Great Wilbraham C of E Primary School

Calculation Policy
2022

1. Introduction

This calculation policy aims to set out our clear expectations for the progression of calculation stages for each of the four operations. This calculation policy has been adapted from St John's Primary School, Cheltenham. It has been created through consultation with staff before being taken to the Full Governing Body.

2. Quality of Education

2.1. Intent of the Curriculum

2.1.1. Curriculum design and coverage

Our curriculum intent for maths and calculation is:

HEAD: Develop critical thinking and reasoning skills to solve problems. Encourage pupils to consider the efficiency of methods and build mathematical fluency.

HEART: Value the contributions of all learners and encourage pupils to share knowledge with others. Develop a love of the subject and build resilience when faced with challenging tasks.

HANDS: Start with the concrete before moving to the abstract. Be contextual and relatable to pupils. Involve creative, engaging activities and make use of a variety of resources including outdoor learning.

2.1.2. Knowledge and skills

The policy lays out expectations for both mental and written calculations (generally collated for Key Stage 1), including calculation of fractions, and includes statements from the national curriculum and supplementary guidance as below:

- National Curriculum statutory statements - in bold
- National Curriculum non-statutory guidance - in italics
- Additional/Supplementary guidance - plain text
- Orange boxes provide teaching guidance and tips
- Speech bubbles denote examples either of key teacher questions or of children's thinking/ speaking.
- A vocabulary list is provided to encapsulate suggested vocabulary for each year group

2.1.3. SEND

This policy guides schools in progression for each operation to ensure smooth transition. It is important that conceptual understanding, supported by the use of representations, is secure for procedures, and if at any point a pupil is struggling with a procedure, they should revert to concrete and/or pictorial resources and representations to solidify understanding.

2.2. Implementation of Teaching and Learning

2.2.1. Subject knowledge

Representations

Key to successful implementation of a school calculation policy is consistent use of representations (models and images that support conceptual understanding of the mathematics) and this policy promotes a range of relevant representations, across the primary years.

Mathematical understanding is developed through use of representations that are first of all **concrete** (e.g. Numicon, Dienes apparatus), and then **pictorial** (e.g. Array, place value counters) to then facilitate **abstract** working (e.g. Columnar addition, long multiplication).

Whilst a mathematically fluent child will be able to choose the most appropriate representation and procedure to carry out a calculation, whether written or mental, schools should support pupils with carefully selected representations that underpin calculation methods (as detailed in this policy), and ensure there is consistency across year groups.

The 'Representations to support mental and written calculation' box on each page provides a range of models and images that underpin calculating in that year group. It is not an exhaustive collection and applies to both mental and written calculation in most circumstances. Additional specific examples are included inside mental and written calculation boxes.

Progression in Calculation

The calculation policy promotes particular methods and procedures with particular representations alongside to support understanding of calculation. It is recommended that schools ensure consistency in both procedure and conceptual understanding to ensure fluency and confidence with written methods.

2.2.2. Leadership support

Regular learning walks, book scrutinies and monitoring of learning environments will be taken with feedback appropriately provided.

2.2.3. Resources

The school has a variety of concrete resources and planning resources such as Pearson Active Learn and White Rose Maths.

2.2.4. Learning environment

Examples of how calculations should be completed might be added to the maths working wall.

2.3. Impact

2.3.1. Summative assessment

Assessment will take place termly using the White Rose maths end of term materials. This must be to inform planning and to the development of children.

2.3.2. Applying learning

Opportunities to apply learning through reasoning and problem-solving activities are provided in addition to development of calculation skills.

3. Behaviour and Attitudes

3.1. Attitudes to learning

Children are taught a variety of methods for recording their work and are encouraged and helped to use the most appropriate and convenient. Children are encouraged to use mental strategies and their own jottings before resorting to more formal written methods. Children's own jottings to support their work is encouraged throughout all year groups.

3.2. Positive and respectful culture

Staff and children will respect everyone's abilities in maths and aim to support each other to be the best they can be in a safe and supportive environment.

