Viking Academy Trust

Calculation Policy

Upton Junior School

Approved by the Trust: Term 6 2017

Reviewed annually: Term 1

Last review date: *N/A*

Signed:

Chair of Trustees

CALCULATION POLICY

The Viking Academy Trust

Schools in the Viking Academy Trust (VAT)

Chilton Primary School

Ramsgate Arts Primary School

Upton Junior School

This 'Calculation' policy is specifically for **Upton Junior School**.

1. Rationale:

At the Viking Academy Trust, we believe all employees must ensure their mathematical subject knowledge is relevant conditional to current methodologies and expectations in teaching mathematics.

2. Purpose:

To establish an accessible document that clearly outlines the progression through each of the four calculations within mathematics; addition, subtraction, multiplication and division. With the help of concrete, pictorial and abstract representations, teachers are able to use this document in order to plan a succession of effective lessons regarding the conceptualised teaching and learning of calculation.

3.1 Guidelines:

This policy is separated firstly into the four calculations and then additionally by year group in order to show a clear route of development through years 3 to 6 in addition, subtraction, multiplication and division; including the expected formal abstract written methods, visual representations and links to other areas of the curriculum.

This policy should be used alongside other school mathematics initiatives such as ***Primary Advantage Maths*** in which a further wealth of concrete, pictorial and abstract representations of the four calculations can be found.

3.2 Formal written method guidance:

	Year 3	Year 4	Year 5	Year 6
Addition	Column method without exchanging (up to **3** digits) Begin exchanging when appropriate.	Column method with exchanging (up to **4** digits)	Column method with exchanging (up to **4** digits and beyond) Decimals – with the **same** amount of decimal places.	Column method with exchanging (up to **4** digits and beyond) Decimals – with **different** amounts of decimal places.
Subtraction	Column method without exchanging (up to **3** digits) Begin exchanging when appropriate.	Column method with exchanging (up to **4** digits)	Column method with exchanging (up to 4 digits and beyond) Decimals – with the **same** amount of decimal places.	Column method with exchanging (up to 4 digits and beyond) Decimals – with **different** amounts of decimal places.
Multiplication	Counting in multiples. Repeated addition. Arrays – showing commutativity. Partitioning using the **grid method**.	**Column** (vertical) multiplication (2 and 3 digit multiplied by 1 digit)	**Column** (vertical) multiplication Long multiplication (up to 4 digit multiplied by 1 or 2 digits)	**Column** (vertical) multiplication Long multiplication (multi digit up to 4 digits multiplied by 2 digits)
Division	Division with arrays. Division with a remainder. **Short division** (2 digit by 1 digit)	Division with arrays. Division with a remainder. **Short division** (up to 3 digits by 1 digit)	**Short division** (Up to 4 digits by 1 digit) Remainders can be interpreted in different ways.	**Short division** **Long division** (Up to 4 digits by 2 digits) Remainders interpreted as whole numbers, fractions or round.

Upton Calculation Policy for addition: YEAR 3

Mental calculations

Add numbers mentally, including:

- **A three-digit number and ones**
- **A three-digit number and tens**
- **A three-digit number and hundreds**
- Partition all numbers and recombine, start with TO + TO then HTO + TO
- Use straws, Dienes, place value counters, empty number lines.

Common mental calculation strategies:
Partitioning and recombining
Doubles and near doubles
Use number pairs to 10 and 100
Adding near multiples of ten and adjusting
Using patterns of similar calculations
Using known number facts
Bridging through ten and hundred
Complementary addition (mental number line)

Written calculations

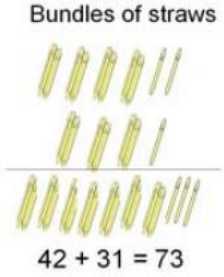
Add numbers with up to three digits, using the column method.

30 + 4	34
20 + 5	+25
50 + 9	59

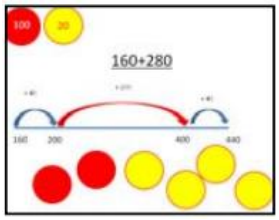
200 + 30 + 4	234
500 + 20 + 7	+ 527
700 + 60 + 1	761
10	1

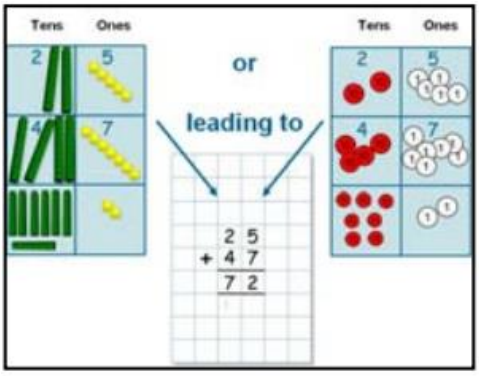
Supporting representations

Use a range of concrete, pictorial and abstract representations, including those below.



0 + 50 + 3
10 + 40 + 3
20 + 30 + 3
30 + 20 + 3
40 + 10 + 3
50 + 0 + 3





Dienes and place value counters

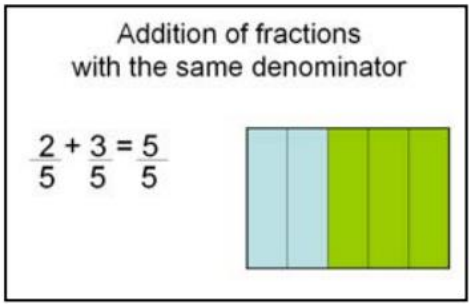
76 + 21
= 70 + 6 + 20 + 1
= 90 + 7 = 97

Partitioning and recombining

What is the same and what is different about all these methods?

Fractions

Addition of fractions with the **same denominator** within one whole.



Links from other strands

Pupils should estimate the answers to a calculation and use inverse operations to check answers.
Add amounts of money using both pounds (£) and pence (p) in practical and appropriate contexts.
Measure, compare and add lengths (m/cm/mm), mass (kg/g) and volume/capacity (l/ml).

Upton Calculation Policy for addition: YEAR 4

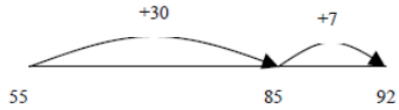
Mental calculations

Practise mental methods with increasingly large numbers.
See year 3 guidance

Consolidate partitioning and re-partitioning
Use compensation for adding too much/little and adjusting.
Use straws, Dienes, place value counters,
Empty number lines etc.

Common mental calculation strategies:
Partitioning and recombining
Doubles and near doubles
Use number pairs to 10 and 100
Adding near multiples of ten and adjusting
Using patterns of similar calculations
Using known number facts
Bridging through ten and hundred
Complementary addition (mental number line)

I know that 63 + 29 is the same as 63 + 30 - 1



55 + 37 = 55 + 30 + 7
= 85 + 7
= 92

Written calculations

Add numbers with up to four digits, using the column method.

Include decimal addition for money.

789 + 642 becomes

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

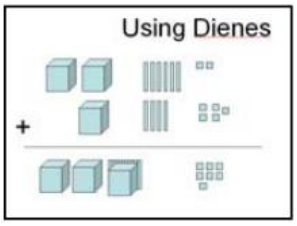
Answer: 1431

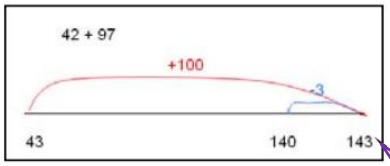
Supporting representations

Use a range of concrete, pictorial and abstract representations, including those below.

Bundles of straws

42 + 31 = 73





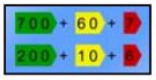
Compensating in mental addition

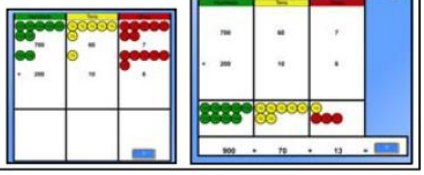
£12.32
+ £11.81
£24.13
1

0 + 50 + 3
10 + 40 + 3
20 + 30 + 3
30 + 20 + 3
40 + 10 + 3
50 + 0 + 3

Re-partitioning

Place value cards & counters to counters, support the expanded method in readiness for the column

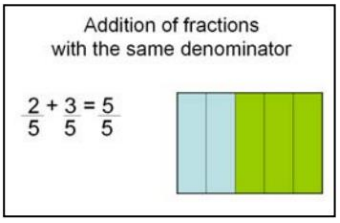


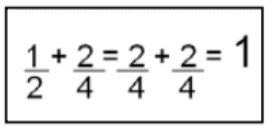


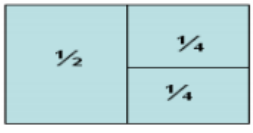
What is the same and what is different about all these methods?

