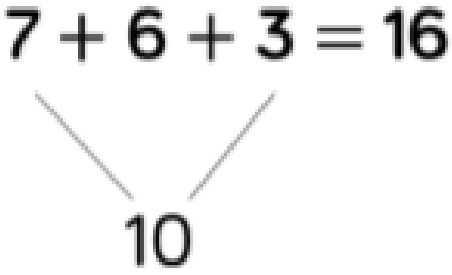
$7 + 6 + 3 = 16$











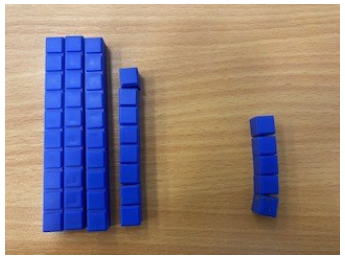
7 + 6 + 3 = 16

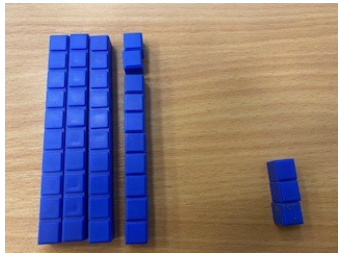
Pupils should be encouraged to look for number bonds or doubles/ near doubles. The idea of commutativity should be introduced here. All additions using number lines should show jumps above the number line.

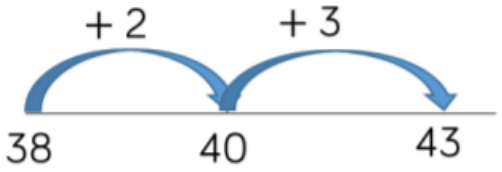
YEAR 2/3

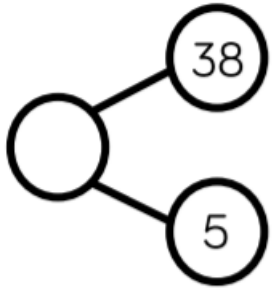
Add 1-digit and 2-digit numbers to 100

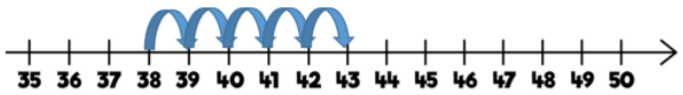
$$38 + 5 = 43$$

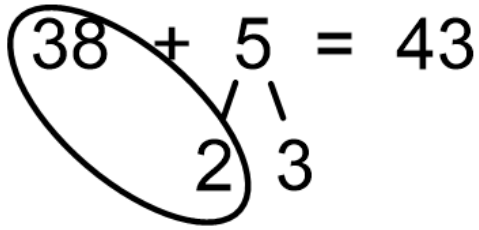












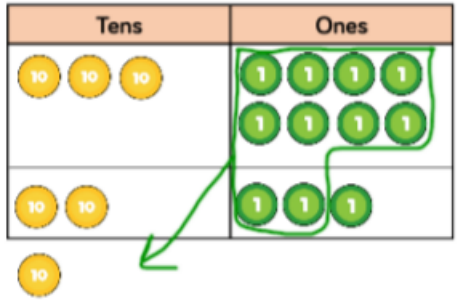
38 + 5 = 43

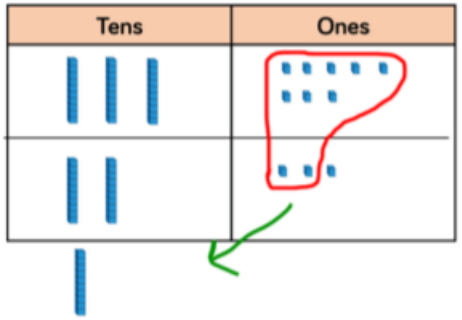
Encourage children to start with the larger number and initially count on. Try to highlight number bonds to 10 within the question. Eg 8 + 2 = 10, so 38 +2 = 40. All additions using number lines should show jumps above the number line.

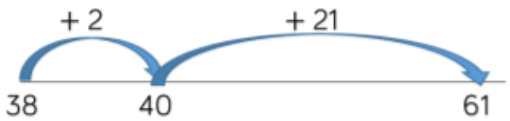
YEAR 2/3

Add two 2-digit numbers to 100

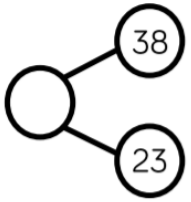
$$38 + 23 = 61$$







61	
38	23



38
+ 23
8+3 = 11
30 + 20 = 50
61

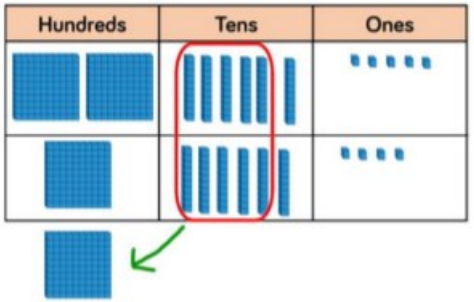
$$\begin{array}{r} 38 \\ +\ 23 \\ \hline 61 \\ \hline 1 \end{array}$$

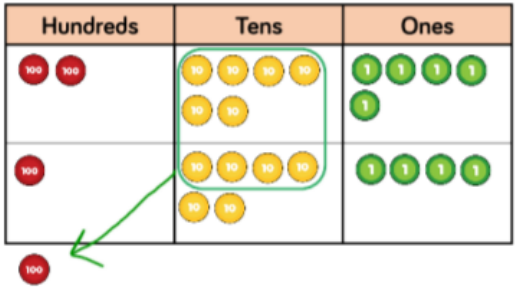
38 + 23 = 61

This is the point we would encourage pupils to use the formal column method for calculations such as this one. (not for 40 +20 etc) Make sure the pupils see the link between concrete resources such as base 10 and the formal method. All additions using number lines should show jumps above the number line.

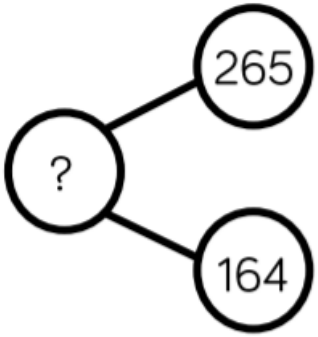
YEAR 3

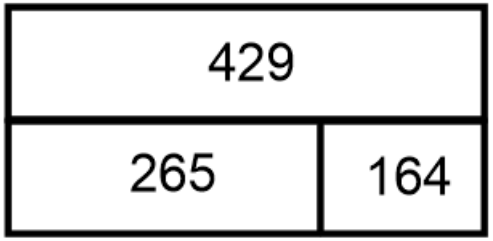
Add numbers with up to 3 digits





$$265 + 164 = 429$$





265 + 164 = 429

200 + 60 + 5

100 + 60 + 4

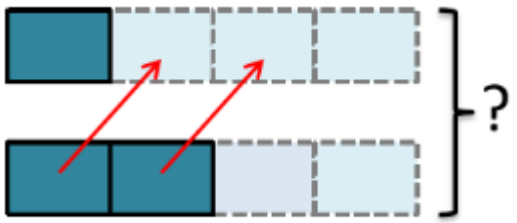
\+ +

$$\begin{array}{r} 265 \\ +\ 164 \\ \hline 429 \\ \hline 1 \end{array}$$

Base 10 and place value counters are the most effective manipulatives when adding numbers with up to 3 digits. Ensure children write their calculation alongside any concrete resource so they can see the links to the written column method.

YEAR 3

Add two fractions with the same denominator



$$\frac{1}{4} + \frac{2}{4} = \frac{3}{4}$$

1 + 2

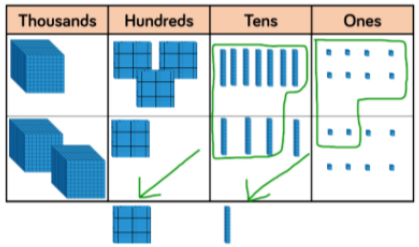
Denominator remains the same

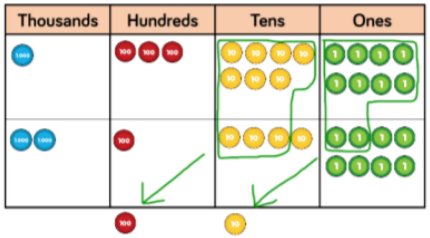
Paper strips can be used as a concrete resource, however it is important the parts are equal to one another. When adding same denominator fractions it is important to reinforce that the whole remains the same (denominator) and it is only the parts (numerator) we are combining.