3.3. Supporting colleagues

Colleagues will be supported by the maths lead and provided with CPD or key ideas to develop their teaching.

4. Personal development

4.1. Social, Moral, Spiritual, Cultural

Children will:

- Work together to solve problems
- Make responsible moral decisions and act on them, helping others
- Make an active contribution in maths sessions
- Understand, appreciate and contribute to a positive mind-set culture

5. Leadership and management

5.1. Continuing professional development

Staff needs in CPD in relation to calculations may come through performance management, recognition of a whole school need or through the needs of individual pupils.

5.2. Working with governors

The maths coordinator links with a key governor who reports back to the Full Governing Body progress in maths teaching, learning and data.

5.3. Inclusion and equal opportunities

Positive attitudes towards mathematics are encouraged, so that all children, regardless of race, gender, ability or special needs, including those for whom English is a second language, develop an enjoyment and confidence with mathematics. This policy is in line with the school's 'Equality' policy. The aim is to ensure that everyone makes progress and gains positively from lessons and to plan inclusive lessons. Lessons involving lots of visual, aural and kinaesthetic elements will benefit all children including those for whom English is an additional language (EAL). Differentiated questions are used in lessons to help children and planned support from Teaching Assistants and other adults.

5.4. Reviewing and monitoring

This policy will be reviewed by the staff and maths leader every three years unless there is a change in maths curriculum.

6. Links to other policies

6.1. Maths Policy
6.2. Curriculum Policy
6.3. Assessment Policy
6.4. Feedback Policy
6.5. Special Needs Policy
6.6. Equalities Policy

7. Appendices

7.1. Calculation progression overview below

Wilbraham Way Expectations – calculations

Planning – we have developed our own long term overview that suits our style of teaching, plans from Abacus and White Rose are used and combined as resources to aid learning
Curriculum – teachers ensure that tasks are appropriate to the children's needs but also to the level of their year group
Progression – children only progress when fully mastered the learning but the challenge is to enable all children to progress
Mastery – mastering the calculations and deepening learning is vital
Knowledge – all teachers will know the progression and where the children are moving towards and they must have a clear understanding of the progression of skills; this document aids this knowledge acquisition
Resources – children will learn from using concrete objects not just abstract calculations and every classroom has maths boxes full of a range of equipment

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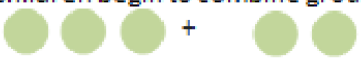
EYFS ADDITION

If available, Numicon shapes are introduced straight away and can be used to:

- identify 1 more/less
- combine pieces to add.
- find number bonds.
- add without counting.

Children can record this by printing or drawing around Numicon pieces.

Children begin to combine groups of objects using concrete apparatus



Construct number sentences verbally or using cards to go with practical activities.

Children are encouraged to read number sentences aloud in different ways
"Three add two equals 5" "5 is equal to three and two"

Children make a record in pictures, words or symbols of addition activities already carried out.

Solve simple problems using fingers

5 + 1 = 6

Number tracks can be introduced to count up on and to find one more:

1	2	3	4	5	6

What is 1 more than 4? 1 more than 13?

Number lines can then be used alongside number tracks and practical apparatus to solve addition calculations and word problems.

Children will need opportunities to look at and talk about different models and images as they move between representations.

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Y1 ADDITION

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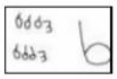
Mental Calculations

- **Read, write and interpret mathematical statements using symbols +, -, =**
- **Represent and use number bonds and related addition facts within 20**
- **Add one digit and two-digit numbers up to 20, including zero.**
- **Solve one-step problems using concrete objects and pictorial representations, and missing number problems such as 7 = ☐ - 9**
- **Given a number, identify (and use the language) one more**

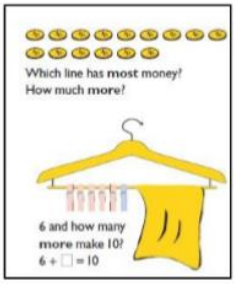
Written Calculations

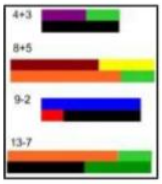
- Begin to compare (what's the same/different?) for commutative sums e.g 3 +7 = 7 + 3
- *Memorise and reason with number bonds to 10 & 20 in several forms*
- Add using objects, Numicon, cubes etc and number lines and tracks
- Check with everyday objects
- Ensure pre-calculation steps are understood, including:
  - Counting objects (including solving simple concrete problems
  - Conservation of number:
  - Recognise place value in numbers beyond 20
  - Counting as reciting and as enumerating



Representations to support mental and written calculations.