Fractions

Addition of fractions with the **same denominator** bridging whole numbers.
Counting using simple fractions and decimals, both forwards and backwards.







Links from other strands

Pupils should estimate the answers to a calculation and use inverse operations to check answers.
Add amounts of money using both pounds (£) and pence (p) in practical and appropriate contexts.
Measure, compare and add lengths (m/cm/mm), mass (kg/g) and volume/capacity (l/ml).
Calculate the perimeter of composite rectilinear shapes using different units of measurement.
Solve addition two step problems in context, deciding which operation and methods to use and why.

Upton Calculation Policy for addition: YEAR 5

Mental calculations

Add numbers mentally with increasingly large numbers, e.g. 12,462 + 2,300 = 14,762
Mentally add tenths, and one-digit numbers and tenths.
Add decimals, including a mix of whole numbers and decimals, decimals with different numbers of places, and complements of 1 (e.g. 0.67 + 0.33 = 1)

Children use representation of choice
Refer back to pictorial and physical representations when needed.

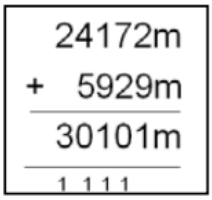
See years 3 and 4 guidance for further scaffolding of less able.

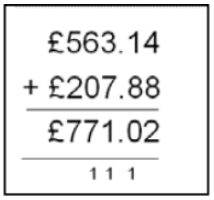
Common mental calculation strategies:
Partitioning and recombining
Doubles and near doubles
Use number pairs to 10 and 100
Adding near multiples of ten and adjusting
Using patterns of similar calculations
Using known number facts
Bridging through ten and hundred
Complementary addition (mental number line)

Written calculations

Add numbers with up to four digits (or more than four if exceeding), using the column method.

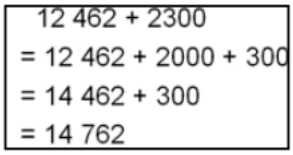
Include decimal addition for money.





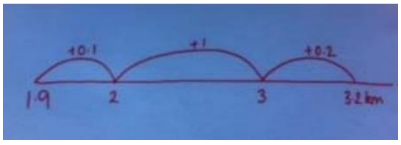
Supporting representations

Use a range of concrete, pictorial and abstract representations, including those below.

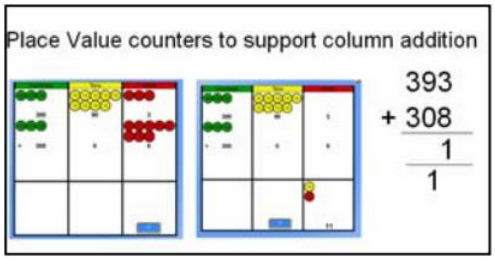


Partitioning and recombining

What is the same and what is different about all these methods?

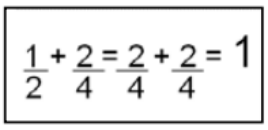


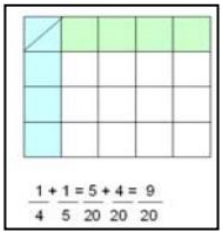
Jottings to support mental calculations



Fractions

Addition of fractions with the **same denominator** and **denominators that are multiples of the same number** *(to become fluent through a variety of increasingly complex problems and add fractions that exceed 1 as a mixed number).*
Counting using simple fractions and decimals, both forwards and backwards.





Links from other strands

Pupils should solve problems involving up to three decimals numbers.
Solve addition and subtraction multi-step problems in context, deciding which operations and methods to use and why.
Use all four operations to solve problems involving measure (e.g. length, mass, volume/capacity, money, duration) using decimal notation.
Calculate the perimeter of composite rectilinear shapes using different units of measurement.
Use angle sum facts and other properties to make deductions about missing angles.
Solve comparison, sum and difference problems using information presented in a line graph.

Upton Calculation Policy for addition: YEAR 6

Mental calculations

Perform mental calculations, including with mixed operations and large numbers *(more complex calculations)*

Children use representation of choice.
Consolidate partitioning and re-partitioning.
Use compensation for adding too much/little and adjusting.
Refer back to pictorial and physical representations when needed.

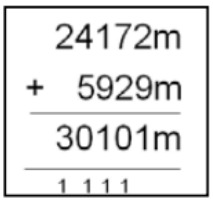
See years 3, 4 and 5 guidance for further scaffolding of less able.

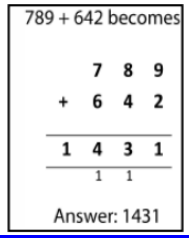
Common mental calculation strategies:
Partitioning and recombining
Doubles and near doubles
Use number pairs to 10 and 100
Adding near multiples of ten and adjusting
Using patterns of similar calculations
Using known number facts
Bridging through ten and hundred
Complementary addition (mental number line)

Written calculations

Add larger numbers using the column method.

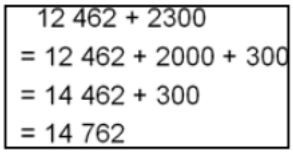
Include decimal addition for money.



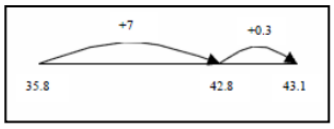


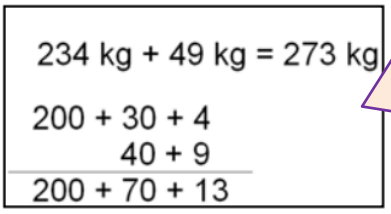
Supporting representations

Use a range of concrete, pictorial and abstract representations, including those below.

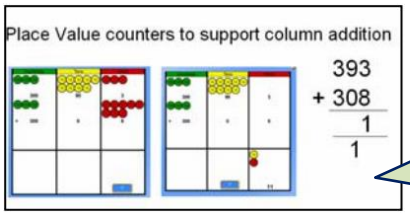


Partitioning and recombining





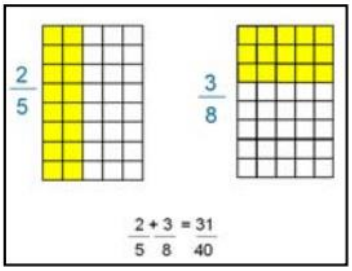
What is the same and what is different about all these methods?



I can explain my method using place value counters.

Fractions

Addition of fractions with different denominators and mixed numbers, using the concept of equivalent fractions.
Start with fractions where the denominator of one fraction is a multiple of the other (e.g. 1/2 + 1/8 = 5/8) and progress to varied and increasingly complex problems.
Practise calculations with simple fractions and decimal equivalents to aid fluency.



Links from other strands

Pupils should use their knowledge of the order of operations to carry out calculations involving the four operations (BIDMAS).
Solve problems involving all four operations.
Algebra: use symbols and letters to represent variables and unknowns *e.g. a + b = b + a*
Solve problems involving the calculation and conversions of units of measure, using decimal notation of up to three decimal places where appropriate.
Using the number like, pupils use, add and subtract positive and negative integers for measures such as temperature.
Calculate and interpret the mean as an average.
Interpret and construct pie charts and line graphs and use these to solve problems
Find missing angles, and express geometry relationships algebraically (e.g. d=2xr)

Upton Calculation Policy for subtraction: YEAR 3

Mental calculations

Add and subtract numbers mentally, including:

- *A three-digit number and ones*
- *A three-digit number and tens*
- *A three-digit number and hundreds*

Use a number line, Dienes, hundred squares, two-hundred squares and similar representations to support mental calculations.

