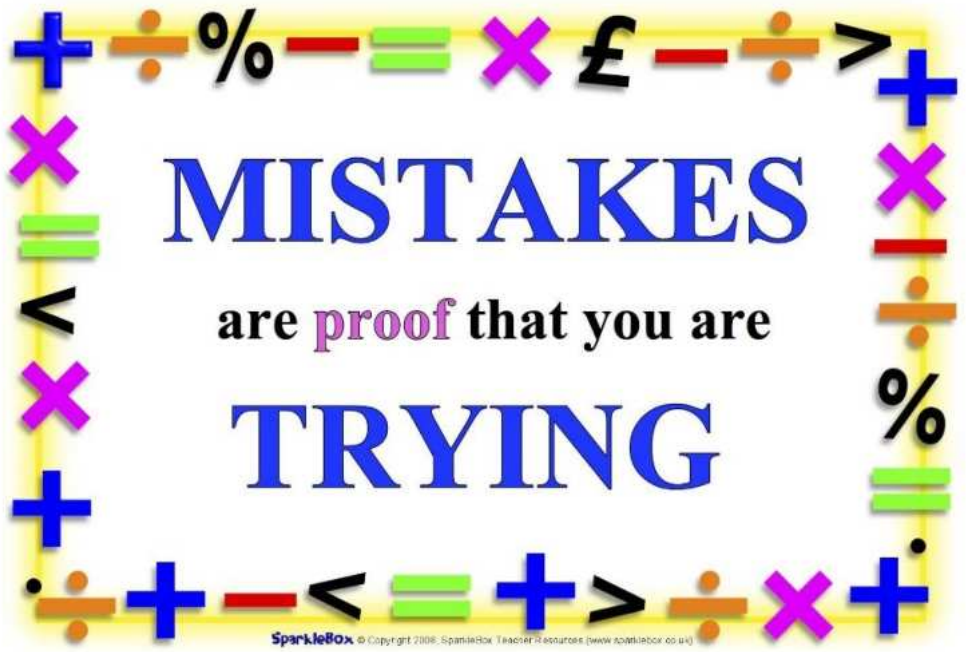
Meridian Trust

Calculation Policy
Years 1 - 6



Parts of this policy have been snipped from the White Rose Calculation policies. CPD Training | Free maths resources | White Rose Maths

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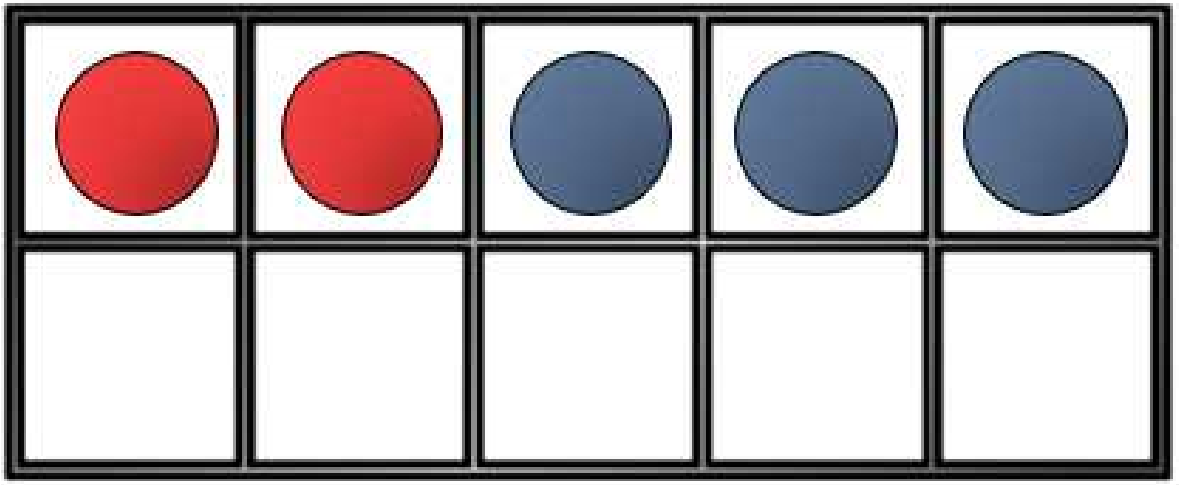
Addition



2 + 3 = 5

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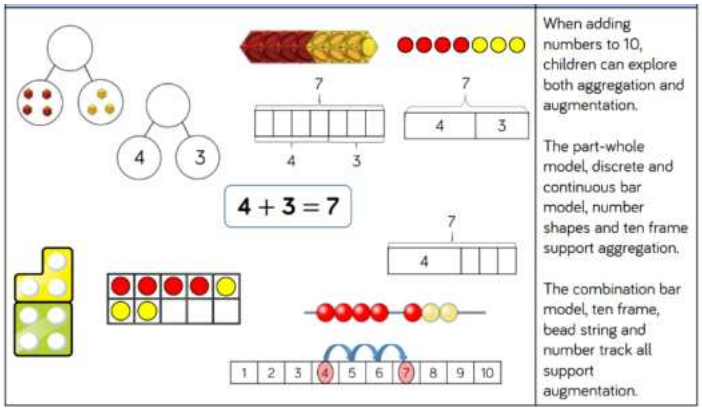
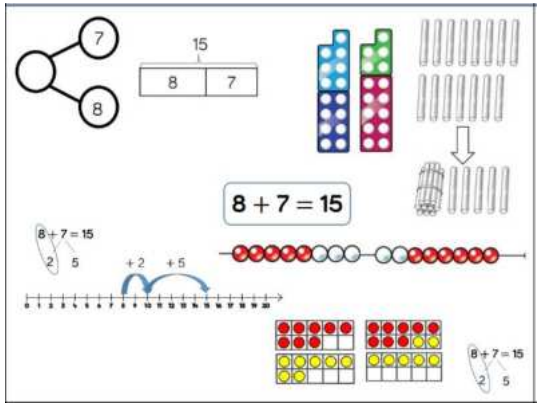
Year 1

Key representations and resources:





Aggregation - combining two or more quantities or measures to find a total.
Augmentation - increasing a quantity or measure by another quantity (counting on)

Rekenreks- bonds to/ within 10 and 20, doubling/halving

Mental methods: children should learn to:
Count on from one part (the greatest part) for example; 7+2= 6+3=
Use known facts- number bonds to 5, 10 and 20

Concrete and Pictorial representations:
Part whole models, bar models and tens frames can be used to show how the parts combine (can be added together) to make the whole- *physical resources such as counters can be used before using numerals.*
Tens frame, bar models, bead strings can be used to show how numbers can be increased by adding on. Children should be encouraged to subitise smaller numbers (rather than count every object) and count on from the greater number.

Adding by making 10- **use of 10 frames** will encourage children to visually make the 10 and counting on before moving onto using number lines.

Rekenreks can be used to teach number bonds, doubles and number facts (inverse, commutativity)

Moving to abstract representations:
(Using concrete and pictorial resources alongside abstract representations such as number sentences/calculations and number lines may be needed)

Number tracks and number lines can be used to support augmentation (counting on)

Addition is commutative, this means that two numbers can be added together and the answer will be the same no matter what order they are.
For example 3 + 4 = 7 and 4 + 3 = 7.

Inverse is using the opposite operation. 5+2=7, 7-5=2- **part whole models and bar models** show how the parts can be added or subtracted- moving into using numerals to represent the numbers.