Use a range of concrete and pictorial representations, including:





Number lines

Bead strings

Number tracks

Real everyday objects

Links from other strands

- *Combine and increase numbers, counting forwards and backwards.*
- *Develop the concept of addition and subtraction and … use these operations flexibly.*
- *Discuss and solve problems in familiar practical contexts, including using quantities*
- *Compare, describe and solve practical [measure] problems e.g. longer, more than, heavier than*
- Problems terminology should include: put together, add, altogether, total, take away, distance between, difference between, more than and less than.

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Y2 ADDITION

Mental Calculations

Add numbers using concrete objects, pictorial representations, and mentally, including:

- **a two-digit number and ones**
- **a two-digit number and tens**
- **two two-digit numbers**
- **adding three one-digit numbers**

17 + 2 = 19 12 + 4 = 16
57 + 2 = 59 32 + 34 = 66

- **Recall and use addition and subtraction facts to 20 facts fluently, and derive and use related facts up to 100**
- **Demonstrate the commutative law of addition**

12 + 30 = 30 + 12
□ + 25 = 25 + 41

65 = 60 + 5
65 = 50 + 15
65 = 40 + 25
65 = 30 + 35
65 = 20 + 45
65 = 10 + 55

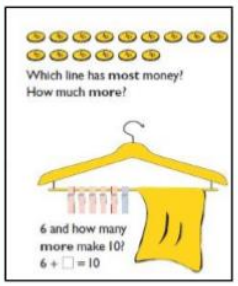
Written Calculations

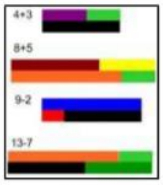
- Re-partition numbers eg.
- Use a hundred square
- *Check calculations using inverse and by adding numbers in different order*
- Using partitioning to separate tens and units, eg,

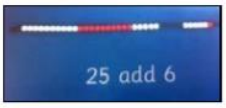
54 = 50 + 4

Representations to support mental and written calculations.

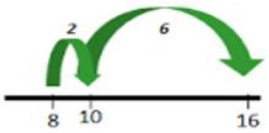
Use a range of concrete and pictorial representations, including:



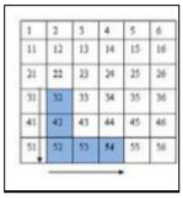




Bead strings



Number lines

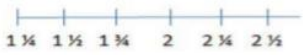


Number tracks

Real everyday objects

Fractions

Counting in fractions up to 10, starting from any numbers and using the 1/2 and 2/4 equivalence on the number line



Links from other strands / bar modelling

- Solve problems:
- Using concrete objects, pictorial representations (numbers, quantities & measures)
- Applying increasing knowledge of mental & written methods
- *Discuss and solve problems that emphasise the value of each digit in two-digit numbers*

(They should) develop the concept of addition and subtraction and ... use these operations flexibly. (*Number-addition and subtraction, Non-statutory guidance.)*

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Y3 ADDITION

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 TU + TU then HTU + TU
- Use hundred square, place value counters, 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 though ten, hundred