Common mental calculation strategies:
Find differences by counting up
Partitioning
Applying known facts
Bridging through 10 and multiples of 10
Subtracting 9, 11 etc. by compensating
Counting on to, or back from the largest number

Written calculations

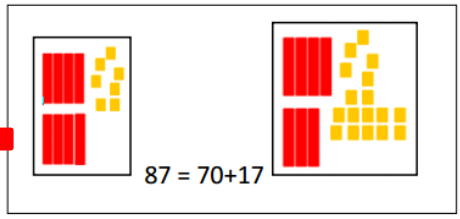
Subtract numbers with up to three digits, using formal written methods of columnar subtraction.

(1) Extended columnar - no exchange

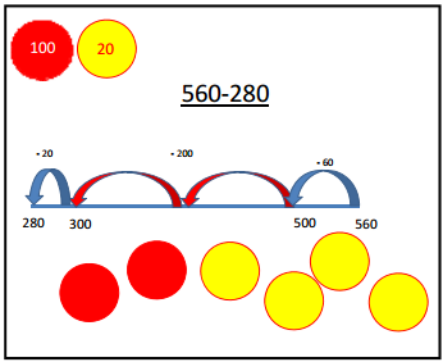
Extended method 87 - 53 =

80 and 7
- 50 and 3
30 and 4 = 34

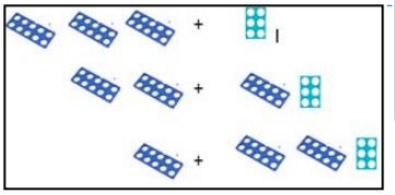
(2) Extended columnar – with exchange:
87-58 becomes
70 +1 7
-50 + 8
20 + 9



Supporting representations



Partitioning and re-partitioning support the understanding of place value.



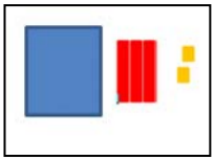
All of these representations still comprise the amount of 36.

30 + 6

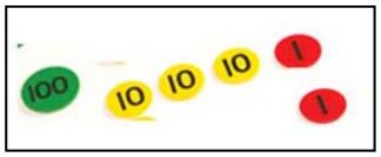
20 + 16

10 + 26

Introduce transition from concrete place value representations (e.g. Dienes or straws), to pictorial – such as place value counters or money.



132 in Dienes

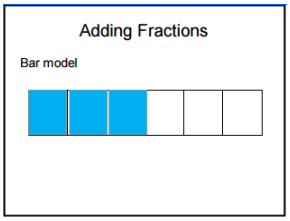


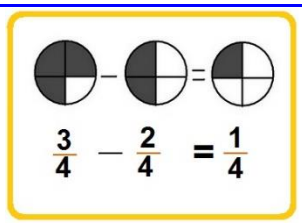
132 in place value counters

Revert to concrete manipulatives and expanded methods when difficulties arise.

Fractions

Count up and down in tenths.
Add and subtract fractions with the same denominator within one whole.





Links from other strands

Add and subtract amounts of money to give change, using both pounds (£) and pence (p) in practical contexts.
Compare durations of events, for example calculating the time taken by particular events or tasks.

Upton Calculation Policy for subtraction: YEAR 4

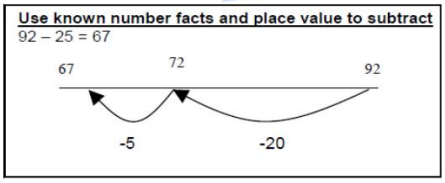
Mental calculations

Continue to practise mental methods with increasingly large numbers to aid fluency.

Find small differences by counting up
e.g. 5003-4996
Subtract nearest multiple of ten and adjust.
Partition larger numbers.

Encourage children to use visualisations, such as number lines, wherever possible.

This could be done using an empty number line. Children should recall and use number facts to reduce the number of steps.



Written calculations

Subtract numbers with up to four digits, using formal written methods of columnar subtraction.
Build on formal, extended method (*see year 3*) using exchange wherever necessary.
Continue to use representations and manipulatives to develop understanding of place value.

372—147 =

300 + 70 + 2
-100 + 40 + 7

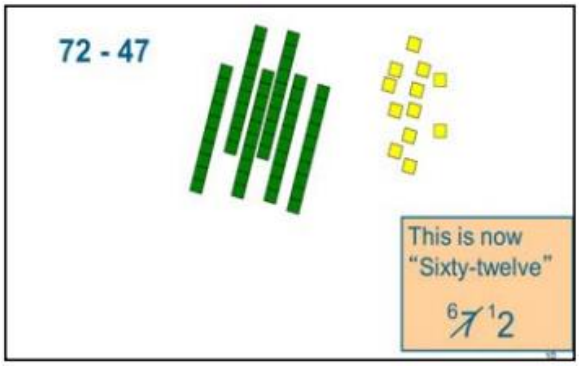
→ 300 + 60 + 12
-100 + 40 + 7
200 + 20 + 5

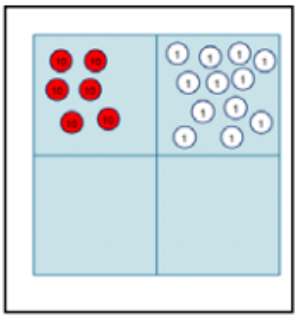
→ 60 1
300 + 70 + 2
- 100 + 40 + 7
200 + 20 + 5

Apply understanding of subtraction with larger integers to that of decimals in context of money and measures. (See Year 5.)

Supporting representations

Use a range of concrete, pictorial and abstract representations, including those below. Dienes blocks and place value counters can be used effectively to model calculations and underlying concepts.



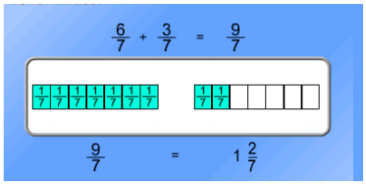


Use physical and/or pictorial representations and expanded algorithms ***alongside*** columnar methods. Ask: *what is the same? What's different?* Compare and discuss the suitability of different methods ion context.
Pupils decide which operations and methods to use and why.

"I would count on a number line to calculate 5003-4896; because the numbers are close together."

Fractions

Count up and down in hundredths
Add and subtract fractions with the same denominator.
Solve simple measure and money problems involving fractions and decimals to two decimal places.



Links from other strands

Identify, represent and estimate numbers using different representations (place value).
Estimate and use inverse operations to check answers to a calculation.
Solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why.
Estimate, compare and calculate different measures, including money in pounds and pence.

Upton Calculation Policy for subtraction: YEAR 5

Mental calculations

- Subtract numbers mentally with increasingly large numbers.
e.g. 12,462 – 2300 = 10,162
- Use rounding to check answers to calculations and determine, incontect of a problem, levels of accuracy.
- Pupils practise subtracting decimals, including a mix of whole numbers and decimals, decimals with different numbers of decimal places, and complements of 1
e.g. 1 – 0.17 = 0.83
- Pupils mentally subtract tenths, and one-digit whole numbers and tenths.

Common mental calculation strategies:
Find differences by counting up
Partitioning
Applying known facts
Bridging through 10 and multiples of 10
Subtracting 9, 11 etc. by compensating
Counting on to, or back from the largest number

Children use or visualise representations of their choice. Refer back to physical representations as required.

Written calculations

Subtract whole numbers with more than four digits using the formal written columnar method.
Practise subtracting numbers including decimals.

(See year 4) compare phsyical and/or pictorial representations and exapded algorithms alongside columnar methods. Ask the children what's the same and different?
Compare and discuss the suitability of different menthods (mental or written), in context.
Revert to expanded methods whenever difficulties arise.

£17.34—£12.16

What is the same about these models? What's different?