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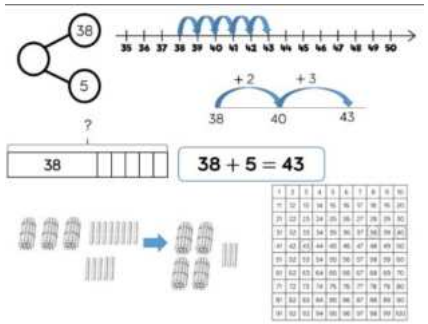
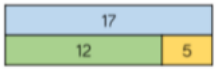
Year 2

Children should be continuously reminded that addition is commutative and the inverse (reverse) operation to subtraction.

Key representations and resources:



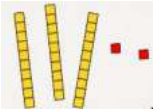


17=12+5 17=5+12 12+5=17 5+12=17

Calculations should be shown and written in a variety of ways as above including missing

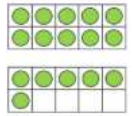
____ + 12=17 12+____=17

Rekenreks- bonds to/ within 10 and 20, doubling/halving



Diennes- children know 10 ones =1 ten

numl



Tens frames

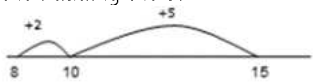
Mental methods: children should learn to:

Count on from one part (the greatest part) for example; 17+2= 26+3=
Use known facts- number bonds to 5, 10, 20 and 100
Count in 2s, 3s, 5s, 10s when adding multiples

Partitioning and bridging through 10.

It is an essential prerequisite that children are confident in the number bonds of all numbers to 10 as emphasised in Year 1.

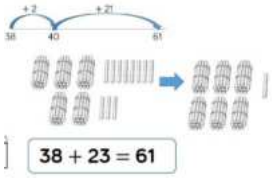
Children should be taught to bridge through a multiple of 10, e.g. children should be able to partition the 8 to relate adding the 2 to reach a multiple of 10 and then adding the 5.



8 + 7 = 15

Counting on in tens and ones:

Practically: add the ones then add the 10s.

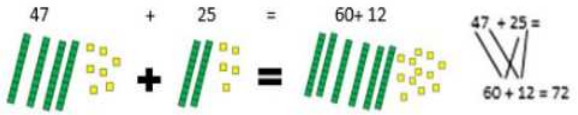


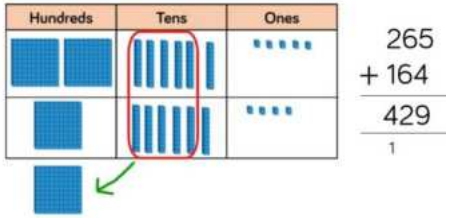
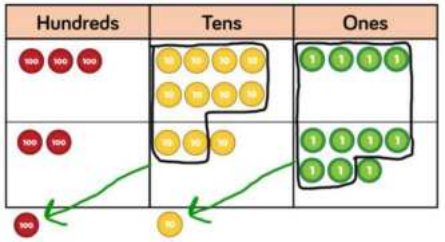
Moving onto:

23 + 12 = 23 + 10 + 2
= 33 + 2
= 35

Towards a Written Method:

Partitioning in different ways and recombine:



Year 3	Year 4
Mental addition (Adjusting) Stem sentence: "We can adjust the parts but the whole must stay the same." This structure will be explored using concrete (dienes and PVC) and pictorial (bar models and part, part whole). 74 + 9 = 73 + 10 = 83 98 + 353 = 100 + 351 = 451 **Adding multiples of 1,10 and 100** Pattern spotting and creation of generalisations, supported by accurate stem sentences, for example: "When adding on multiples of 10 the ones stay the same." Concrete objects (dienes and Place Value Counters) are used to visualise the structures. 247 + 2 = 249 247 + 30= 277 247 + 200 = 447 247 + 5 247 + 70 **Formal Written method (Compact)** Children should carry out the work with dienes and written calculations side by side so that they are able to see the connection between the representation and the abstract method and understand the equivalence of any exchanges.  265 + 164 429 1 **Children should be continuously reminded that addition is commutative and the inverse (reverse) operation to subtraction**	**Mental Methods** Adjusting (continued from Year 3): Stem sentence: "We can adjust the parts but the whole must stay the same." This structure will be explored using concrete (dienes and PVC) and pictorial (bar models and part, part whole). 7,574 + 997 = 7,571 + 1,000 = 8,571 **Formal Written method (Compact)** Children should be familiar with exchanging (see year 3). This should continue to be emphasised. Children should carry out the work with counters and written calculations side by side so that they are able to see the connection between the representation and the abstract method. This should allow them to move quickly onto the more compact method.  384 + 237 621 1 1 **Children should be continuously reminded that addition is commutative and the inverse (reverse) operation to subtraction.**

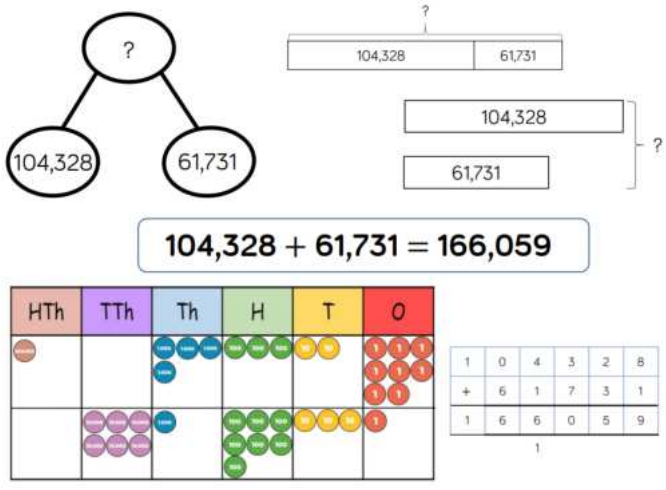
Year 5 and Year 6

Mental Methods

Adjusting (continued from Year 4):
Stem sentence: "We can adjust the parts but the whole must stay the same."
This structure will be explored using concrete (dienes and PVC) and pictorial (bar models and part, part whole).
499,995 + 132,548 = 500,000 + 132,543 = 632,543

Written Methods

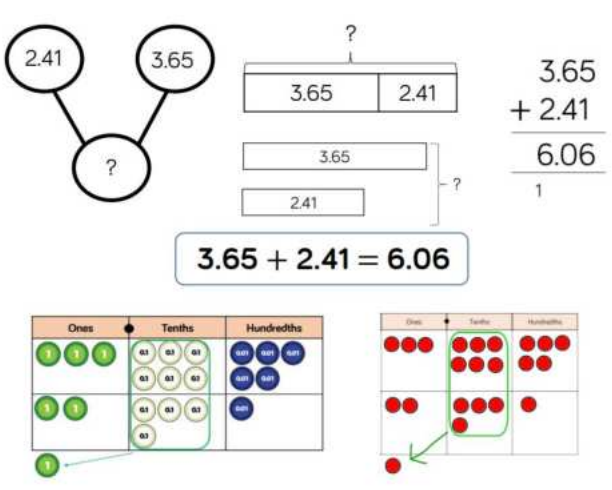
Whole Numbers



Place value counters or plain counters on a place value grid are the most effective concrete resources when adding numbers with more than 4 digits.

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

Decimals



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.

Ensure children have experience of adding decimals with a variety of decimal places. This includes putting this into context when adding money and other measures.

Children should be continuously reminded that addition is commutative and the inverse (reverse) operation to subtraction. They should by now be familiar with using the inverse operation to check that their answers are correct.