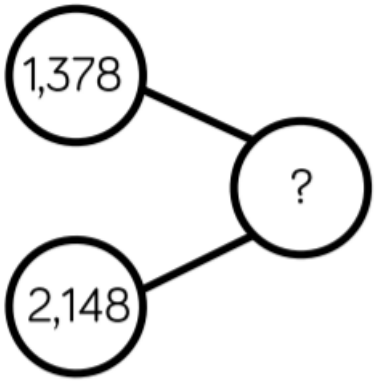
YEAR 4

Add numbers with up to 4 digits

1,378 + 2,148 = 3,526







3,526	
1,378	2,148

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

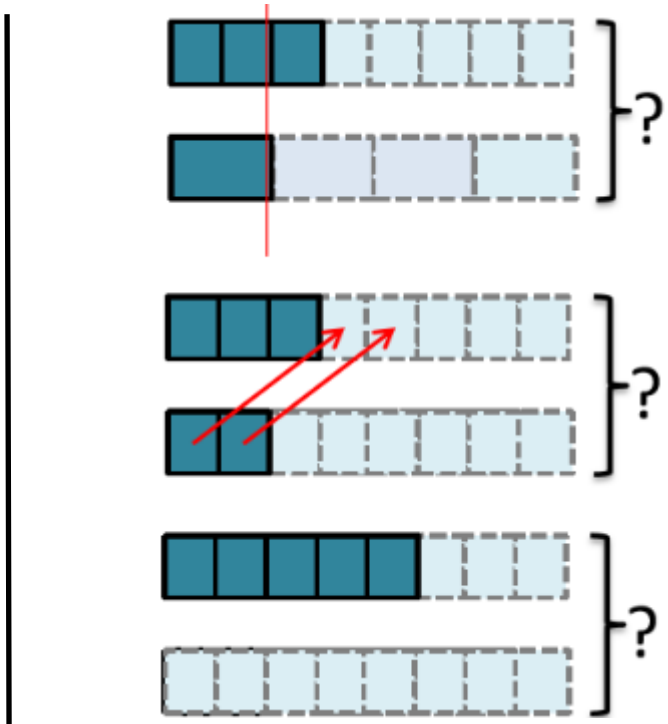
Base 10 and place value counters are the most effective manipulatives when adding numbers with up to 4 digits. Ensure children write their calculation alongside any concrete resource so they can see the links to the written column method.

YEAR 4

Add two fractions with different denominators

$\frac{3}{8} + \frac{1}{4}$

$\frac{3}{8} + \frac{2}{8}$



$\frac{3}{8} + \frac{1}{4}$ x2

$\frac{3}{8} + \frac{2}{8}$

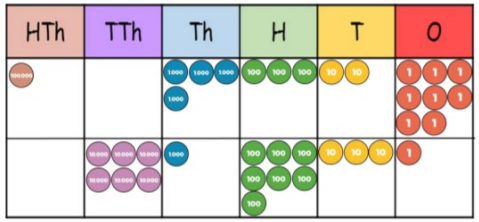
$\frac{5}{8}$

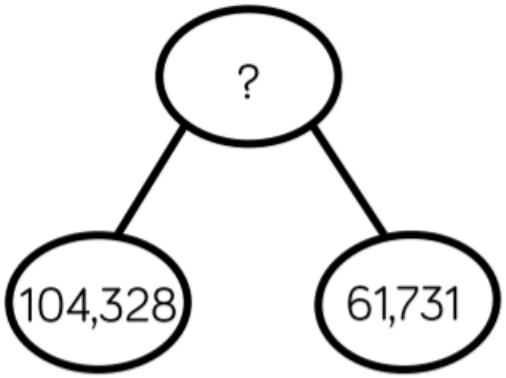
Paper strips can be used as a concrete resource, however it is important the parts are equal to one another. As well as this, when lining up the second fraction it is important to show that 2/8 = 1/4 and these should be the same size to show equivalence.

YEAR 5/6

Add numbers with more than 4 digits

$$104{,}328 + 61{,}731 = 166{,}059$$





166,059					
104,328			61,731		

1	0	4	3	2	8
+	6	1	7	3	1
1	6	6	0	5	9

1

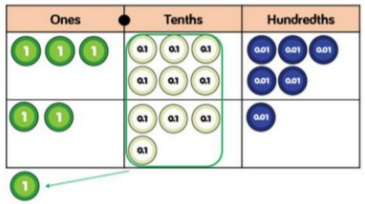
At this stage, children should be encouraged to work in the abstract, using the column methods to add larger numbers efficiently.

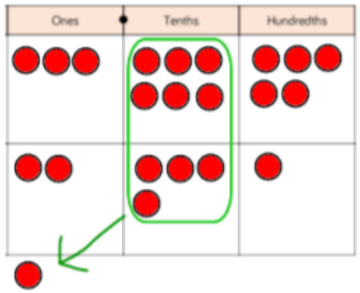
YEAR 5/6

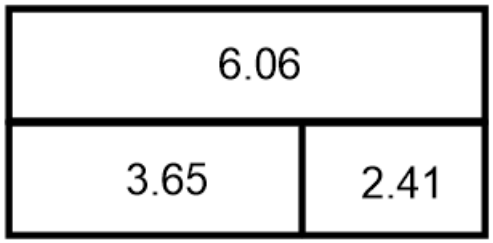
Add with up to 3 decimal places

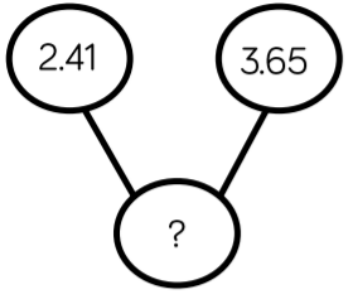
$$3.65 + 2.41 = 6.06$$

3.65 + 2.41 = 6.06









Initially with place value headers

$$\begin{array}{r} 3.65 \\ +\ 2.41 \\ \hline 6.06 \\ \hline 1 \end{array}$$

Place value counters and plain counters on a place value grid are the most effective manipulatives when adding decimals with 1,2 and then 3 decimal places. Put into context eg money.

Little London Academy

Maths Calculation Policy

Subtraction

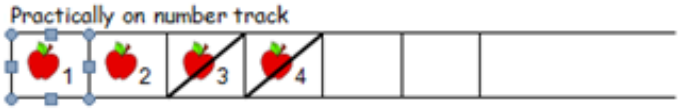
Part of GORSE

EYFS

Children view subtraction as take away (using objects or drawing and crossing out).

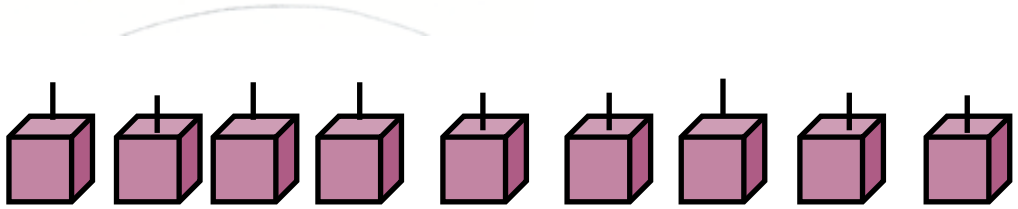
7 - 2 = 5

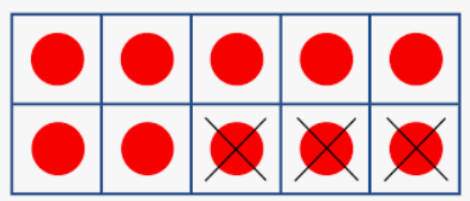
There are 4 apples on a tree, 2 fall off. How many are left on the tree?



Drawings and jottings

There are nine cakes on a plate. Sarah eats three. How many are left?'