1000+700+20+14p
- 1000+200+10+ 6p
500+10+ 8p

→

2
17 3 4p
- 1216p
518p

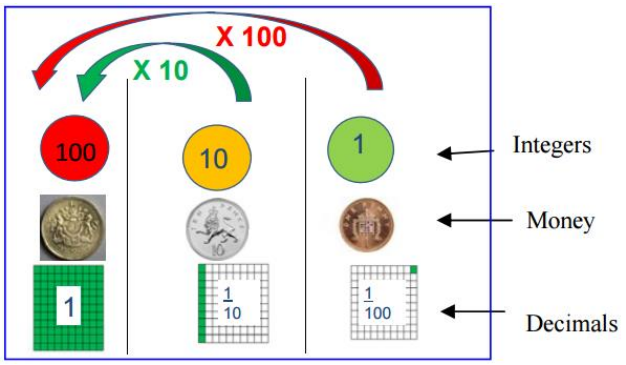
→

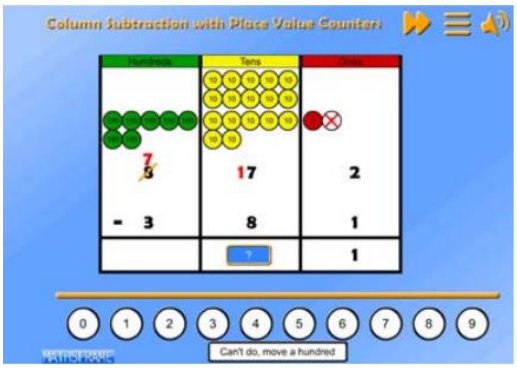
£ 2
17.3 4
- 12.16
5.18

Relate place value of decimals with that of whole numbers using representations. See below.

Supporting representations

Use a range of concrete, pictorial and abstract representations, including those below. Stress the place value relationships between money, decimals and whole numbers. Extended place value mats can be used, moving away from the traditional 'Hundreds, Tens and Ones' used in lower KS2.





Fractions

Subtract fractions with the same denominators and denominators that are multiples of the same number. *(Include fractions exceeding 1 as a mixed number).*
Solve measure and money problems involving fractions and decimals to three decimal places.
Mentally subtract tenths/hundredths, and one-digit whole numbers and tenths/hundredths.

Links from other strands

Solve problems involving addition, subtraction, multiplication and division and a combination of these, including truly understanding the meaning of the equals sign.
Use all four operations to solve problems involving time, money and measure using decimal notation up to 3 decimal places.

Upton Calculation Policy for subtraction: YEAR 6

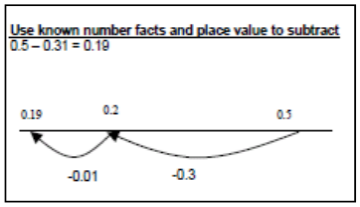
Mental calculations

- Perform mental calculations, including with mixed operations, increasingly large numbers and complex calculations.

- Use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.

Common mental calculation strategies:
Find differences by counting up
Partitioning
Applying known facts
Bridging through 10 and multiples of 10
Subtracting 9, 11 etc. by compensating
Counting on to, or back from the largest number

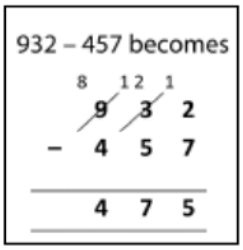
Children use or visualise representations of their choice. Refer back to physical representations as required.



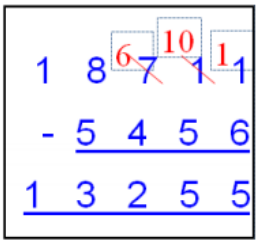
Written calculations

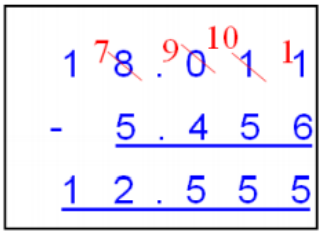
Subtract whole numbers with more than four digits using the formal written columnar method.
Practise subtracting numbers including decimals.

(See year 3, 4 and 5) compare phsyical and/or pictorial representations and exapded algorithms alongside columnar methods. Ask the children what's the same and different?
Compare and discuss the suitability of different menthods (mental or written), in context.
Revert to expanded methods whenever difficulties arise.



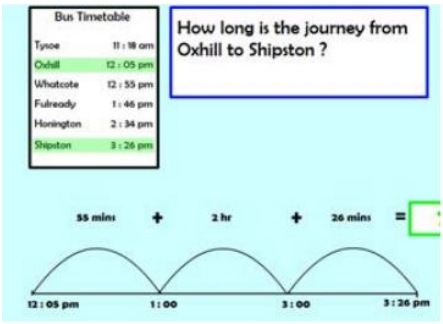
Consolidate columnar methods, paying attention to the occurrence of zeros as placeholders.

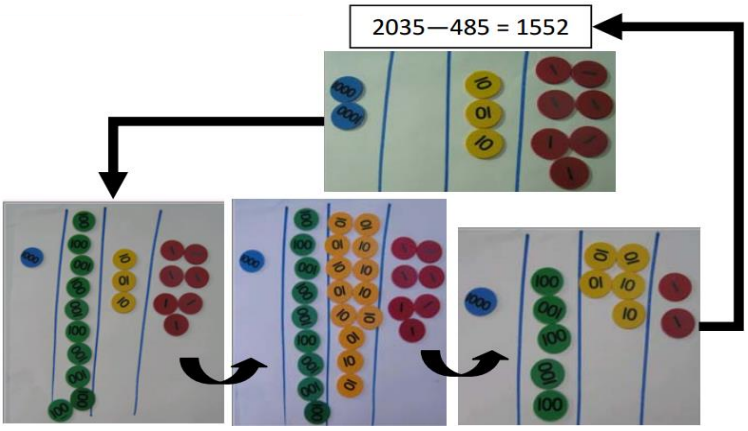




Supporting representations

Use a range of concrete and pictorial representations alongside the column method when needed.
What is the same? What is different?





Fractions

Subtract fractions with different denominators and mixed numbers.
Practise calculations with simple fractions and decimal fraction equivalents to aid ***fluency***.

Links from other strands

Use their knowledge of the order of operations to carry out calculations involving the four operations (BIDMAS)
Solve problems involving all four operations.
Algebra: use symbols and letters to represent variable and unknowns e.g. a + b = b + a
Using the number line, pupils use, add and subtract positive and negative integers for measures such as temperature.

Upton Calculation Policy for multiplication: YEAR 3

Mental calculations

Recall and use multiplication and division facts for the 3, 4 and 8 times tables.
Children should draw on year 2 understanding of 2, 5 and 10 times tables.
Use doubling to connect 2, 4 and 8 times tables.
Develop efficient mental methods using commutativity and associativity.
Derive related muliplication and division facts.

The associative law:
4 x 12 x 6 = 4 x 5 x 12
= 20 x 12
= 240

Calculate mathematical statements for multiplication using the multiplication tables they know, including for two-digit numbers times one-digit numbers, using mental methods.
Partitioning: multiply the tens first and then multiple the units,
e.g. 57 x 4 = (50 x 4) + (7 x 4) = 200 + 28 = 228.
Children can apply these skills to solve spoken word problems too, including missing number statements e.g. 72 ÷ _ = 8

The commutative law:
4 x 12 = 12 x 4

'I have 8 packets, each containing 12 crayons. How many crayons do I have in total?'

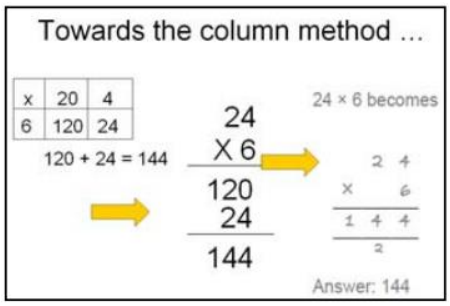
Ensure opportunities to learn multiplication tables through use of **visual models**, images and also rote learning.

Deriving related facts:
3 x 2 = 6, 6 ÷ 3 = 2, 6 ÷ 2 = 3
↓
30 x 2 = 60, 60 ÷ 3 = 20, 60 ÷ 2 = 30

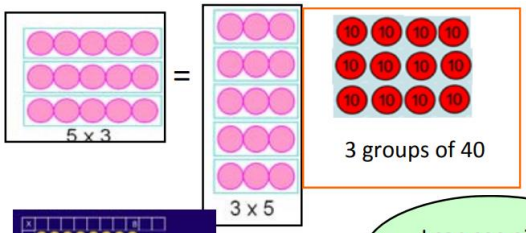
Multiplication and division facts:
8 x 4 = 32, 4 x 8 = 32, 32 ÷ 8 = 4,
32 ÷ 4 = 8

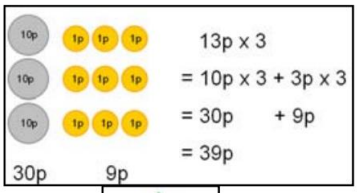
Written calculations

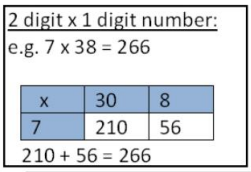
Write and calculate mathematical statements for multiplication using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, progressing to formal written methods.
Estimate before calculating to develop number fluency.
Ensure written methods build on or relate to mental methods.