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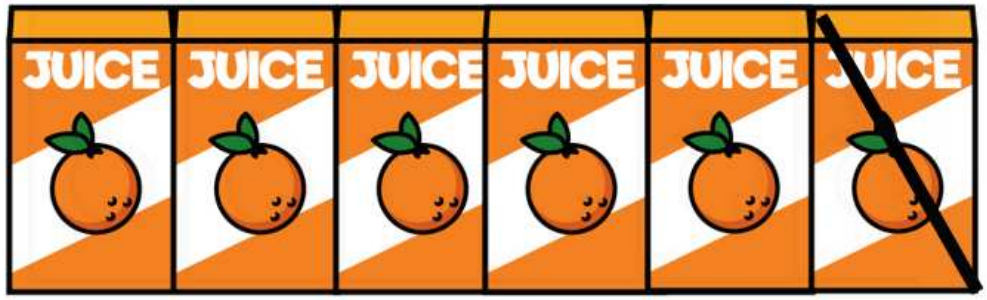
Subtraction

Subtraction – Taking away



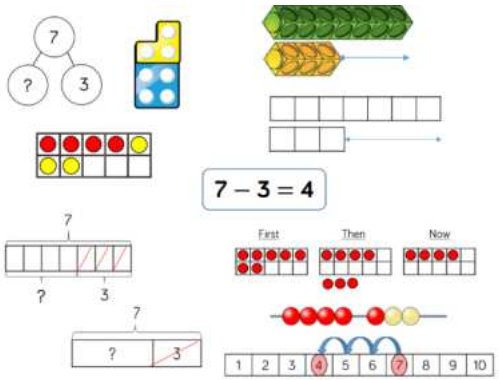
First there were 6 juice boxes.

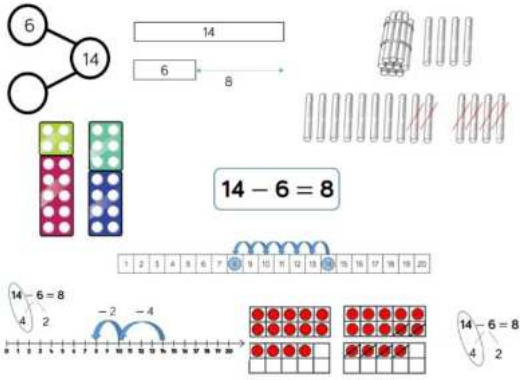
Then Amir drank 1 juice box.

Now there are 5 juice boxes.

Year 1

Key representations and resources:





Subtraction as partitioning- splitting a whole into parts and taking a part away
Subtraction as reduction- starting with the whole and counting back/taking away
Subtraction as difference- the difference between 2 numbers

Children should be taught:
Subtraction is the inverse of addition, but it is not commutative.

Rekenreks- bonds to/ within 10 and 20 and inverse, doubling/halving

Mental methods: children should learn to:

Count back using knowledge of one/two less e.g. 12-1= 8-3=
Use knowledge of numbers bonds- to 5, 10 and 20

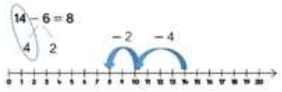
Concrete and pictorial representations:

Part whole models, bar models and tens frames will support subtraction as partitioning.
Tens frames, number tacks, single bar models and bead strings can support subtraction as reduction.
Cubes and bar models can support subtraction as finding the difference.

Moving to abstract representations:

Using concrete and pictorial resources alongside abstract representations such as number sentences/calculations and number lines may be needed)

Number lines and number tracks can be used to support subtraction as reduction and partitioning.



Children should be taught to partition by counting back to 10 then continuing to count back.

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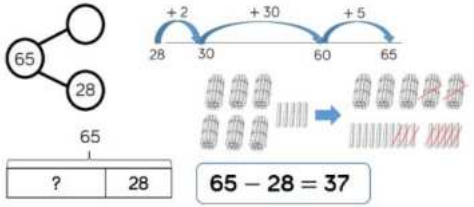
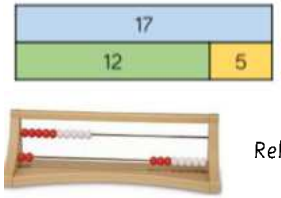
Year 2

It is essential that the children come to understand that subtraction is the inverse of addition but is not commutative.

Subtraction as partitioning- splitting a whole into parts and taking a part away
Subtraction as reduction- starting with the whole and counting back/taking away
Subtraction as difference- the difference between 2 numbers

Key representations and resources:





17-12=5 17-5=12 12+5=17 5+12=17

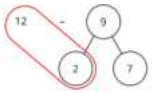
The bar model shows clearly the relationship between addition and subtraction and difference.

Rekenreks- bonds to/ within 10 and 20 and inverse, doubling/halving

Mental methods: children should learn to:
Count back using knowledge of one/two/ten less e.g. 72-10= 80-30=
Use knowledge of numbers bonds- to 5, 10, 20 and 100
Count back in 2s, 3s, 5s and 10s

Recall and use subtraction facts to 20 and derive and use related facts to 100
Bar models and part whole models show the relationship between addition and subtraction.
Children should use the inverse of number bonds to find subtraction facts- tens frames and Rekenreks can support this practically.

Subtracting a one digit number from a 2 digit number: partitioning
Children use their knowledge of bonds within 10 to partition and then subtract to 10. Tens frames will help children work practically then moving to the more abstract representation below:



Subtracting 2 two- digit numbers:

Subtracting ones then 10s (not crossing 10)

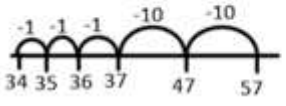
36 - 12 = 24

Subtracting ones then 10s- (crossing 10) and exchanging

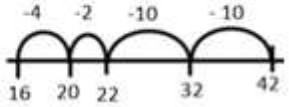
36-19=

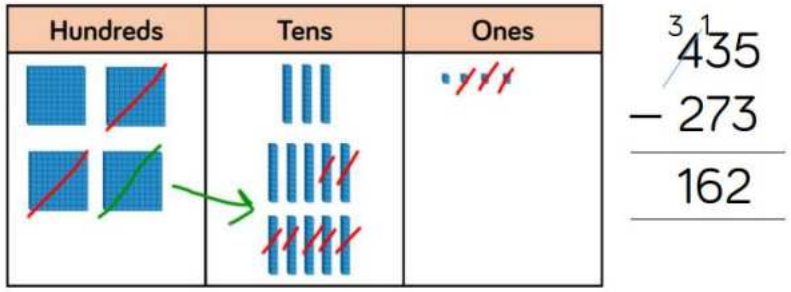
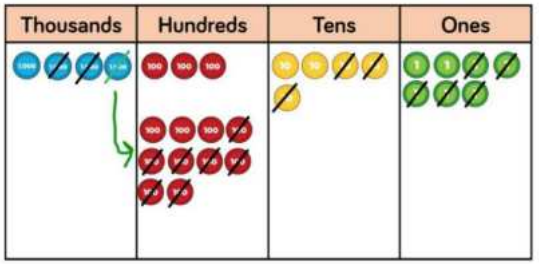
Then moving onto using an empty number line:

57 - 23 = 34



42 - 26 = 16



Year 3	Year 4
Mental Methods Adjusting: Stem sentence: "We can adjust the parts but the difference must stay the same." This structure will be explored using concrete (dienes and PVC) and pictorial (bar models and part, part whole). Subtrahend adjusted: 353 - 98 = 355 - 100 = 255 **Subtracting multiples of 1,10 and 100** Pattern spotting and creation of generalisations, supported by accurate stem sentences, for example: "When subtracting multiples of 10 the ones stay the same." Concrete objects (dienes and Place Value Counters) are used to visualise the structures. 247 - 2 = 245 247 - 30= 217 247 - 200 = 47 247 - 9 247 - 70 **Formal Written Method (Compact)**  3 1 4 3 5 − 2 7 3 1 6 2 **Children should be continuously reminded that subtraction is not commutative and is the inverse (reverse) operation to addition (bar model).**	**Mental Methods** Adjusting (continued from Year 3): Stem sentence: "We can adjust the parts but the difference must stay the same." This structure will be explored using concrete (dienes and PVC) and pictorial (bar models and part, part whole). Adjusting the subtrahend: 7,574 - 997 = 7,577 - 1,000 = 6,577 **Formal Written Method (Compact)** Children should be familiar with exchanging (see year 3). This should continue to be emphasised. Children should carry out the work with counters and written calculations side by side so that they are able to see the connection between the representation and the abstract method. This should allow them to move quickly onto the more compact method.  3 1 4 3 5 7 − 2 7 3 5 1 6 2 2 **Children should be continuously reminded that subtraction is not commutative and is the inverse (reverse) operation to addition (bar model).**

Year 5 and Year 6

Adjusting (continued from Year 4):

Stem sentence: "We can adjust the parts but the difference must stay the same."

This structure will be explored using concrete (dienes and Place Value Counters) and pictorial (bar models and part, part whole).

Adjusting the subtrahend:

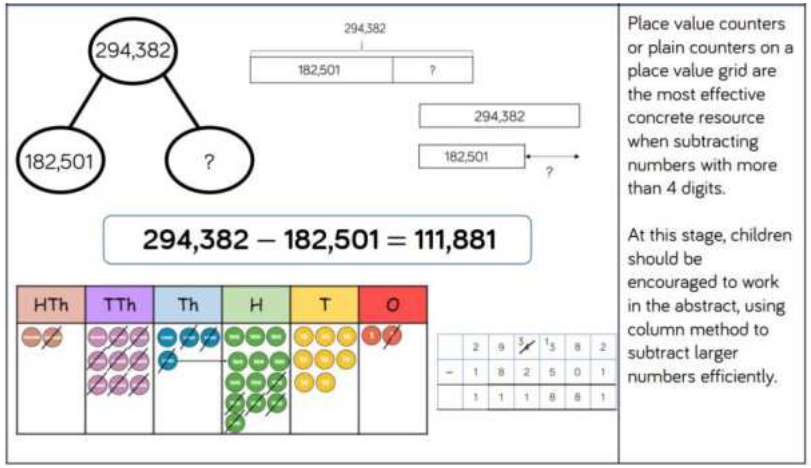
685,057 – 99,998 = 685,059 – 100,000 = 585,059

Adjusting the minuend:

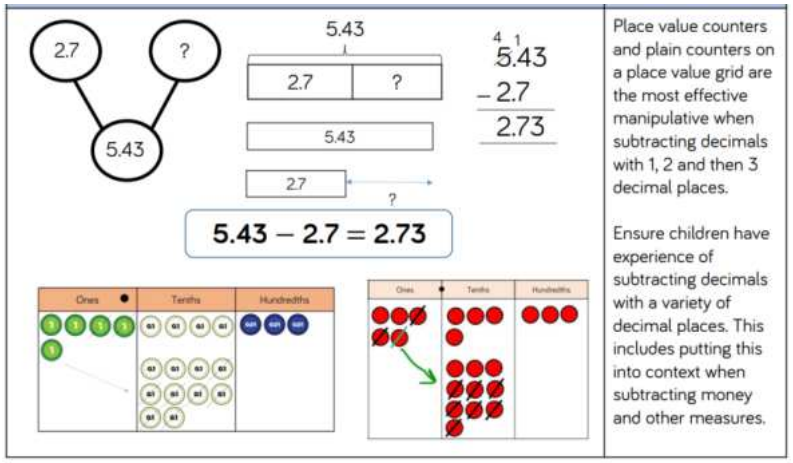
£100 - £56.89 = £99.99 - £56.88 = £43.11

Written Methods

Whole numbers



Decimals



Children should be continuously reminded that subtraction is not commutative and is the inverse (reverse) operation to addition (bar model). They should by now be familiar with using the inverse operation to check that their answers are correct.

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Multiplication

There are 3 equal groups with
4 in each group.

$$4 + 4 + 4 = 12$$

$$3 \times 4 = 12$$

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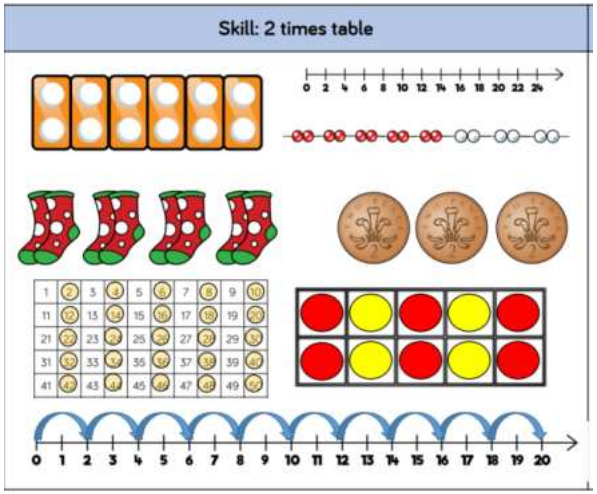
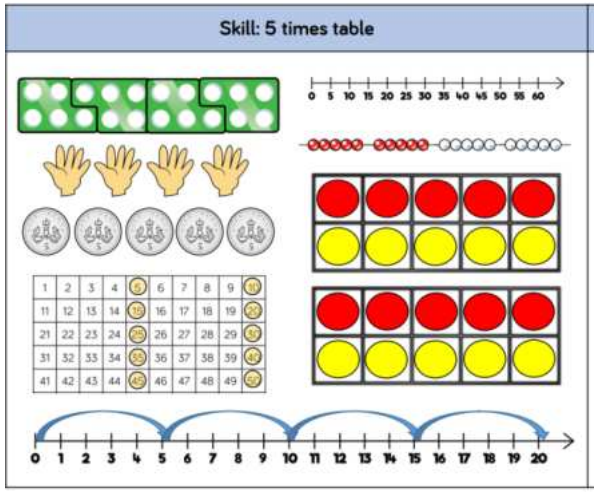
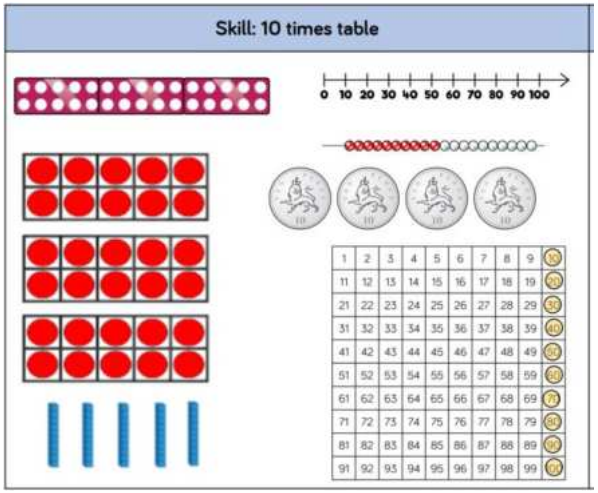
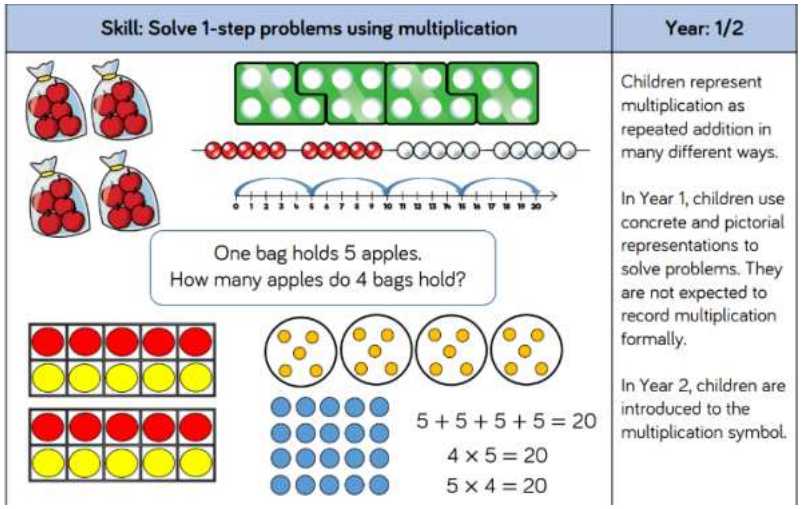
Year 1 and Year 2