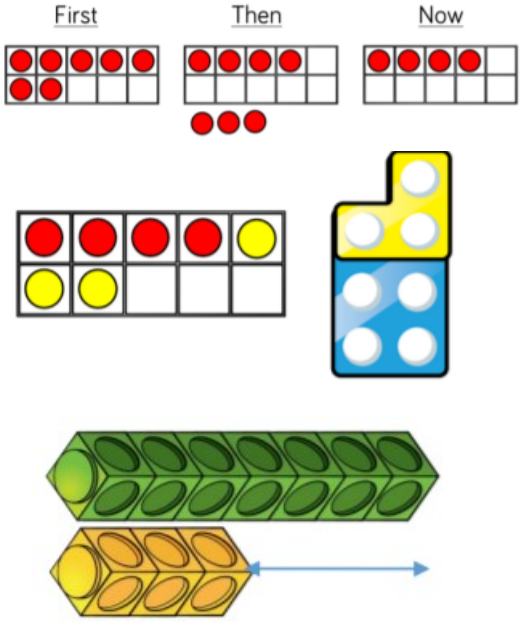


Use tens frames to subtract by crossing out.

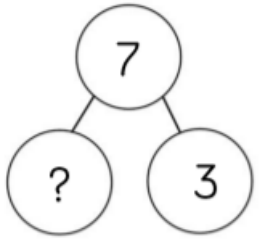
YEAR 1

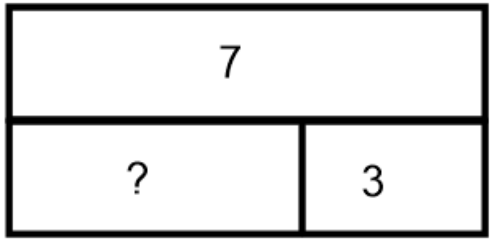
Subtract 1-digit numbers within 10

$$7 - 3 = 4$$

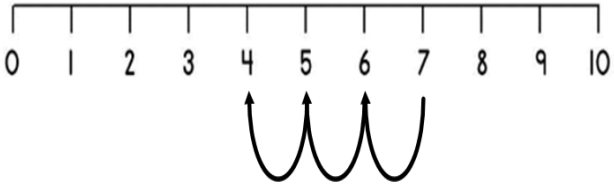


Make the number with cubes, then snap off the number that you are subtracting.





7—3 = 4

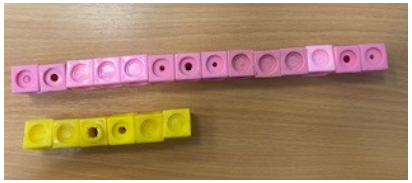


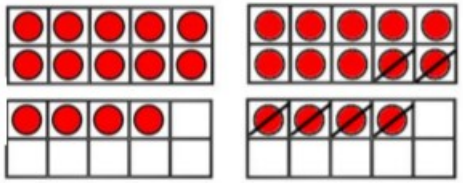
Part whole models, bar models and ten frames all support partitioning. Ten frames, number tracks support reduction. Cubes and bar models can support finding the difference. When using number lines for subtraction, the jumps should be made below the number line.

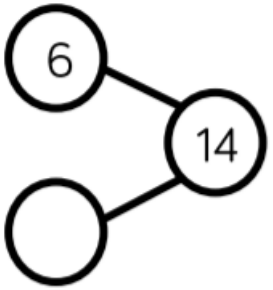
YEAR 1/2

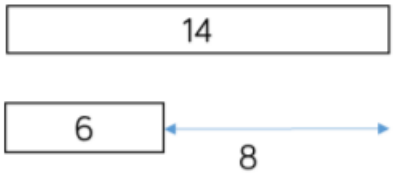
Subtract 1 and 2-digit numbers to 20 [crossing 10]

$14 - 6 = 8$

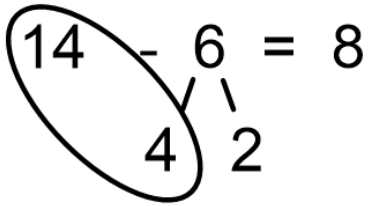


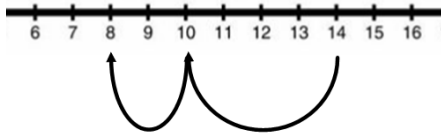


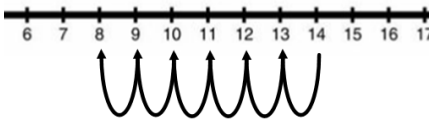




14 - 6 = 8







It is important to highlight the importance of ten ones equalling one ten. Partitioning is a really important skill here. Eg 14 - 4 –2 = 14 –6. A number line can be particularly useful for this. When using number lines for subtraction, the jumps should be made below the number line.

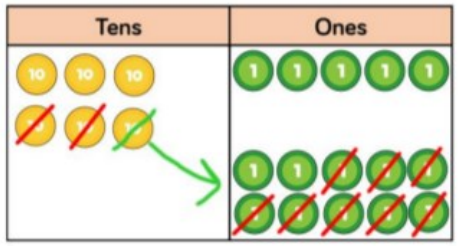
YEAR 2

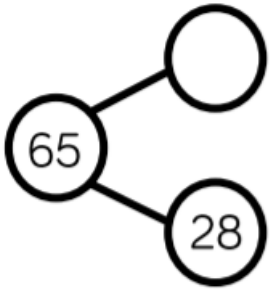
Subtract 1 and 2-digit numbers to 100

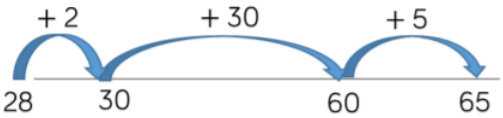
Not sure about below...

$$65 - 28 = 37$$

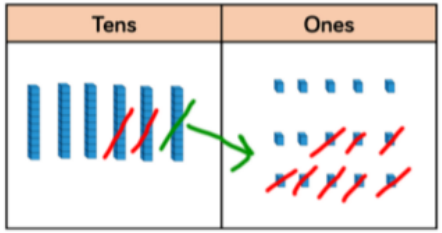
65—28 = 37

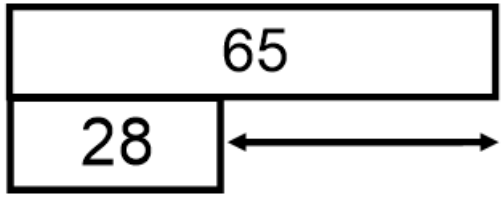


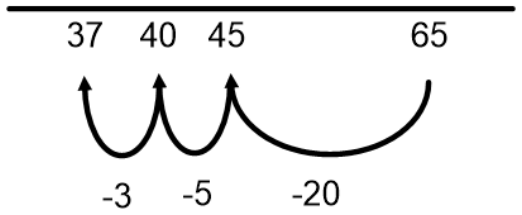




$$\begin{array}{r} {}^{5}\not{6}\,{}^{1}5 \\ -\ 28 \\ \hline 37 \end{array}$$





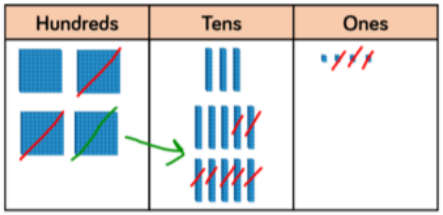


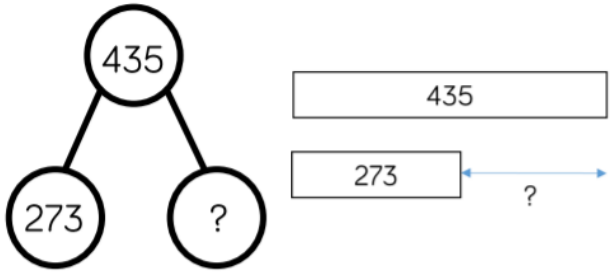
Base 10 and place value counters should be used alongside the formal method. A blank number line can be used to aid finding the difference. We subtract on a number line below the line to support inverse operations. When using number lines for subtraction, the jumps should be made below the number line.

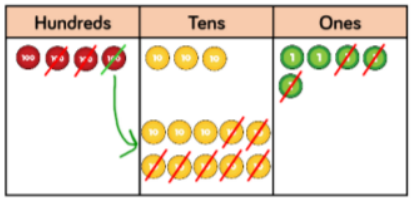
YEAR 3

Subtract numbers with up to 3 digits

$$435 - 273 = 262$$







435	
273	?