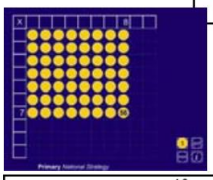


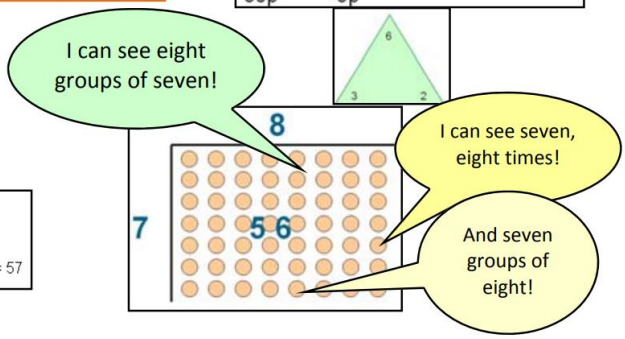
Supporting representations

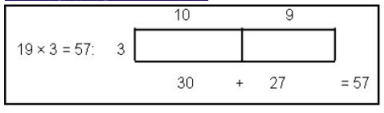




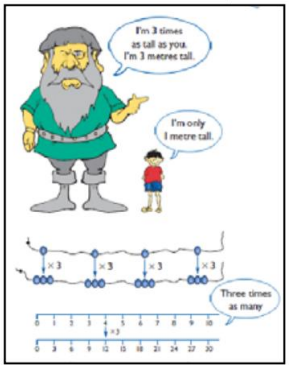








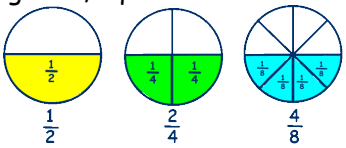
Use arrays for partitioning too



Fractions

Recognise and show, using diagrams, equivalent fractions with small denominators.

2	4	6	8	10	12	14	16	18	20
3	6	9	12	15	18	21	24	27	30
4	8	12	16	20	24	28	32	36	40
5	10	15	20	25	30	35	40	45	50



Links from other strands

Solve problems, including missing number problems, involving multiplication, including positive integer scaling problems and correspondence problems in which *n* objects are connected to *m* objects.
The comparison of measures includes simple scaling by integers, e.g. a given measurement or quantity is twice as long or five times as high.
Pupils now use multiples of 2, 3, 4, 5, 8, 10, 50 and 100.
Pupils understand and use simple scales in pictograms and bar charts with increasing accuracy.

Upton Calculation Policy for multiplication: YEAR 4

Mental calculations

Recall multiplication and division facts for multiplication tables up to 12 x 12
Use place value, known and derived facts to multiply and divide mentally, including:
- **Multiplying by 0 and 1;**
- **Dividing by 1;**
- **Multiplying three numbers together.**

Recognise and use factor pairs and commutativity in mental calculations.
Practise mental methods and extend this to three-digit numbers to derive facts, (for example 600 ÷ 3 = 200 can be derived from 2 X 3 = 6)

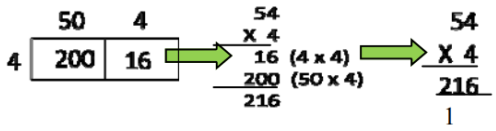
The associative law:
(2 x 3) x 4 = 2 x (3 x 4)

The distributive law:
39 x 7 = 30 x 7 + 9 x 7

Using facts and rules:
2 x 6 x 5 = 10 x 6 = 60

Written calculations

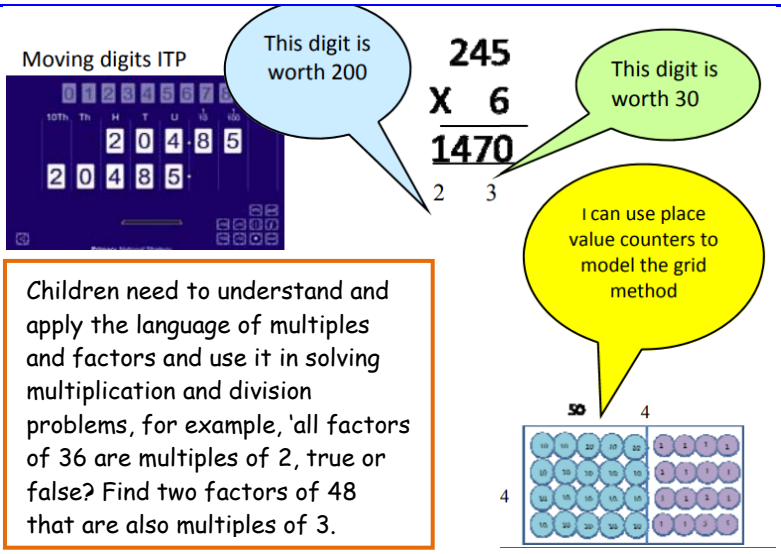
Multiply two-digit and three-digit numbers by a one-digit number using a formal written layout.
Estimate before calculating to develop number fluency.
Ensure written methods build on or relate to mental methods.
Introduce the grid method alongside expanded column methods.



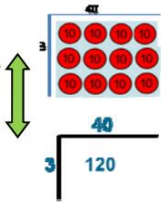
Key skills to support:
- Know or quickly recall multiplication facts up to 12 x 12.
- Understand the effect of multiplying numbers by 10, 100 or 1000.
- Multiply multiples of 10, for example, 20 x 40
- Approximate, e.g. recognise that 72 x 38 is approx. 70 x 40.

Supporting representations

Ensure children can confidently multiply and divide by 10 and 100, that multiplying by 10 makes the number bigger and all digits move one place to the left, while dividing does the opposite.



Use arrays made with place value counters to demonstrate the link between multiplication and division. This will support the understanding of the grid method.



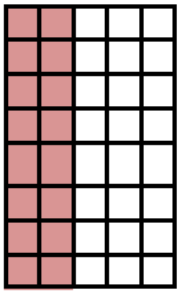
Children need to understand and apply the language of multiples and factors and use it in solving multiplication and division problems, for example, 'all factors of 36 are multiples of 2, true or false? Find two factors of 48 that are also multiples of 3.

Fractions

Recognise and show, using diagrams, families of common equivalent fractions.
Understand the relation between non-unit fractions and multiplication and division of quantities, with particular emphasis on tenths and hundredths.
Make connections between fractions of a length, of a shape and as a representation of one whole or set of quantities.
Use factors and multiples to recognise equivalent fractions and simplify where appropriate.

$\frac{4}{10}\ \frac{6}{15}\ \frac{8}{20}\ \frac{10}{25}\ \frac{12}{30}\ \frac{14}{35}\ \frac{16}{40}$

$\frac{2}{5} = \frac{16}{40}$



Links from other strands

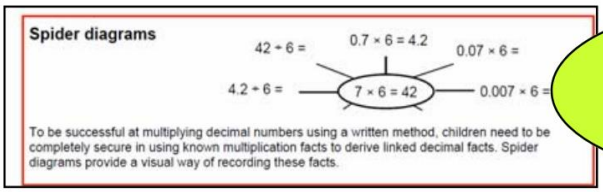
Solve problems, including missing number problems, involving multiplication, including positive integer scaling problems and correspondence problems in which *n* objects are connected to *m* objects.
Convert between different units of measure (e.g. km to m)
Relate area to arrays and multiplication
Pupils understand and use a greater range of scales in their representations (statistics)

Upton Calculation Policy for multiplication: YEAR 5

Mental calculations

Multiply and divide numbers mentally drawing upon known facts.
Multiply and divide whole numbers and those involving decimals by 10, 100 and 1000.
Recognise and use square and cube numbers (and notation)

Pupils should be taught throughout that percentages, decimals and fractions are different ways of expressing proportions.