Repeated addition- recognising equal groups and encouraging to count in multiples of 2s. 5s, 10s (3s-Year 2)

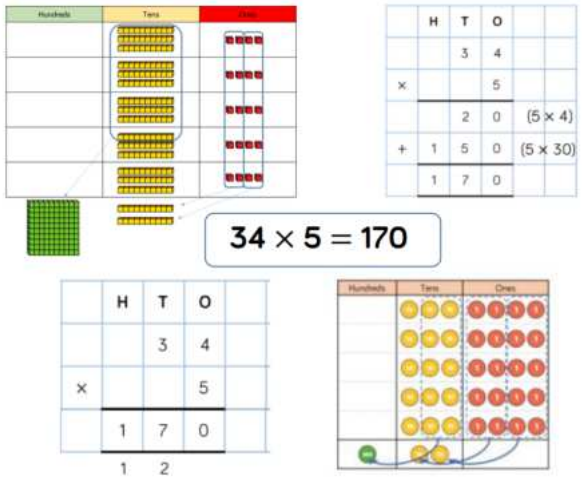
Year 2 move onto recording repeated addition as multiplication number sentences using the X symbol,

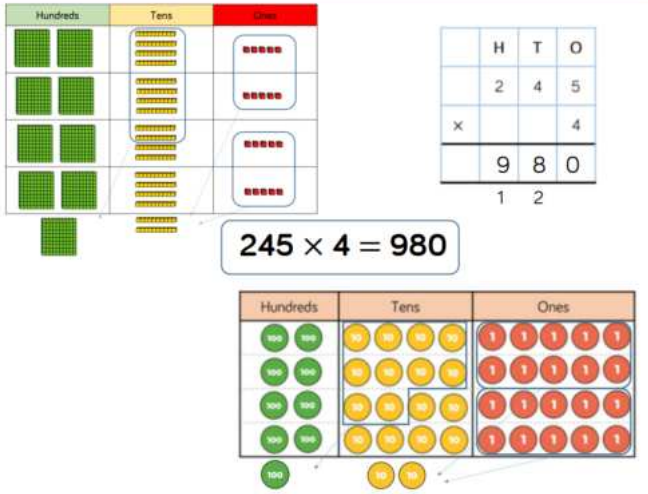
Counting- in 2s, 5s 10s (3s in Year 2) Forwards and back, missing numbers on number track or number line

Pattern spotting- seeing equal groups, using arrays for commutativity

Doubling and doubling patterns. (linked to halving in division)

Year 3 and Year 4

Skill: Multiply 2-digit numbers by 1-digit numbers	Year: 3/4
	Informal methods and the expanded method are used in Year 3 before moving on to the short multiplication method in Year 4. Place value counters should be used to support the understanding of the method rather than supporting the multiplication, as children should use times table knowledge.

Skill: Multiply 3-digit numbers by 1-digit numbers	Year: 4
	When moving to 3-digit by 1-digit multiplication, encourage children to move towards the short, formal written method. Base 10 and place value counters continue to support the understanding of the written method. Limit the number of exchanges needed in the questions and move children away from resources when multiplying larger numbers.

Times tables

Children to continue to learn all multiplication and related division facts (inverse). The expectation is that they have learnt all facts up to 12 x 12 by the end of Year 4.

Laws

Commutative – 6 X 7 = 7 X 6 = 42
Associative – 4 X 7 X 5 = 5 X 4 X 7 = 20 X 7 = 140
Distributive – 12 X 6 = 10 X 6 + 2 X 6 = 60 + 12 = 72
https://www.mathsisfun.com/associative-commutative-distributive.html
:

Multiplying by 10 and 100

Children are taught to relate this to the base 10 system.
"When multiplying by 100 the digits move up two place value columns and place holders are added if needed"
45 X 100 = 4,500 and 0.45 X 100 = 45

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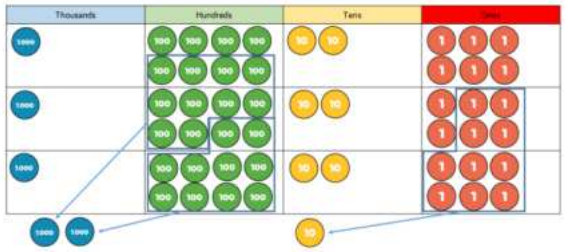
Year 5 and Year 6



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

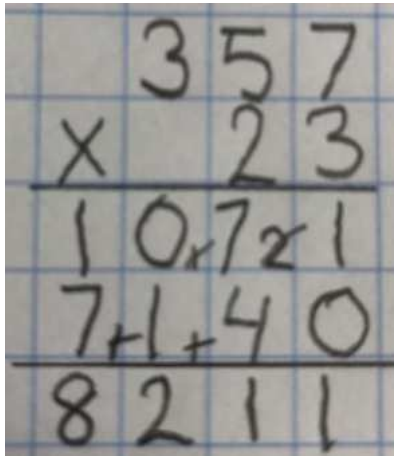
	Th	H	T	O
	1	8	2	6
×				3
	5	4	7	8
	2		1	

When multiplying 4-digit numbers, place value counters are the best manipulative to use to support children in their understanding of the formal written method.
If children are multiplying larger numbers and struggling with their times tables, encourage the use of multiplication grids so children can focus on the use of the written method.

<u>Long multiplication</u>

Children may come up putting the exchanges in different places than shown. If they are being accurate with this then don't make them change.

Th	H	T	O
	2	3	4
×		3	2
	4	6	8
1 7	1 0	2	0
7	4	8	8



Times Tables, Laws and multiplying and dividing by multiples of 10, 100 and 1,000 – build on Years 3 and 4.

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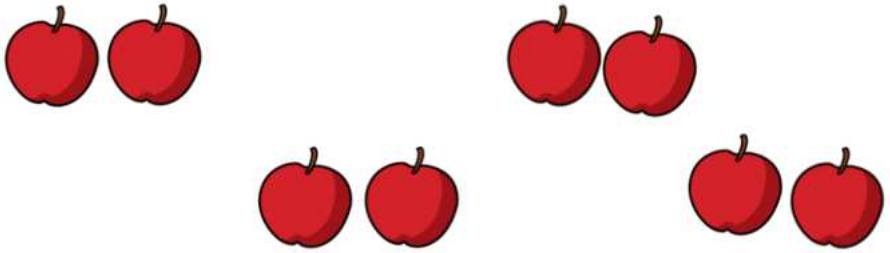
Division

The apples are put into bags with 2 apples in each bag.