Written Calculations

Add numbers with up to three digits, using formal written (columnar) methods

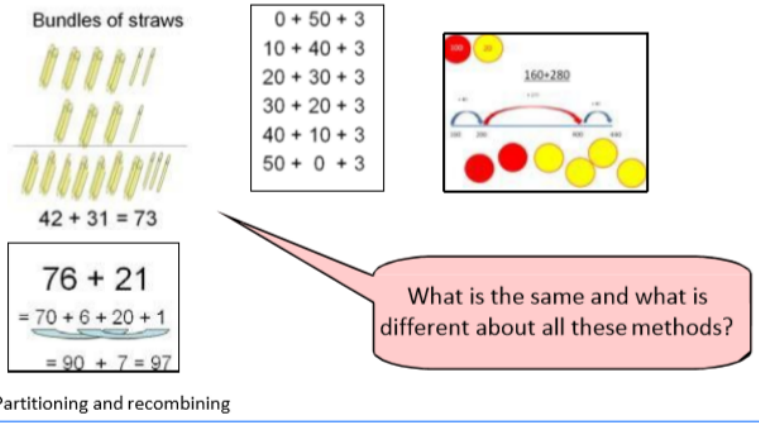
Add to three digit numbers using physical and abstract representations;

- dienes, place value counters, empty number lines

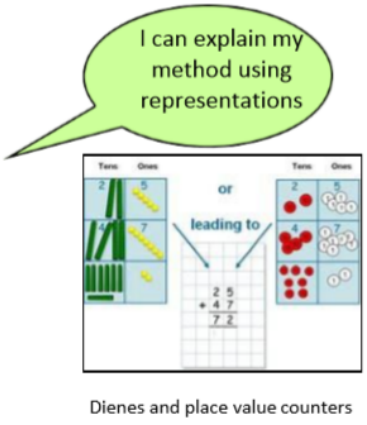
Revert to concrete representations if children find expanded/column methods difficult

Representations to support mental and written calculations.

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



Partitioning and recombining



Dienes and place value counters

Fractions

Addition of fractions with the same denominator within one whole.

Addition of fractions with the same denominator

$\frac{2}{5} + \frac{3}{5} = \frac{5}{5}$

Links from other strands / bar modelling

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

Use bar modelling to solve word problems - including missing number problems, using number facts, place value, and more complex addition

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Y4 ADDITION

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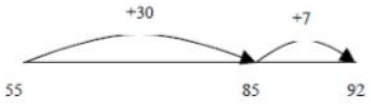
Informal methods to support mental Calculations

Practise mental methods with increasingly large numbers

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



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

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

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 though ten, hundred
Complementary addition

Written Calculations

Add numbers with up to four digits, using the formal written (columnar) method
Add three digit numbers using columnar method and then move onto 4 digits.
Include decimal addition for money - Expanded then moving to compact

789 + 642 becomes

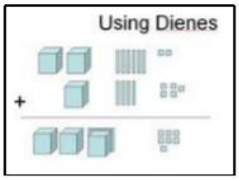
	7	8	9
+	6	4	2
1	4	3	1
	1	1	

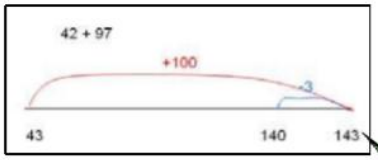
Answer: 1431

Revert to expanded methods if children find formal calculation method difficult

Representations to support mental and written calculations.

Use physical/pictorial representations alongside expanded and columnar methods.





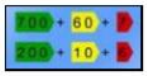
Compensating in mental addition

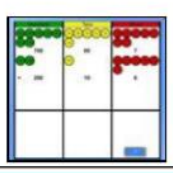
£12.32
+ £11.81
£24.13
1

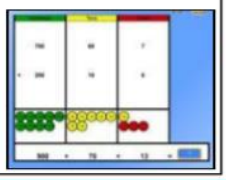
0 + 50 + 3
10 + 40 + 3
20 + 30 + 3
30 + 20 + 3
40 + 10 + 3
50 + 0 + 3

Re-partitioning

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



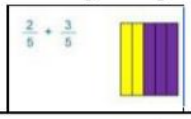




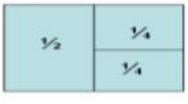
Ask what is the same and what is different about all these methods?