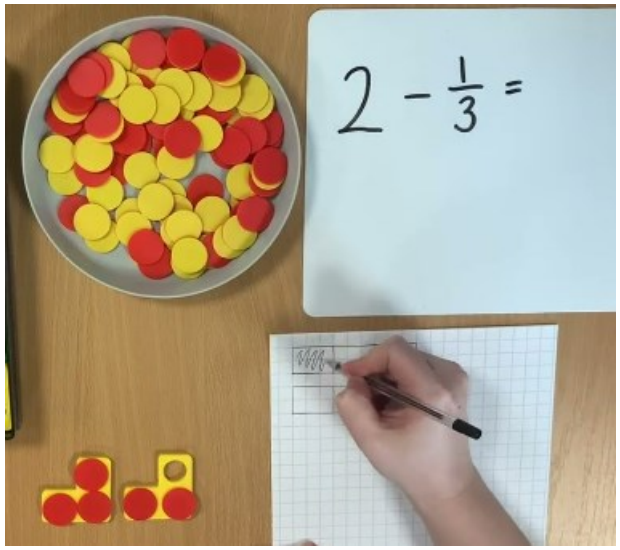
435—273 = 262

$$\begin{array}{r} {}^{3}\not{4}{}^{1}\not{3}5 \\ -\ 273 \\ \hline 262 \end{array}$$

Base 10 and place value counters should be used alongside the formal method. A blank number line can be used to aid finding the difference. Ensure children write their calculation alongside any concrete resources so they can see the links to the column method.

YEAR 3

Subtracting fractions with the same denominator



$$\frac{4}{5} - \frac{3}{5} = \frac{1}{5}$$

4 - 3

Denominator remains the same

Take away

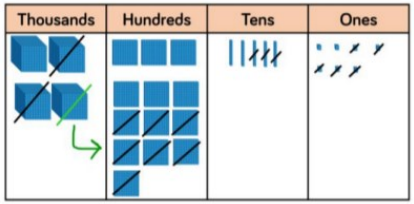
Find the difference

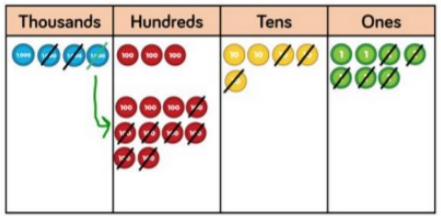
Using bar models, counters can be placed within each section and these can then either be taken away or the difference can be found between two bar models. It is important that both bar models are of equal parts and the same size.

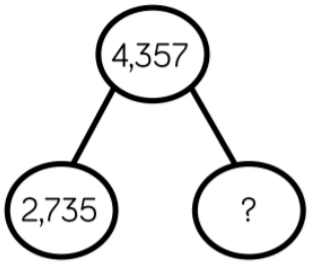
YEAR 4

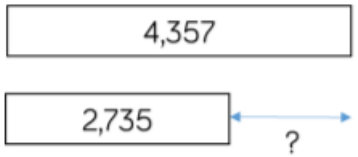
Subtract numbers with up to 4 digits

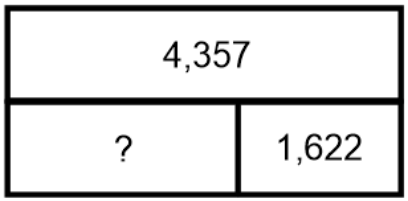
4,357 – 2,735 = 1,622











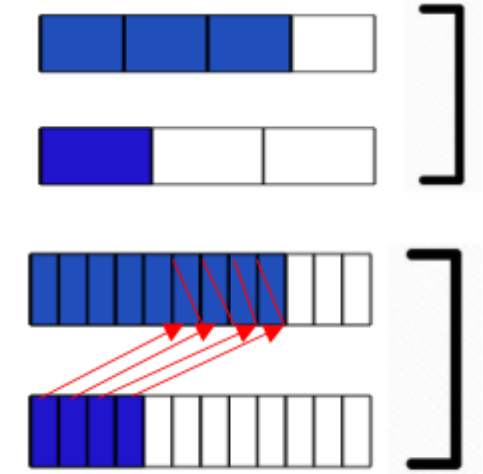
4,357—2,735 = 1,622

$$\begin{array}{r} {}^{3}\cancel{4}^{1}357 \\ -\ 2735 \\ \hline 1622 \end{array}$$

Base 10 and place value counters should be used alongside the formal method. A blank number line can be used to aid finding the difference. Ensure children write their calculation alongside any concrete resources so they can see the links to the column method.

YEAR 4

Subtracting fractions with different denominators



$\frac{3}{4} - \frac{1}{3} = \frac{9}{12} - \frac{4}{12}$

$\frac{3}{4} - \frac{1}{3}$

X3 X4

$= \frac{9}{12} - \frac{4}{12}$

$= \frac{5}{12}$

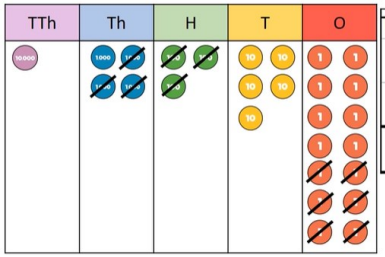
Using Cuisenaire rods, fraction walls or paper strips equivalent fractions can be found to find a common denominator. When pictorially showing equivalence to subtract fractions, ensure that bar models show equivalence e.g. 3/4 of a bar model is equal to 9/12 of a bar model as the whole is the same value.

YEAR 5/6

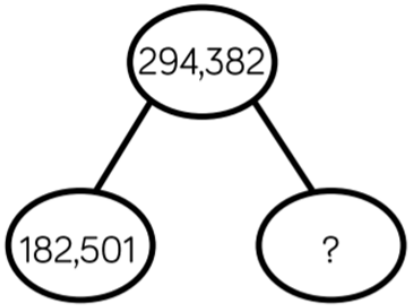
Subtract numbers with more than 4-digits

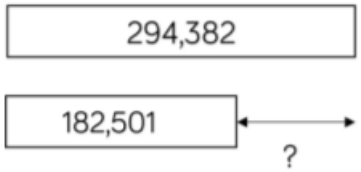
$$294{,}382 - 182{,}501 = 111{,}881$$

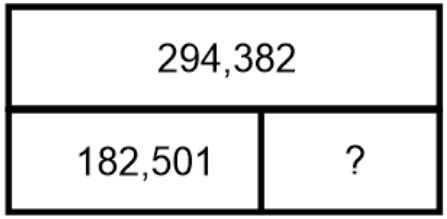
There are 14,364 people at a football match.
3,306 of the crowd are children.
How many adults are there?



TTh	Th	H	T	O
1	4	3	$\cancel{6}^{5}$	$^{1}4$
	3	3	0	6
		0	5	8







294,382—182,501 = 111,881

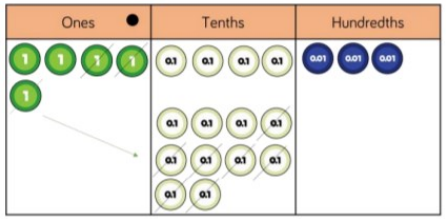
	2	9	$\cancel{3}^{}$	$^{1}3$	8	2
–	1	8	2	5	0	1
	1	1	1	8	8	1

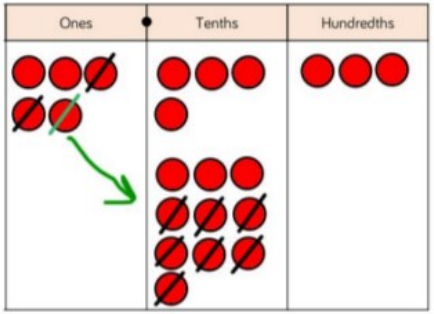
At this stage children should be encouraged to work in the abstract, using column method to subtract larger numbers efficiently.

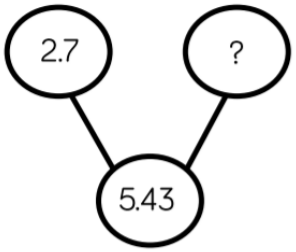
YEAR 5

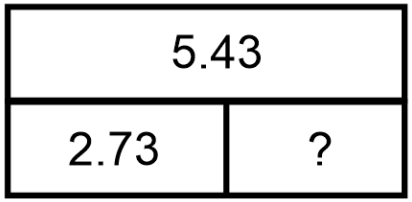
Subtract numbers with up to 3 decimal places

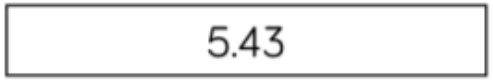
$$5.43 - 2.7 = 2.73$$











5.43—2.7 = 2.73

$$\begin{array}{r} {}^{4}\cancel{5}^{1}.43 \\ -\ 2.7\,0 \\ \hline 2.73 \end{array}$$

Place value counters and plain counters on a place value grid are the most effective manipulative when subtracting decimals with 1,2,and then 3 decimal places. Give the children context, e.g. money.