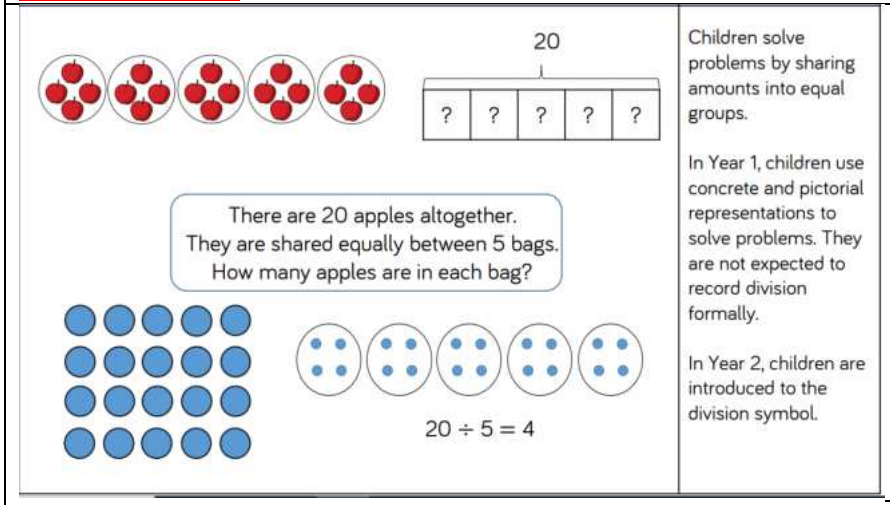
There are 8 apples altogether.

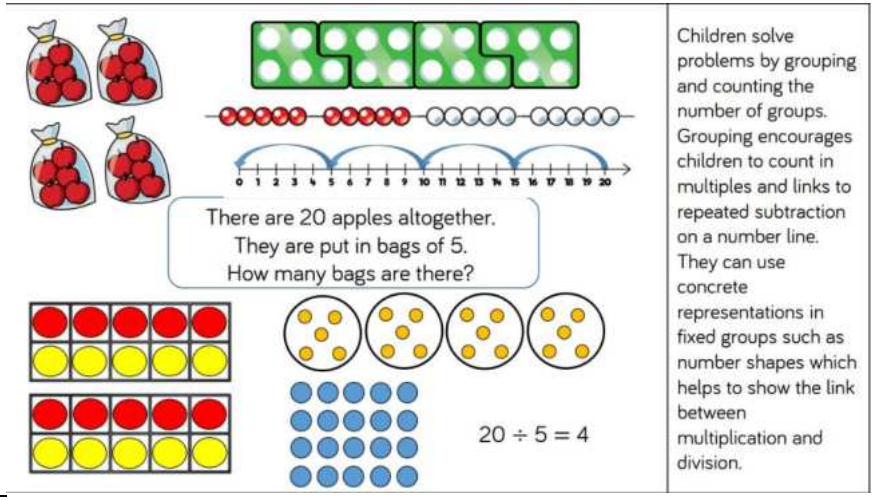
There are 2 in each group.

There are 4 groups.

8 ÷ 2 = 4

Year 1 and Year 2





Division as grouping and sharing- grouping/seeing equal groups from a whole **or** sharing into groups form a whole.

Halving and halving patterns (linked to doubling)

Inverse: children make connection between multiplication and division (using arrays can show this)

Odd and even numbers: working out if a number is odd or even by exploring if it can be shared by 2. identify even numbers as multiples of 2

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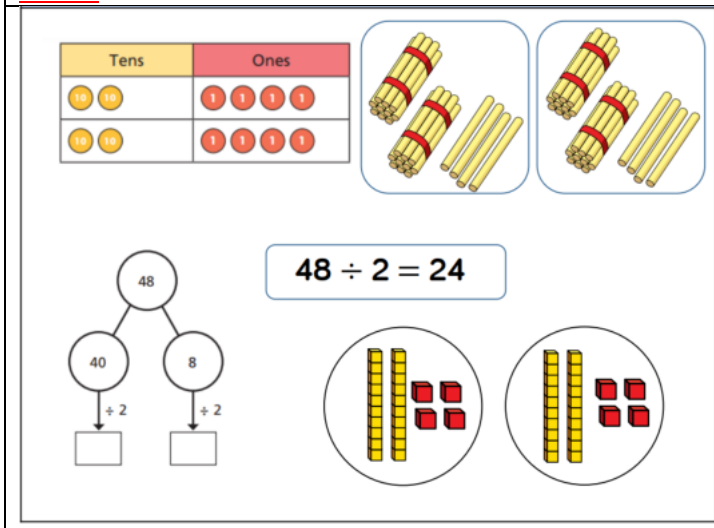
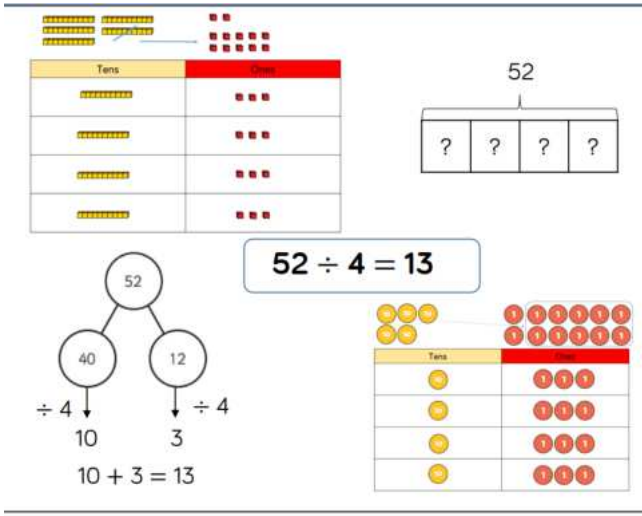
Year 3



When dividing larger numbers, children can use manipulatives that allow them to partition into tens and ones.

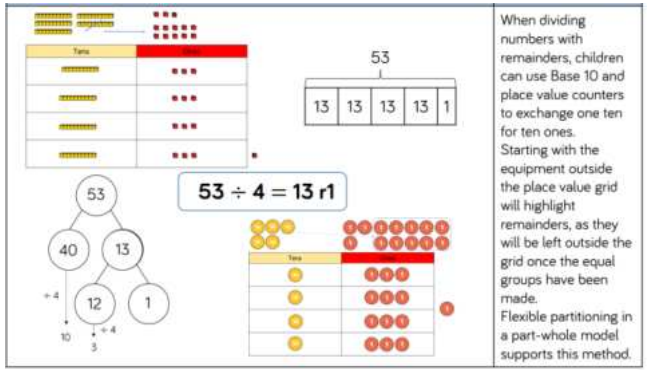
Straws, Base 10 and place value counters can all be used to share numbers into equal groups.

Part-whole models can provide children with a clear written method that matches the concrete representation.



When dividing numbers involving an exchange, children can use Base 10 and place value counters to exchange one ten for ten ones.
Children should start with the equipment outside the place value grid before sharing the tens and ones equally between the rows.

Flexible partitioning in a part-whole model supports this method.



When dividing numbers with remainders, children can use Base 10 and place value counters to exchange one ten for ten ones.
Starting with the equipment outside the place value grid will highlight remainders, as they will be left outside the grid once the equal groups have been made.
Flexible partitioning in a part-whole model supports this method.