Fractions

Addition of fractions with the same denominator *to become fluent through a variety of increasingly complex problems beyond one whole*
Counting using simple fractions and decimals, both forwards and backwards



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



Links from other strands / bar

- Estimate and use inverse operations to check answers.
- Solve addition and subtraction two step problems in context, deciding which operations and methods to use and why
- Identify, represent and estimate numbers using different representations. (Place value)
- Recognise the place value of each digit in a four-digit number.
- Estimate, compare and calculate different measures, including amounts money in £ and p (including fractions and decimals)

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Y5 ADDITION

Informal methods to support mental Calculations

- **Add numbers mentally with increasingly large numbers, e.g. 12 462 + 2300 = 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. 0.83 + 0.17 = 1)**

Children use representation of choice

Refer back to pictorial and physical representations when needed

Common mental calculations
Doubles and near doubles
Adding near multiples of 10
Using patterns of similar calculations
Bridging though ten, hundred, tenth

Written Calculations

Add whole numbers with more than four digits, using the formal written (columnar) method

Add three digit numbers using columnar method and then move onto 4 digits.
Include decimal addition for money

```
  24172m
+  5929m
  30101m
  1 1 1 1
```

```
  £563.14
+ £207.88
  £771.02
    1 1 1
```

Revert to expanded methods if children find formal calculation method difficult (see Y3)

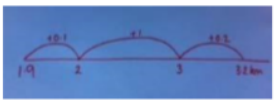
Representations to support mental and written

Use physical/pictorial representations alongside columnar methods where needed.

12 462 + 2300
= 12 462 + 2000 + 300
= 14 462 + 300
= 14 762

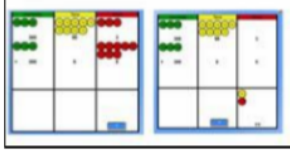
Partitioning and recombining

Ask **what is the same** and **what is different** about all these methods?



Jottings to support mental calculation

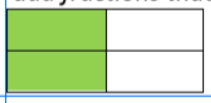
Place Value counters to support column addition



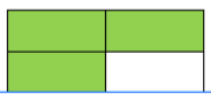
```
  393
+ 308
    1
    1
```

Fractions

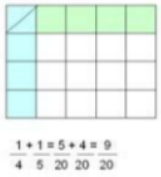
- **Add fractions with the same denominator and denominators that are multiples of the same number** *(to become fluent through a variety of increasingly complex problems and add fractions that exceed 1 as a mixed number)*



Add



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



$\frac{1}{4} + \frac{1}{5} = \frac{5}{20} + \frac{4}{20} = \frac{9}{20}$

Links from other strands / bar modelling

- Solve problems involving up to three decimal 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, money] using decimal notation,
- Calculate the perimeter of composite rectilinear squares in centimetres and metres
- Use angle sum facts and other properties to make deductions about missing angles
- Solve comparison, sun and difference problems using information presented in a line graph

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Y6 ADDITION

Informal methods to support 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.

Common mental calculation strategies:

Partitioning and recombining
Doubles and near doubles
Use number pairs to 10 and 100

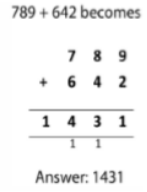
Adding near multiples of ten and adjusting
Using patterns of similar calculations

Using known number facts
Bridging though ten, hundred, tenth
Complementary addition

Written Calculations

Add larger numbers using the formal written (columnar) method

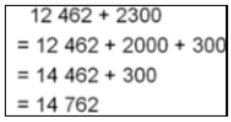
Add three digit numbers using columnar method and then move onto 4 digits.
Include decimal addition for money



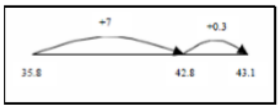
Revert to expanded methods if children find formal calculation method difficult (see Y3)

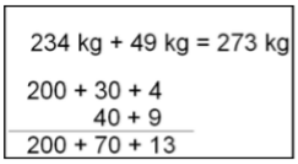
Representations to support mental and written

Use physical/pictorial representations alongside columnar methods where needed. Ask what is the same and what is different?

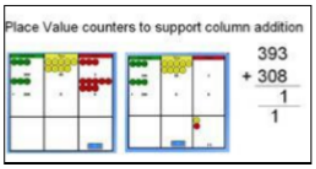


Partitioning and recombining





I can explain my method using place value counters



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

Fractions

- **Add 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 / bar modelling

- 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*
- 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 line, 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)*

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EYFS SUBTRACTION

Children begin with mostly pictorial representations

XXX XX

Concrete apparatus is used to relate subtraction to taking away and counting how many objects are left.
Concrete apparatus models the subtraction of 2 objects from a set of 5.