24 x 15 = ?

I did: 24 × 5 = 120 (half of 24 × 10), then multiplied 120 by 3 to get 360

I did: (24 × 10) + (24 × 5).

Example of constructing equivalence statements:
4 x 35 = 2 x 2 x 35;
3 x 270 = 3 x 3 x 9 x 10
= 92 x 10

Written calculations

Multiply numbers up to 4 digits by a one-digit or two-digit numbers using a formal written method, including long multiplication for two-digit numbers.

24 × 16 becomes

	2	4
×	1	6
2	4	0
1	4	4
3	8	4

124 × 26 becomes

	1	2	4
×		2	6
	7	4	4
2	4	8	0
3	2	2	4

2741 × 6 becomes

	2	7	4	1
×				6
1	6	4	4	6

Compact methods for multiplication are efficient but often do not make the value of each digit explicit. When introducing multiplication of decimals, it is sensible to take children back to an expanded form, such as the grid method where the value of each digit is clear, to ensure that the children understand the process.

Supporting representations

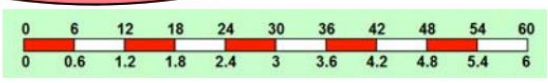
	3000	500	60	7
20	60000	10000	1200	140
4	12000	2000	240	28

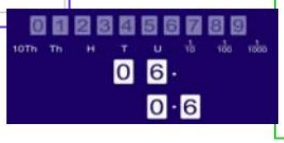
71340
14268
Total 85608

3567
x24
14268
71340
85608

What is the same and what is different about these two methods?

To start multiplying using the **least significant digit** for the grid method will support children with implementation of the written procedure.





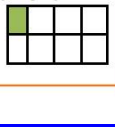
Build on children's understanding: demonstrate multiplication of a decimal number alongside its whole number equivalent

326	3.26
× 8	× 8
2400	24.00
160	1.60
48	0.48
2608	26.08

Fractions

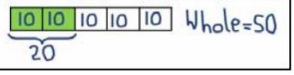
Multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams.
Identify, name and writ equivalent fractions of a given fraction, represented visually, including tenths and hundredths.
Pupils connect multiplication by a fraction to using fractions as operators (fractions of), and to division, building on work from previous years. This related to scaling by simple fractions, including fractions > 1.

¼ x ½
Scaling by ½
"finding a half of a quarter"



½ x ¼
"¼ of a ½": find a ½, then divide it by 4.

Encourage children to draw diagrams to represent situations or problems involving fractions
Model how to do this, for example:
$^2/_5$ of a number is 20. What is the number?



Links from other strands

Identify multiples & factors, including finding all factor pairs of a number, & common factors of two numbers.
Know and use the vocabulary of prime numbers, prime factors and composite (non-prime). Establish whether a number up to 100 is prime and recall prime numbers up to 19.
Solve problems involving multiplication and division including using their knowledge of factors and multiples, squares and cubes, and including understanding the meaning of the equals sign. Use all four operations to solve problems involving measure [for example, length, mass, volume, money] using decimal notation, including scaling.
Convert between different units of metric measure; problems including money.
Other links: *ratio.*

Upton Calculation Policy for multiplication: YEAR 6

Mental calculations

Perform mental calculations, including with mixed operations and large numbers *(increasingly large numbers and more complex calculations).*

Use all the multiplication tables to calculate mathematical statements in order to maintain fluency.

Use estimation to check answers to calculations.

Multiply numbers by 10, 100 and 1000 giving answers up to three decimal places.

Children should know the square numbers up to 12 x 12 and derive the corresponding squares of multiples of 10 e.g. 80 x 80 = 6400

Use mental strategies to solve problems e.g.
X4 by doubling and doubling again.
X5 by x10 and halving.
X20 by x10 and doubling.
X9 by multiplying by 10 and adjusting.
X6 by multiplying by 3 and doubling.

What is the best approximation for 4.4 x 18.6?

Written calculations

Multiply multi-digit numbers up to 4 digits by a two-digit number using a formal written method, including long multiplication.

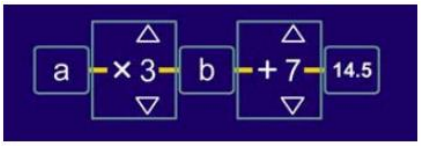
Multiply one-digit numbers with up to two decimal places by whole numbers.

Refer to year 3, 4 and 6 guides if children find formal calculation methods difficult.

£	6.23
x	27
	43.61
	124.60
£	168.21

Supporting representations

Look at long-multiplication calculations containing errors, identify the errors and determine how they should be corrected.



x	8	0.4	0.06	
11	88	4.4	0.66	= 93.06

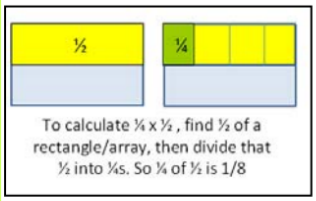
8.46
X 11
93.06

What's the same?
What's different?

Fractions

Multiply simple pairs of proper fractions, writing the answer in its simplest form e.g. $\frac{1}{4} \times \frac{1}{2} = 1/8$

Three key applications of understanding:
- Recognise that ¼ of 12, ¼ x 12 and 12 divided by 4 are equivalent
- Use cancellation to simplify the product of a fraction and an integer e.g. ⅓ x 15 = 3, ⅔ x 15 = 2 x ⅓ x 15 = 2x3 = 6
- Work out how many ⅓s in 15, how many ⅔s in 15, how many 2/5s in 1 etc.



To calculate ¼ x ½ , find ½ of a rectangle/array, then divide that ½ into ¼s. So ¼ of ½ is 1/8

Pupils should use a variety of images to support their understanding of multiplication with fractions. This follows earlier work about fractions as operators (fractions of), as numbers, and as equal parts of objects, e.g. as parts of a rectangle.

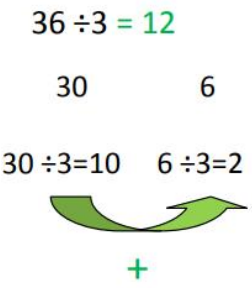
Links from other strands

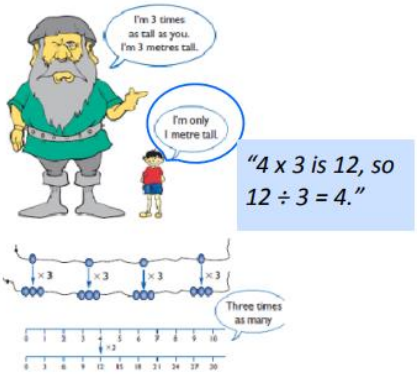
Identify common factors, common multiples and prime numbers.
Use their knowledge of the order of operations to carry out calculations involving the four operations.
Solve problems involving addition, subtraction, multiplication and division.
Explore the order of operations using brackets; e.g. 2 + 1 x 3 = 5 and (2 + 1) x 3 = 9.
Fractions, decimals and percentages including equivalences in different contexts.
Solve problems involving the relative sizes of two quantities where missing values can be found by using integer multiplication and division facts.
Solve problems involving the calculation of percentages (e.g. of measures, such as 15% of 360) and the use of percentages for comparison.
Solve problems involving similar shapes where the scale factor is known or can be found.
Solve problems involving unequal sharing and grouping using knowledge of fractions and multiples.
Algebra including formulae, linear number sequences, combinations of variables.
Measurement including solving problems with conversion of units, decimal notation, area and volume.
Statistics including pie charts, line charts and calculating the mean.

Upton Calculation Policy for division: YEAR 3

Mental calculations

Pupils should be taught to recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables.
Pupils develop efficient mental methods, for example, using commutativity and associativity (e.g. 4 x 12 x 5 = 4 x 5 x 12 = 20 x 12 = 240) and multiplication and division facts to derive related facts.

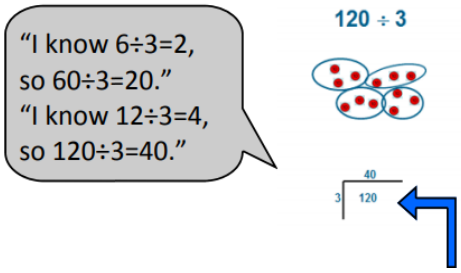




Written calculations

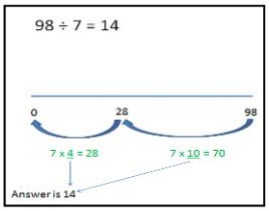
Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, progressing to formal written methods.