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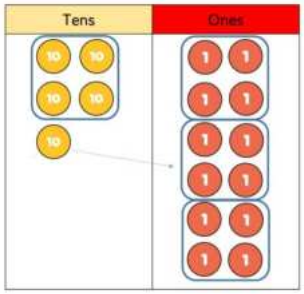
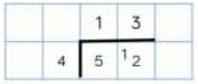
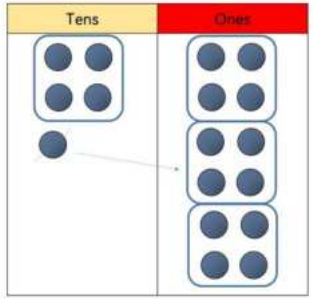
Year 4





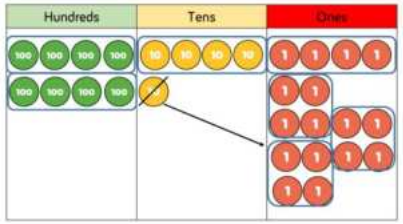


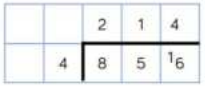
$52 \div 4 = 13$

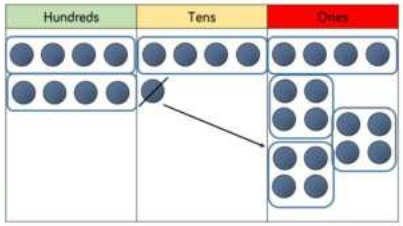
When using the short division method, children use grouping. Starting with the largest place value, they group by the divisor.

Language is important here. Children should consider 'How many groups of 4 tens can we make?' and 'How many groups of 4 ones can we make?'

Remainders can also be seen as they are left ungrouped.







$856 \div 4 = 214$

Children can continue to 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 on a place value grid to support this understanding. Children can also draw their own counters and group them through a more pictorial method.

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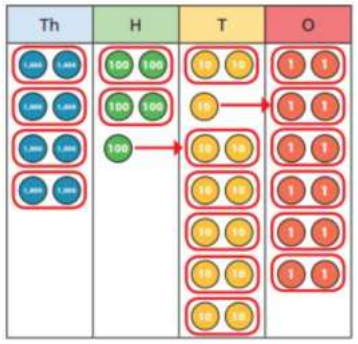
Year 5 and 6



	4	2	6	6
2	8	5	$^{1}3$	$^{1}2$

8,532 ÷ 2 = 4,266

Place value counters or plain counters can be used on a place value grid to support children to divide 4-digits by 1-digit. Children can also draw their own counters and group them through a more pictorial method.

Children should be encouraged to move away from the concrete and pictorial when dividing numbers with multiple exchanges.

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

432 ÷ 12 = 36

7,335 ÷ 15 = 489

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

15	30	45	60	75	90	105	120	135	150

When children begin to divide up to 4-digits by 2-digits, written methods become the most accurate as concrete and pictorial representations become less effective. Children can write out multiples to support their calculations with larger remainders. Children will also solve problems with remainders where the quotient can be rounded as appropriate.

		0	3	6	
1	2	4	3	2	
	−	3	6	0	(×30)
			7	2	
	−		7	2	(×6)
				0	

12 × 1 = 12
12 × 2 = 24
12 × 3 = 36
12 × 4 = 48
12 × 5 = 60
12 × 6 = 72
12 × 7 = 84
12 × 8 = 96
12 × 7 = 108
12 × 10 = 120

432 ÷ 12 = 36

7,335 ÷ 15 = 489

		0	4	8	9	
	15	7	3	3	5	
	−	6	0	0	0	(×400)
		1	3	3	5	
	−	1	2	0	0	(×80)
			1	3	5	
	−		1	3	5	(×9)
					0	

1 × 15 = 15
2 × 15 = 30
3 × 15 = 45
4 × 15 = 60
5 × 15 = 75
10 × 15 = 150

Children can also divide by 2-digit numbers using long division.

Children can write out multiples to support their calculations with larger remainders.

Children will also solve problems with remainders where the quotient can be rounded as appropriate.

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Fractions, Decimals and Percentages

What fraction is shaded?

There are 3 equal parts.

There are 2 parts shaded.

$\frac{2}{3}$ is shaded.

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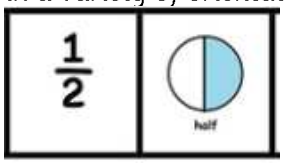
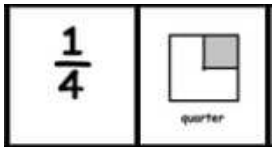
Year 1

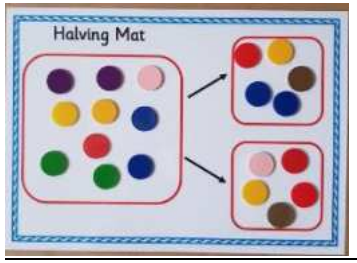
Children should be able to find equal and unequal parts of everyday objects- the leg is part of a table, my arm is part of my body
Children should then be taught that a fraction is 'an equal' part of a whole. The vocabulary of 'equal' may need to be revisited.
Recognise, find and name a half as one of two equal parts of an object, shape or quantity and a quarter as one of four equal parts of an object or quantity.
Representations should be shown using a variety of shapes/objects and in a variety of orientations.

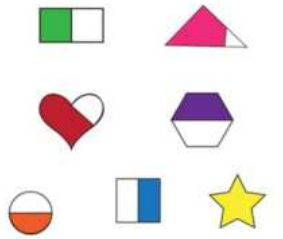




1/4 of a pizza

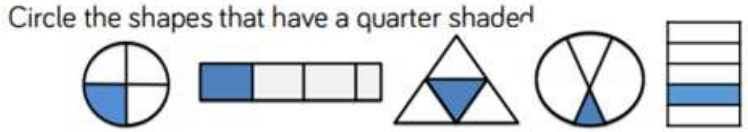
As with division:
Children find ½ of a number of concrete objects by splitting them into 2 equal groups.
They find ¼ by splitting a number of concrete objects into 4 equal groups and draw connections between halving and quartering.
Children should also be able to tell you what is and what is not a half or quarter:
" It is not a half because the 2 parts are not equal."





Year 2

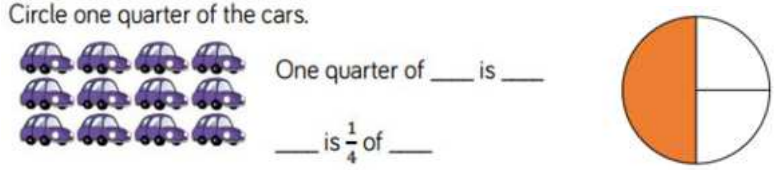
Children still need to be aware of equal and unequal groups.



Children extend their knowledge of whole and half to find quarters, thirds and then three quarters of shapes and quantities.
The links between the concrete, pictorial and abstract representation should be made explicit.

Numerator number of parts being used
Denominator number of equal parts the whole has been divided into

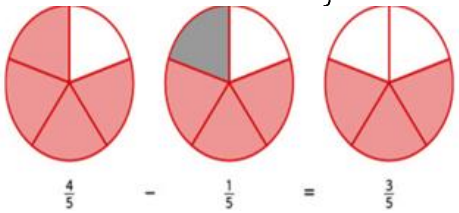
The children use their understanding of fractional representation to find fractions of numbers:
¾ of 12 =
First draw four squares, because there are 4 equal parts.
Share 12 fairly between them. You have found ¼. Now circle 3 squares and count how many in them to find ¾.
The children should recognise that 2/4 is the same as ½.
The children will have come across halving numbers in division (see above) as being the same as dividing by 2 but this should be recapped in the fractions unit.