Little London Academy

Maths Calculation Policy

Multiplication

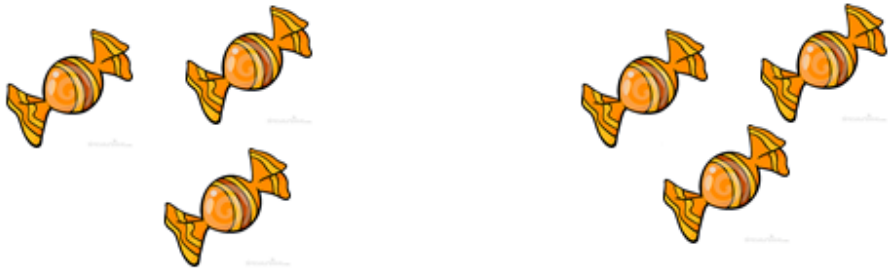
Part of GORSE

EYFS

Practical ways of doubling

Repeated addition

I have 3 sweets. Can you double the number of sweets?



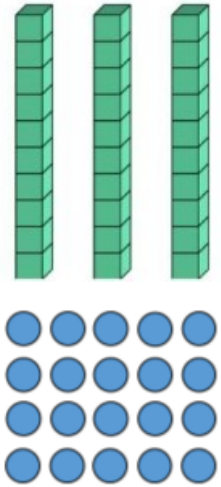
There are 6 sweets in total

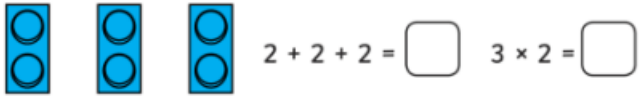
Josh has 3 apples. Hannah has 3 apples. How many apples are there altogether?

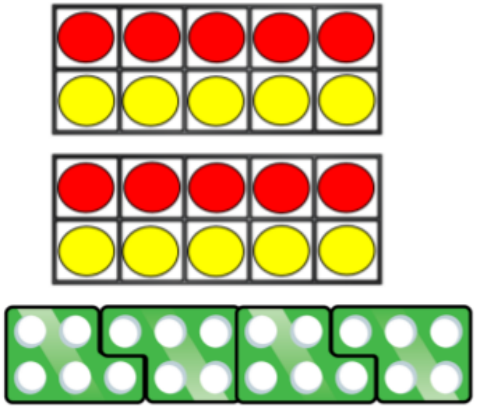
There are 6 apples in total

YEAR 1/2

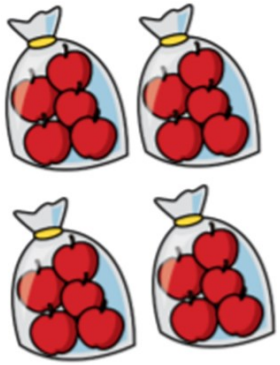
Solve 1-step problems using multiplication







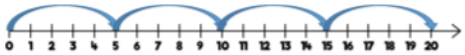
One bag holds 5 apples.
How many apples do 4 bags hold?



$5 + 5 + 5 + 5 = 20$

$4 \times 5 = 20$

$5 \times 4 = 20$



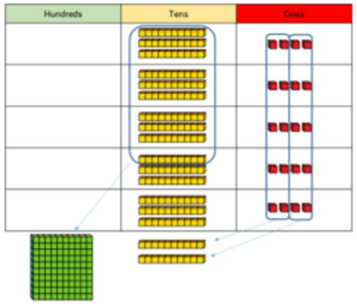
Children encouraged to represent multiplication as repeated addition in different ways. Arrays are a very important way of helping pupils understand multiplication and to support commutativity. If using repeated addition on a number line, remember to add above the number line.

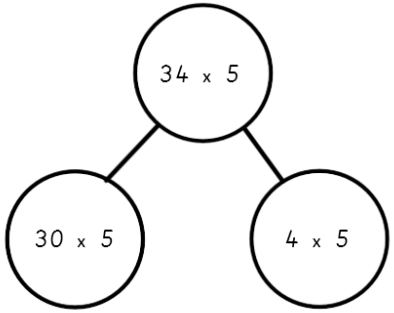
YEAR 3/4/5

Multiply 2 or more digit numbers by 1-digit numbers

$1{,}826 \times 3 = 5{,}478$

$34 \times 5 = 170$





	H	T	O	
		3	4	
×			5	
		2	0	(5 × 4)
+	1	5	0	(5 × 30)
	1	7	0	

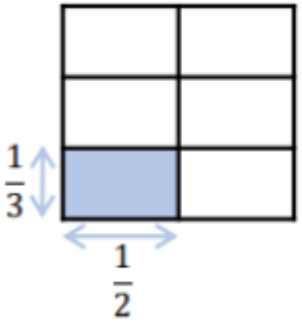
	H	T	O	
		3	4	
×			5	
	1	7	0	
	1	2		

	Th	H	T	O
	1	8	2	6
×				3
	5	4	7	8
	2		1	

The expanded column method can be used to help bridge the gap to the short multiplication method. Place value counters are very helpful in assisting the children's understanding of the method.

YEAR 5/6

Multiplying two proper fractions



Shade the diagram to calculate

$$\frac{1}{3} \times \frac{1}{2} =$$

$$\frac{2}{3} \times \frac{1}{4} = \qquad \frac{2}{3} \times \frac{3}{4} =$$

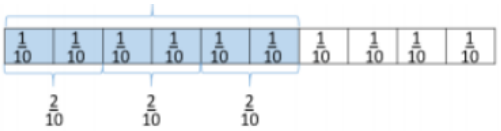
$$\frac{\square}{\square} \times \frac{3}{\square} = \frac{6}{12}$$

When multiplying two fractions together, a bar model can be used. First, divide equally a bar into the first fraction. Then divide the whole bar into the second fraction. It is important to stress that the multiplication symbol can be replaced with the word 'of'.

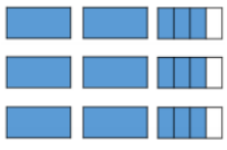
YEAR 5

Multiply proper fractions and mixed numbers by whole numbers

6 lots of $\frac{3}{4}$



$3 \times \frac{2}{10}$



$2 \times 3 = 6$

$\frac{3}{4} \times 3 = \frac{9}{4} = 2\frac{1}{4}$

$6 + 2\frac{1}{4} = 8\frac{1}{4}$

$2\frac{3}{4} \times 3$

$\frac{2}{7} \times 2$

$4 \times \frac{3}{20}$

$4 \times 3\frac{3}{5}$

$2\frac{\square}{8} \times \square = 7\frac{7}{8}$

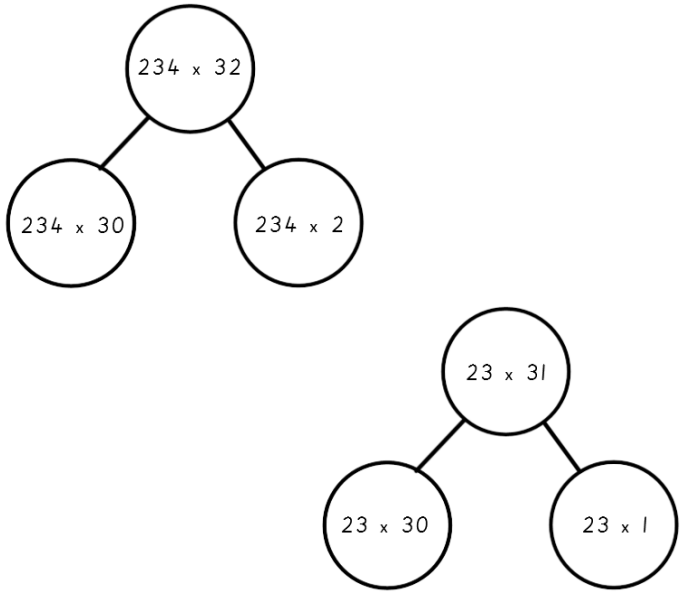
When multiplying fractions, using fraction wheels and bar models is useful to show that each part is of equal value. A number line could also be used to show the equal parts of repeated addition. When using a number line, it is important the jumps are above the number line to show addition.