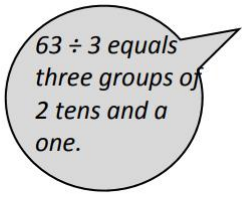
New written methods can be modelled alongside mental or informal methods to ensure understanding.

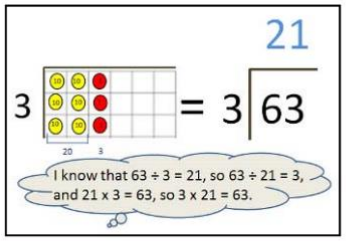


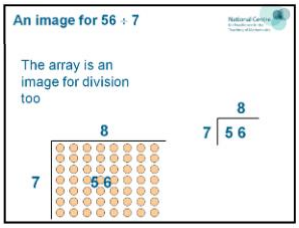
Supporting representations

Use a range of concrete and pictorial resources, including:



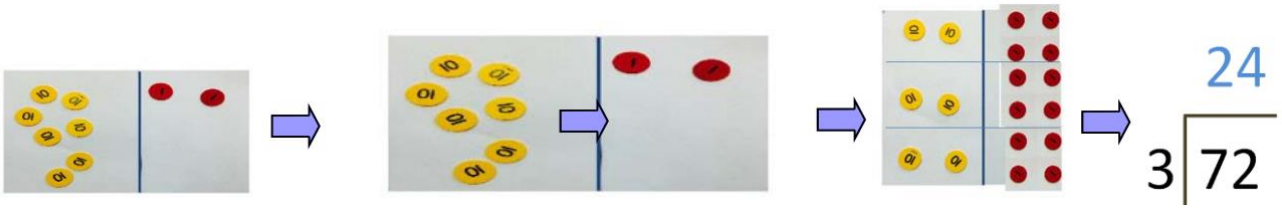






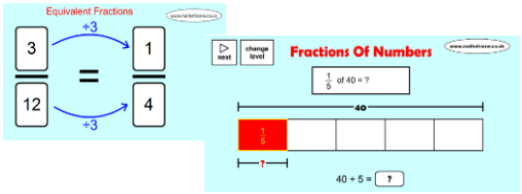
How could I calculate 72÷3 ?

Informal exploration with manipulatives supports the progression to formal written methods—which is continued in Year 4.



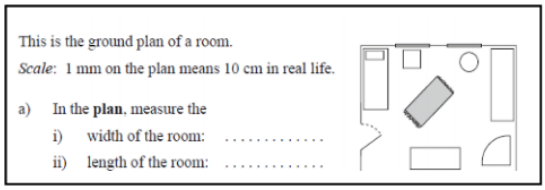
Fractions

Recognise that tenths arise from dividing an object into 10 equal parts and in dividing one-digit numbers or quantities by 10.
Recognise and show, using diagrams, equivalent fractions with small denominators.
Recognise, find and write fractions of a discrete set of objects: Unit fractions and non-unit fractions with small denominators.



Links from other strands

Solve problems, including missing number problems, involving division, including measuring and scaling problems (e.g. four times as high) and correspondence problems in which ***n*** objects are connected to ***m*** objects.



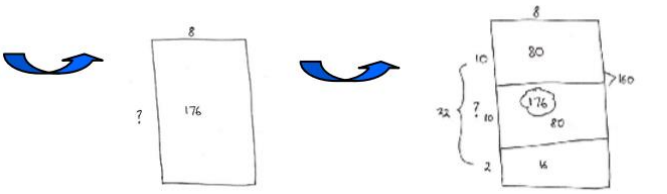
Upton Calculation Policy for division: YEAR 4

Mental calculations

Pupils should be taught to recall and use multiplication and division facts up to 12 x 12.
Use place value, known and derived facts, to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1.
Recognise and use factor pairs and commutativity in mental calculations.

I know that 6 ÷ 3 = 2, so 600 ÷ 3 = 2

Using known facts and blank arrays to calculate 176 ÷ 8.



176 ÷ 8 = 22

Pupils practise mental methods and extend this to three-digit numbers to derive facts.

Written calculations

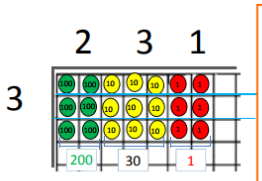
Divide two and three-digit numbers by a one-digit number using formal written layout.
Pupils to become fluent in the formal written method of short division with exact answers.

Revert to expanded methods if children find formal calculation difficult.

591 ÷ 3 = 197

Supporting representations

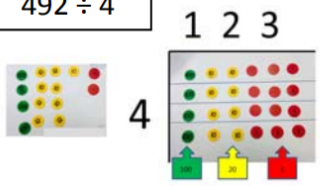
693 ÷ 3



Children can work in pairs: child A constructs the array (dividing manipulatives into 3 rows), child B checks it and records this in a formal, short division format.

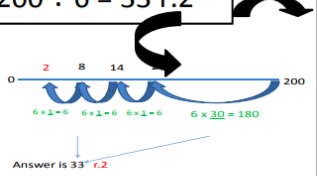
By working through larger number calculations with manipulatives, children gain experience of ex-change (re-partitioning) within division algorithms.

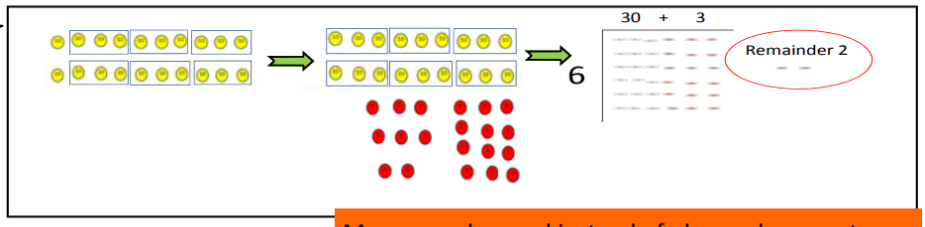
492 ÷ 4



By the end of Year 4, children need to have encountered remainders in a number of contexts. Pupils can be introduced to remainders using known facts: e.g. 13÷4; and then progress to larger numbers. (See below).

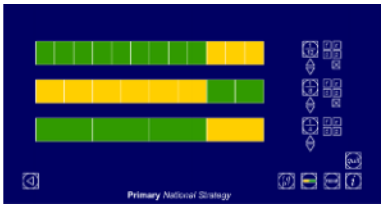
200 ÷ 6 = 33 r.2





Money can be used instead of place value counters.

Fractions



Recognise that hundredths arise from dividing an object into 100 equal parts dividing tenths by 10.
Recognise and show, using diagrams, equivalent fractions.
Solve problems involving increasingly harder fractions to calculate quantities, and fractions to divide quantities, including non-unit fractions where the answer is a whole number.
Find the effect of dividing a one or two-digit number by 10 and 100, identifying the value of the digits in the answer as ones, tenths and hundredths.

Links from other strands

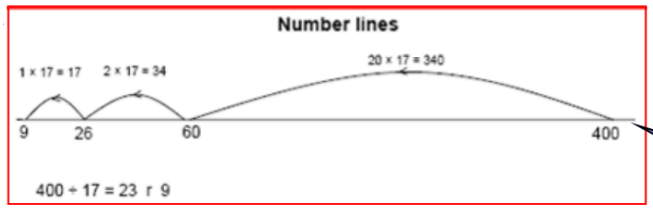
Convert between different units of measure (e.g. km to m; hour to minute).
Estimate, compare and calculate different measures, including money in pounds and pence.
Solve problems, including missing number problems, involving division, including measuring and scaling problems (e.g. four times as high) and correspondence problems in which ***n*** objects are connected to ***m*** objects.

Upton Calculation Policy for division: YEAR 5

Mental calculations

Pupils should be taught to:
Divide whole numbers and those involving decimals by 10, 100 and 1000.
Divide numbers mentally drawing upon known facts.
Identify multiples and factors, including finding all factor pairs of a number, and common factrors of two numbers.