Year 3

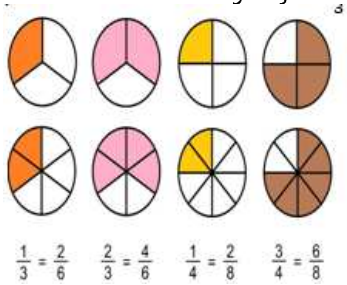
Adding and Subtracting Fractions

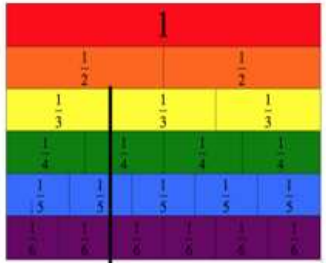
Children add and subtract fractions with the same denominator within 1 This is aided by visual representations.



Equivalent Fractions

Children use a range of models and images to identify equivalent fractions.





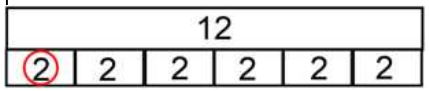
Decimals

When working with tenths in any of the above children should be reminded of the decimal equivalence. Place Value Counters are used to re-enforce this.

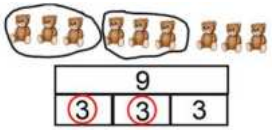
They are encouraged to identify patterns and create generalisations, e.g. "3 sixths is equivalent to a half because 3 is half of 6."

Fractions of Amounts

Fractions are directly related to division, for example $\frac{1}{6}$ of an object means it has been divided into 6 equal parts and it is the value of 1 of those parts.



Non unit fractions of amounts are related to finding the value of one unit (one third for instance) and then multiplying this. This is shown visually with concrete resources and bar models to support understanding:



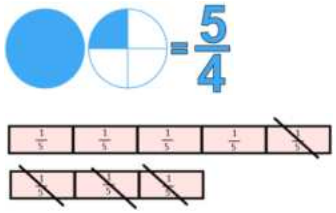
$\frac{2}{3}$ of 9 = 6

Year 4

Adding and Subtracting

Children add and subtract fractions with the same denominator above 1 whole. This is aided by visual representations.

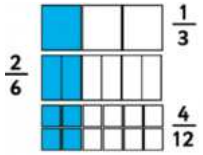
$\frac{3}{4} + \frac{2}{4} = \frac{5}{4}$ or $1\frac{1}{4}$

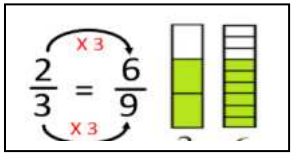


$\frac{8}{5} - \frac{4}{5} = \frac{4}{5}$

Equivalent Fractions

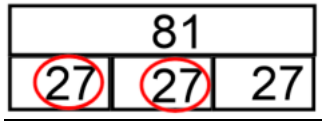
Children use a range of models and images to identify equivalent fractions families.
Children use knowledge of multiples and factors to begin to calculate equivalent fractions.
"Ninths are three times smaller than thirds so we need three times as many to be equivalent."





Fractions of Amounts

Continue to build on work in Year 3 using increasingly larger quantities:



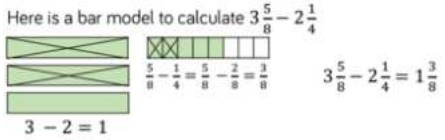
Decimals

When working with tenths and hundredths in any of the above children should be reminded of the decimal equivalence. Place Value Counters are used to re-enforce this.

Year 5

Adding and Subtracting

Continue to add and subtract fractions with the same denominator as per requirements in Year 4.
Add and subtract fractions with the same denominator and multiples of the same number. Pupils will also add and subtract a fraction from a mixed number, this should be done with understanding and not by changing the mixed number to an improper fraction.

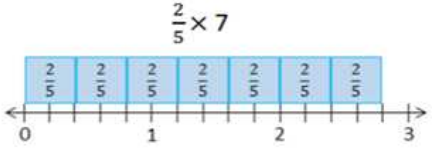


Equivalent fractions

Continue work from Y4, using knowledge of multiples and factors to calculate and convert, comparing images to support understanding.

Multiplying fractions

Multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams.
When multiplying proper fractions, pupils should multiply the whole by the numerator- the number of parts.
When multiplying mixed numbers partition, multiply out and recombine.



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

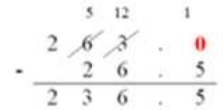
$8 \times 4\frac{3}{8} = 32 + \frac{24}{8} = 32 + 3 = 35$

Fractions of amounts

Build on Y4, using images and short division to support finding fractions of numbers or quantities. Divide by denominator and multiply by numerator. Write remainders as a fraction. E.g. find 1/8 of 25, so 25 ÷ 8 = 3 1/8 .

Decimals

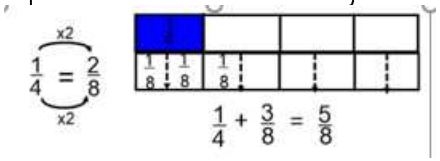
Remind pupils of the decimal equivalence with tenths, hundredths and thousandths. Place Value Counters to reinforce this.
Add and subtract decimals, including a mix of whole numbers and decimals, decimals with different numbers of places and complements of 1 (e.g. 0.83 + 0.17 =1). Line up decimal points and use place holders to support.



Year 6

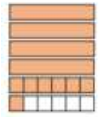
Adding and Subtracting

Pupils will add and subtract fractions that have different denominators using their knowledge of equivalence to change one or all of the fractions.



Building on their learning from Year 5 the children will add and subtract mixed numbers and be encouraged not to change the mixed number to an improper fraction. Where the subtracting fraction is greater than what they have, they will use method outlined below.

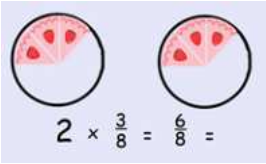
Here is a method to calculate $5\frac{1}{6} - 2\frac{1}{3}$

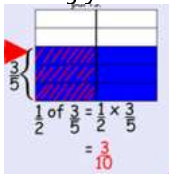


$5\frac{1}{6} - 2\frac{1}{3} = 4\frac{7}{6} - 2\frac{1}{3} = 4\frac{7}{6} - 2\frac{2}{6} = 2\frac{5}{6}$

Multiplying Fractions

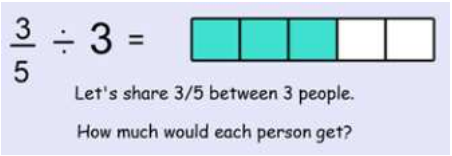
Pupils will multiply fractions by fractions and fractions by whole numbers -simplify the product if required.



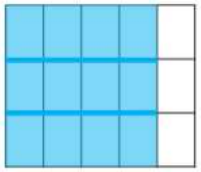


Dividing Fractions by Whole Numbers

Pupils are encouraged to recognise if the numerator is a multiple of the whole number divisor. If not, they can find an equivalent fraction that is.



Make the numerator a multiple of the divisor e.g. $\frac{4}{5} = \frac{12}{15}$



$\frac{4}{5} \div 3 = \frac{4}{15}$

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Percentages

Children should use known facts and fractional knowledge to work out questions mentally where possible, for example 50% is half, 25% a quarter, 20% divide by 5, 99% is 1% less than the whole. For more complex questions children find and use key facts:

78 % of 240
50% = 120
10% = 24
24 x 2 = 48
5% is half of 10% = 12
1% = 7.8
7.8 x 3 = 23.4

120 + 48 + 12 + 23.4 = 203.4