YEAR 5

Multiply 2 or 3-digit numbers by 2-digit numbers

$23 \times 31 = 682$

$234 \times 32 = 7{,}488$



23 × 31

	H	T	O	
		2	3	
×		3	1	
		2	3	(23 × 1)
+	6	9	0	(23 × 30)
	7	1	3	

1

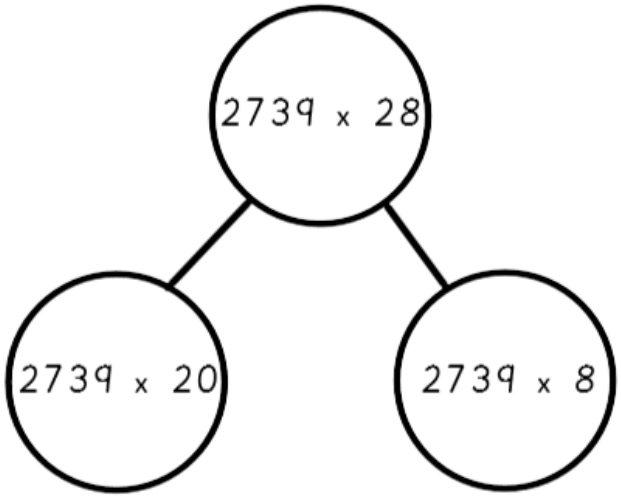
234 x 32

Th	H	T	O
	2	3	4
×		3	2
	4	6	8
$^{1}7$	$^{1}0$	2	0
7	4	8	8

When moving to 2 or more digits being multiplied by 2 digit children should be encouraged to move towards the more formal method. Base 10 and place value counters can help support understanding but Base 10 soon becomes unmanageable. When using the manipulatives, limit the number of exchanges within the question.

YEAR 5/6

Multiply 3 or 4-digit numbers by 2-digit numbers



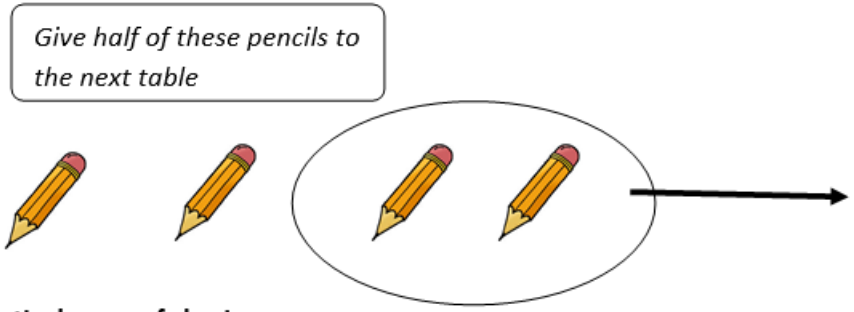
TTh	Th	H	T	O
	2	7	3	9
×			2	8
2 (2)	1 (5)	9 (3)	1 (7)	2
5 (1)	4	7 (1)	8	0
7	6	6	9	2

When multiplying 3 or 4 digit numbers buy 2 digit numbers the children need to be using a formal method. Practise with manipulatives with questions involving fewer digits and allow pupils to have a times tables grid to aid them until the method is embedded.

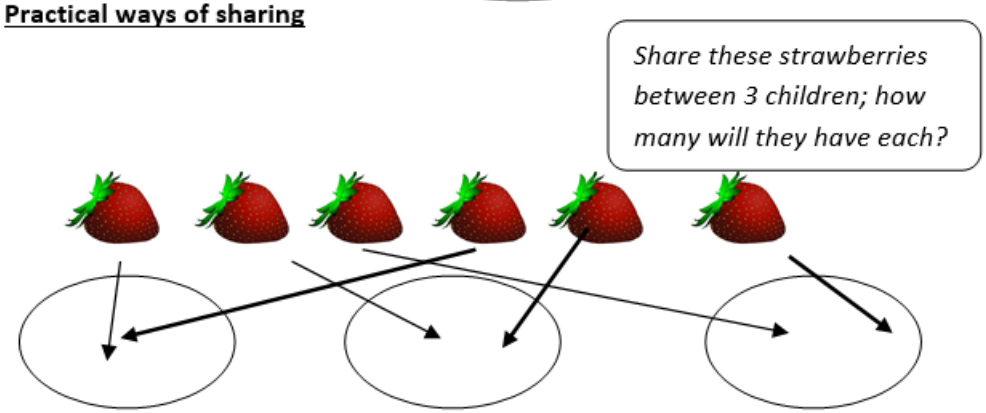
EYFS

Practical ways of halving

Before we halve numbers or groups of items it is key that children understand the vocabulary for halves. We should halve objects, in particular whole objects such as apples, cakes etc which we can physically cut in half.



Practical ways of sharing



Each child will get 2 strawberries each

Little London Academy

Maths Calculation Policy

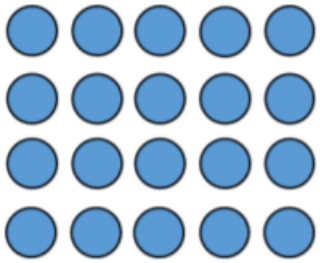
Division

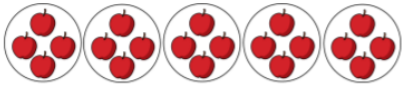
Part of GORSE

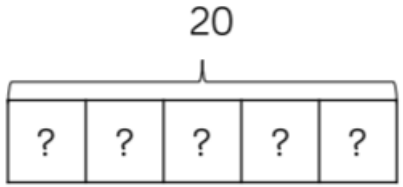
YEAR 1/2

Solve 1-step problems using division (sharing)

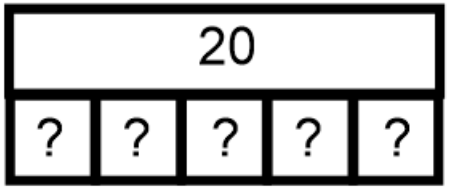
There are 20 apples altogether.
They are shared equally between 5 bags.
How many apples are in each bag?







OR?

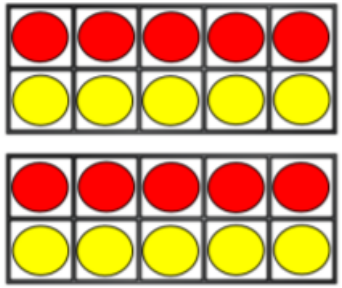


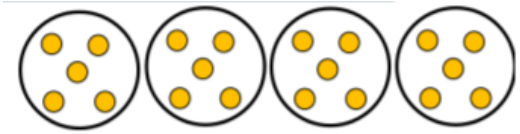
$$20 \div 5 = 4$$

Children solve problems by sharing amounts into equal groups. Children should be encouraged to use concrete and pictorial representations to solve problems before being introduced to the division symbol or formal methods. When using a bar model, it is vital that each part is of an equal size to show sharing equally.

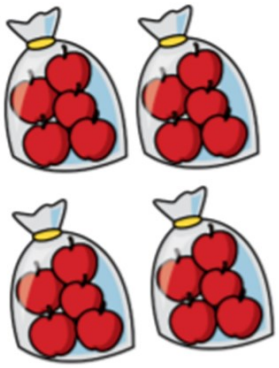
YEAR 1/2

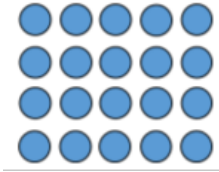
Solve 1-step problems using division (grouping)



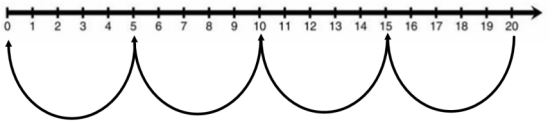


There are 20 apples altogether.
They are put in bags of 5.
How many bags are there?