If 42 ÷ 6 = 7.
÷ 10 ÷ 10
Then 4.2 ÷ 6 = 0.7



Factorising
480 ÷ 15
= 480 ÷ 5 ÷ 3

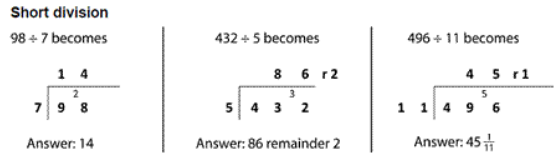
"I know that the answer to 138 ÷ 6 will be close to 20, because 2 x 6 = 12, so 20 x 6 = 120."

Pupils apply all the multiplication tables and related division facts frequently and use them confidently.

Written calculations

Divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context.

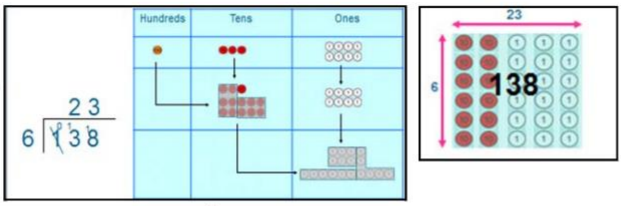
Revert to expanded methods if children find formal calculation difficult.



Supporting representations

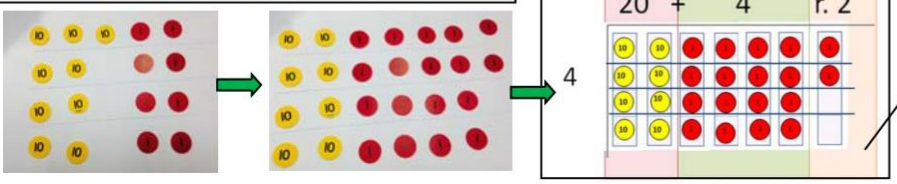
Can we divide this 100 token into 6 equal groups?, then we must exchange it for ten 10 tokens. Can we divide into 6 groups now?

Short division with exchange.



Practical experience with manipulatives is vital for children to talk through the language of division e.g. *exchange, remainder*; and to embed conceptual understanding.

Understanding remainders.



2 out of a whole group of 4 = 2/4 = 1/2 = 0.5

98 ÷ 4 = 98/4 = 24 r 2 = 24 1/2 = 24.5

What is the same? What's different about the ways that these remainders are expressed?

Fractions

Recognise mixed numbers and improper fractions and convert from one form to the other and write mathematical statements > 1 as a mixed number.
Pupils connect equivalent fractions > 1 that simplify to integers with division and other fractions > 1 to division with remainders.
Pupils connect multiplication by a fraction to using fractions as operators (fractions of) and to division.
Pupils should make connections between fractions, percentages and decimals.

Links from other strands

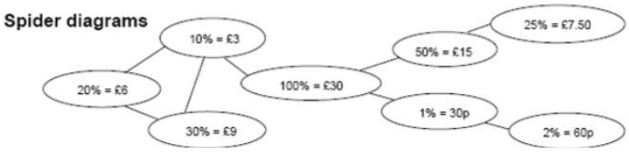
Pupils use all four operations in problems involving time and money, including conversions using decimal notation, including scaling (e.g. 1.5 times larger).
Calculate and compare the area of rectangles (including squares). *'this square is 4 times smaller'*
Solve problems, including missing number problems, involving division, including measuring and scaling problems and correspondence problems in which ***n*** objects are connected to ***m*** objects.
Solve problems including a combination of addition, subtraction, multiplication and division.
Recognise and use square numbers and cube numbers and the notation for square (2) and cube (3).

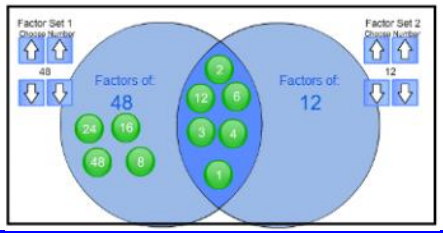
Upton Calculation Policy for division: YEAR 6

Mental calculations

Pupils should be taught to:
Perform mental calculations, including with mixed operations and large numbers.
Use their knowledge of the order of operations to carry out calculations involving the four operations.
Identify common factors, common multiples and prime numbers.

I know that 366 will divide by 6 because it has 2 and 3 as factors.

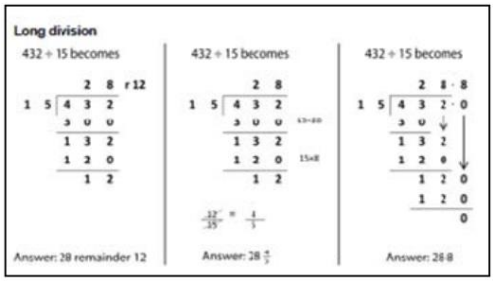




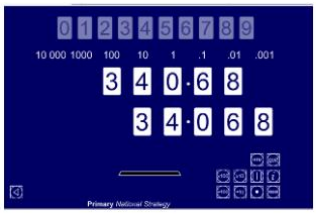
Written calculations

Divide numbers up to 4 digits by a two-digit number using the formal written methods of long and short division and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context.

Revert to expanded methods if children find formal calculation difficult.



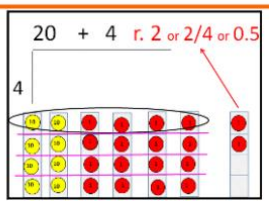
Supporting representations

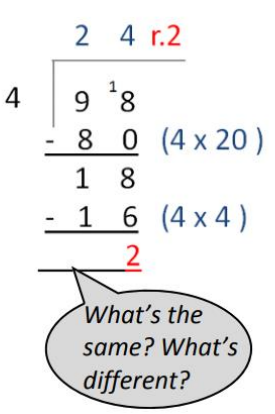


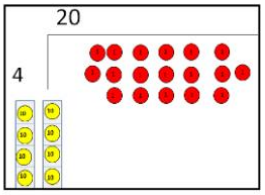
£1362.72 ÷ 40 = ?

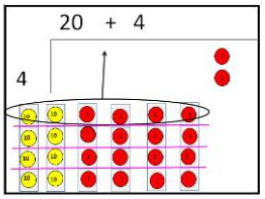
£1362.72 ÷ 4 = £340.68
[½ and ½ again.]
£340.68 ÷ 10 = £34.068
which rounds to £34.07.

To introduce the long division model, use a calculation which can be represented both with manipulatives and by a short division algorithm. Use questioning and discussion to compare written methods.



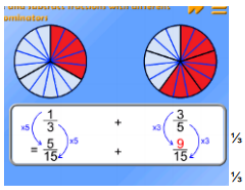


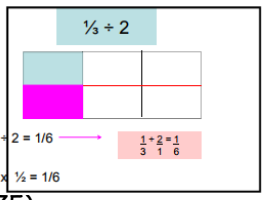




Fractions

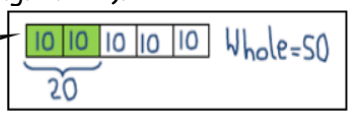
Use common factors to simplify fractions
Compare and order fractions, including fractions > 1
Add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions.
Divide proper fractions by whole numbers (e.g. 1/3 ÷ 2 = 1/6)
Associate a fraction with division and calculate decimal fraction equivalents (e.g. 0.375).





Pupils use their understanding of the relationship between unit fractions and division to work backwards.

2/5 of a number is 20.
What is the number?



Links from other strands

Pupils are introduced to the division of decimal numbers by one-digit whole numbers initially, in practical contexts involving measures and money. They recognise division as the inverse of multiplication.
Pupils also develop their skills of rounding and estimating. This includes rounding answers to a specified degree of accuracy and checking the reasonableness of their answers.
Solve problems involving the calculation and conversion of units of measure, using decimal notation up to three decimal places where appropriate.
Use, read, write and convert between standard units… using decimal notation to up to 3 decimal places.
Interpret and construct pie charts and line graphs and use these to solve problems.
Calculate and interpret the mean as an average.
Solve problems involving the relative sizes of two quantities where missing values can be found by using integer multiplication and division facts.