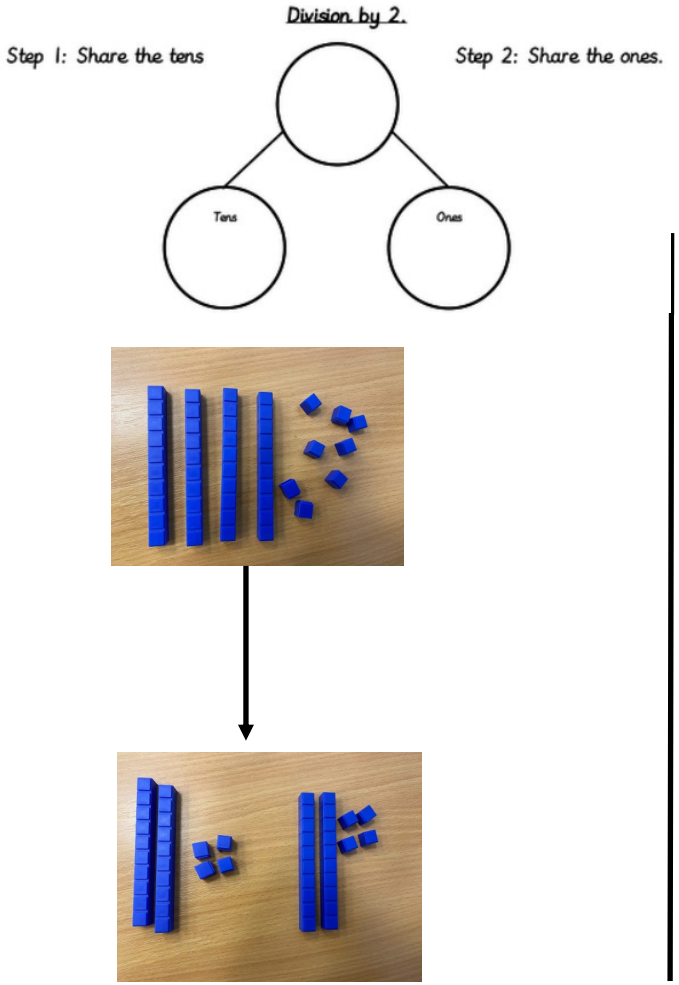
$20 \div 5 = 4$



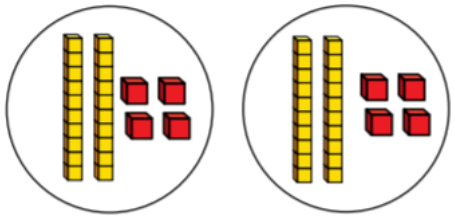
Children solve problems by grouping and counting the number of groups. Grouping encourages children to count in multiples and links to repeated subtraction. Use concrete representations to help show the link between multiplication and division. If using a number line to show equal groups, it is important that this below the number line to show parts of a whole.

YEAR 1/2

Divide 2-digits by 1-digit (sharing with no



$$48 \div 2 = 24$$



Tens	Ones
10 10	1 1 1 1
10 10	1 1 1 1

$$48 \div 2 = 24$$

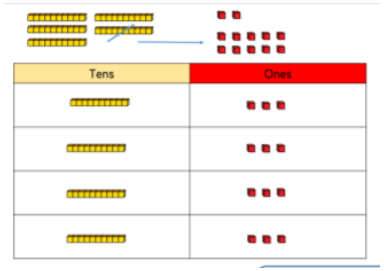
Part whole models??

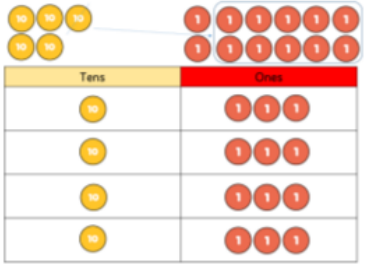
When dividing larger numbers, children can use manipulatives that allow them to partition into tens and ones. Base 10 and place value counters can all be used to share numbers into equal groups.

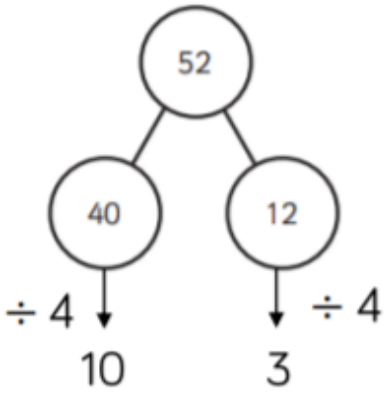
YEAR 3/4

Divide 2-digits by 1-digit

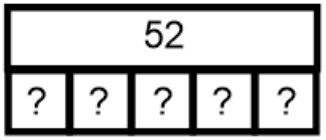
$52 \div 4 = 13$







$10 + 3 = 13$



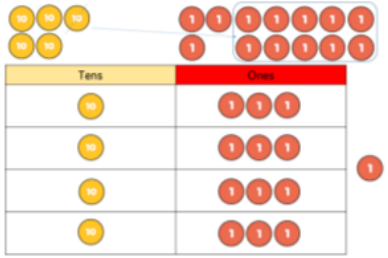
$52 \div 4 = 13$

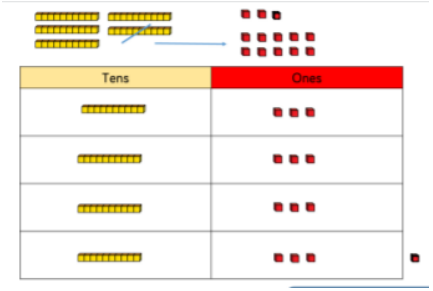
When dividing numbers involving an exchange, children can use Base 10 and place value counters to exchange one ten for ten ones. When using a bar model, it is vital that each part is of an equal size to show sharing equally.

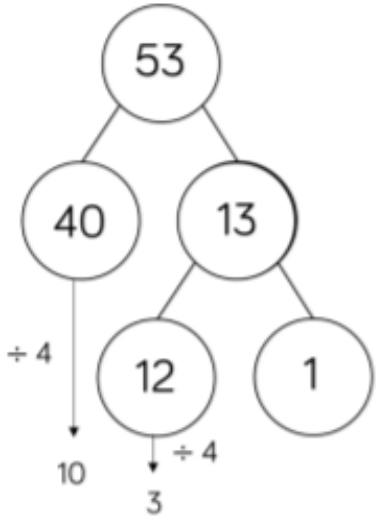
YEAR 3/4

Divide 2-digits by 1-digit (sharing with remainders)

$$53 \div 4 = 13 \text{ r}1$$







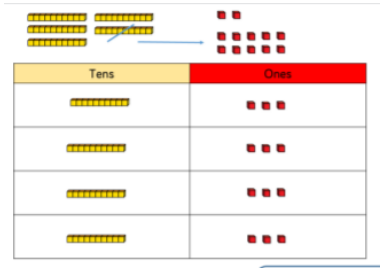
53 ÷ 4 = 13 r 1

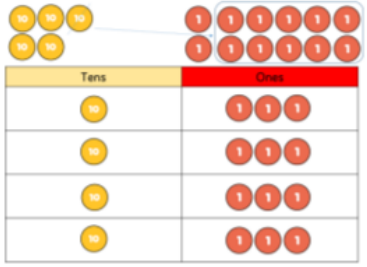
When dividing numbers with remainders, children can use Base 10 and place value counters to exchange one ten and ten ones. Use the place value grid as this will highlight remainders.

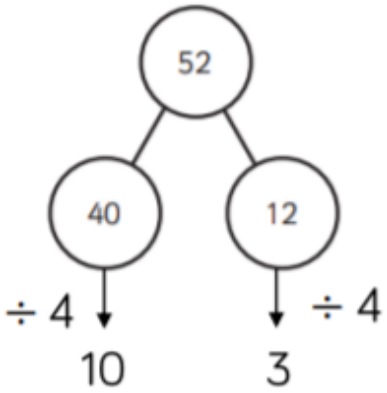
YEAR 4/5

Divide 2-digits by 1-digit

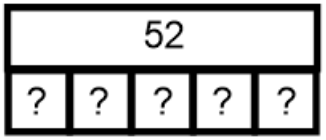
52 ÷ 4 = 13







10 + 3 = 13



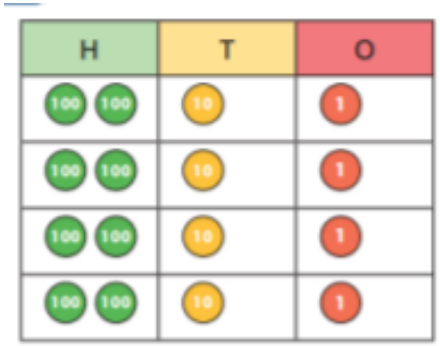
52 ÷ 4 = 13

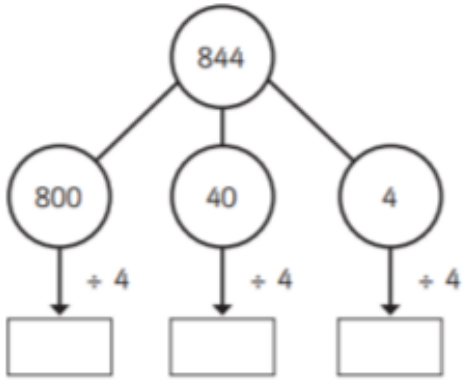
Pupils are introduced to the abstract written method here. It is imperative they are introduced to this alongside manipulatives to support them. The part whole model is very helpful in understanding the written method. When using a bar model, it is vital that each part is of an equal size to show sharing equally.

YEAR 4

Divide 3-digits by 1-digit (sharing)

$$844 \div 4 = 211$$





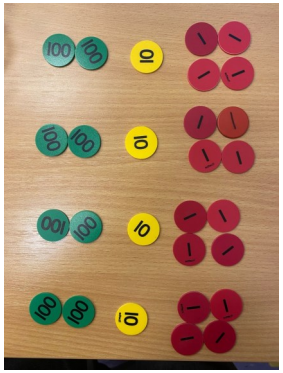
$844 \div 4 = 211$

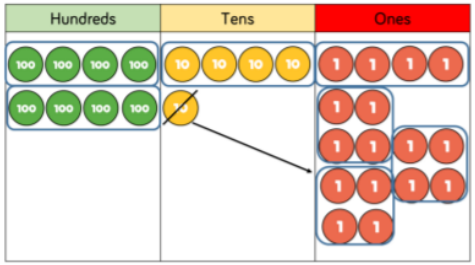
Children can continue to use place value counters to share 3 digit numbers into equal groups. Children should start with the equipment outside the place value grid before sharing the hundreds, tens and ones equally between the rows. This method can also help to highlight remainders. Partitioning can help support this method.

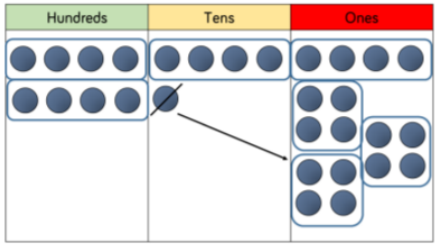
YEAR 5

Divide 3 or 4-digits by 1-digit (grouping)

$$856 \div 4 = 214$$







$856 \div 4 = 214$

		2	1	4
	4	8	5	$^{1}6$

Steps to show working

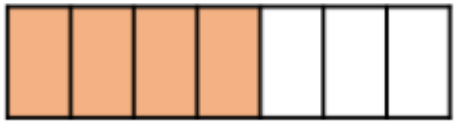
Children can use grouping to support their understanding of short division when dividing a 3-digit number by a 1-digit number. Place value counters or plain counters can be used to support this method.

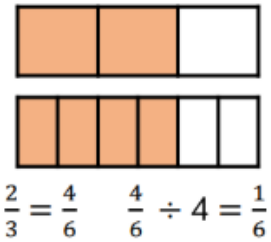
YEAR 5/6

Dividing a fraction by an integer

$\frac{3}{4} \div 3 =$

$\frac{4}{7} \div 4 =$





$\frac{2}{3} = \frac{4}{6}$ $\frac{4}{6} \div 4 = \frac{1}{6}$

dividing $\frac{2}{3}$ by 4

(need to find an equivalent fraction first before dividing)

$\frac{6}{11} \div 3 =$ $\frac{9}{11} \div 3 =$

$\frac{20}{23} \div \square = \frac{5}{23}$

$\frac{1}{5} \div 3 =$ $\frac{2}{5} \div 3 =$

$\square \div 4 = \frac{7}{36}$

When dividing a fraction by a whole number, bar models and fraction wheels can be used to show the equal parts of the fraction. Where the numerator is not a factor of the whole number, equivalent fractions should be found in both concrete and pictorial instances. When working abstractly, equivalent fractions can be found, however the denominator and whole number can also be multiplied.

YEAR 6

Divide multi digits by 2-digits (short division)

$432 \div 12 = 36$

		0	3	6
	12	4	$^{4}3$	$^{7}2$

$7{,}335 \div 15 = 489$

	0	4	8	9
15	7	$^{7}3$	$^{13}3$	$^{13}5$

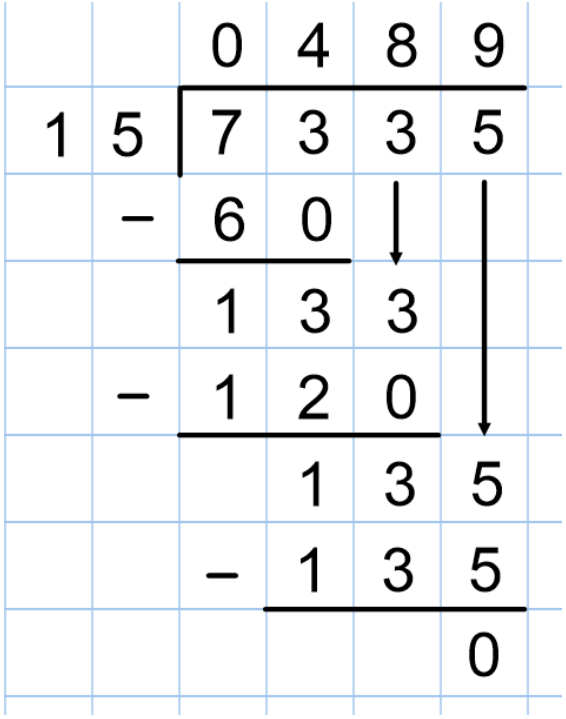
x		1	5
1		1	5
2		3	0
3		4	5
4		6	0
5		7	5
6		9	0
7	1	0	5
8	1	2	0
9	1	3	5

Children should be using written methods for this as pictorial and concrete representations become less effective. Ask children to write out multiples in a table on the right of the page. They can use these multiples for reference.

YEAR 6

Divide multi digits by 2-digits (long division)

7,335 ÷ 15 = 489



x		1	5
1		1	5
2		3	0
3		4	5
4		6	0
5		7	5
6		9	0
7	1	0	5
8	1	2	0
9	1	3	5

A written method is the most effective method when attempting these questions. As with short division, multiples can be written out in a table down the right hand side. Use arrows to point where each remainders go to help signpost to the children the method.

YEAR 6

Divide multi digits by 2-digits (long division with remainder)

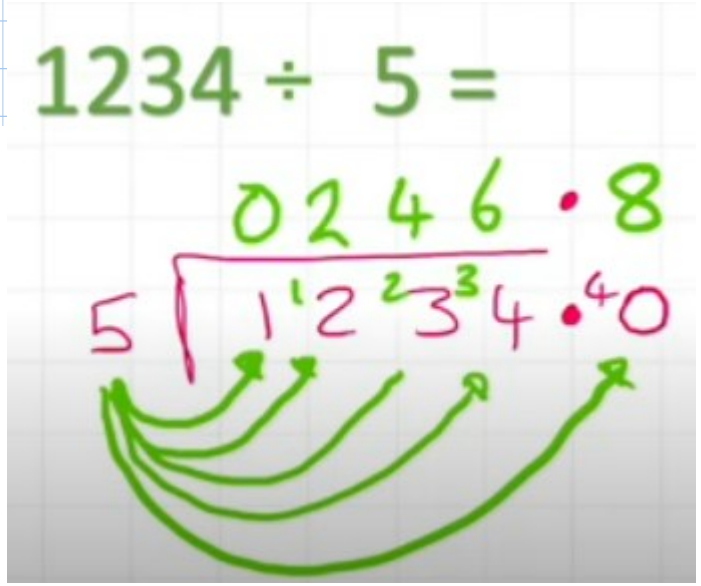
$372 \div 15 = 24\frac{4}{5}$

		0	2	4	$\frac{4}{5}$
1	5	3	7	2	
	−	3	0	↓	
			7	2	
	−		6	0	
			1	2	

$\frac{12}{15} = \frac{4}{5}$

$372 \div 15 = 24\ r12$

		0	2	4	r	1	2
1	5	3	7	2			
	−	3	0	↓			
			7	2			
	−		6	0			
			1	2			



When calculating a quotient that has a remainder, children must show the remainder as either a fraction or a decimal.