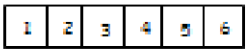
Construct number sentences verbally or using cards to go with practical activities.

Children are encouraged to read number sentences aloud in different ways "five subtract one leaves four" "four is equal to five subtract one"

Children make a record in pictures, words or symbols of subtraction activities already carried out.

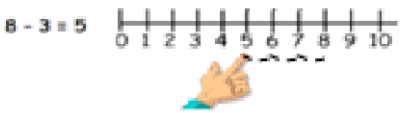
Solve simple problems using fingers

Number tracks can be introduced to count back and to find one less:



What is 1 less than 9? 1 less than 20?

Number lines can then be used alongside number tracks and practical apparatus to solve subtraction calculations and word problems. Children count back under the number line.



Children will need opportunities to look at and talk about different models and images as they move between representations.

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Y1 SUBTRACTION

Mental Calculations

Subtract one digit and two-digit numbers to 20, including zero.
Read, write and interpret mathematical statements using symbols (+, -, =) signs.
Represent and use number bonds and related addition facts within 20
Solve one-step problems using concrete objects and pictorial representations, and missing number problems such as 7 = - 9
Memorise and reason with number bonds
Add using objects, Numicon, cubes etc and number lines and tracks
Check with everyday objects
Ensure pre-calculation steps are understood, including:
Counting objects,

Conservation of number

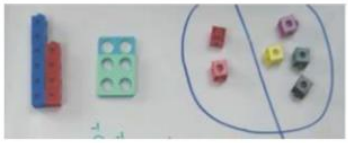
Written Calculations

Subtract one-digit and two-digit numbers to 20, including zero.

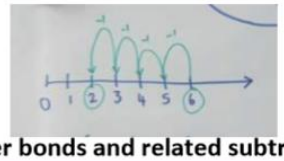
$7-3=\square$, $7-\square=4$

$\square-3=4$, $17-13=\square$

$17-\square=4$



Read, write and interpret mathematical statements involving addition (+), subtraction (–) and equals (=) signs .

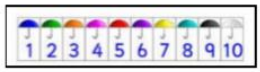


What's the difference between 4 and 6?

Represent and use number bonds and related subtraction facts within 20.

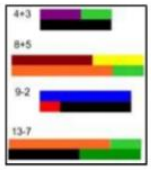
Representations to support mental and written calculations.

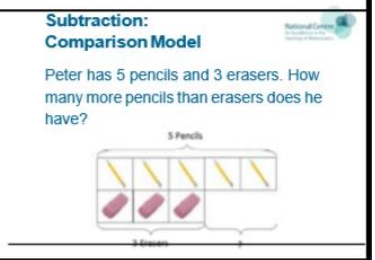
Use a range of concrete and pictorial representations, including:



Hands, and children themselves.

Bead strings, number tracks and lines





Fractions

Counting in fractions to 1

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

Links from other strands / bar modelling

Pupils should combine and increase numbers, counting forwards and backwards.
(They should) develop the concept of addition and subtraction and … use these operations flexibly.
Problems should include the terms: put together, add, altogether, total, take away, distance between, more than and less than, so that pupils develop the concept of addition and subtraction and are enabled to use these operations flexibly.
(Number-addition and subtraction, Non-statutory guidance.)
Pupils discuss and solve problems in familiar practical contexts . (*Non-statutory guidance.*)
Pupils compare, describe and solve practical (measurement) problems .
(Measurement)

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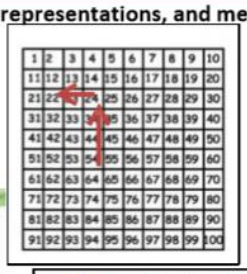
Y2 SUBTRACTION

Mental Calculations

Add and subtract numbers using concrete objects, pictorial representations, and mentally, including:

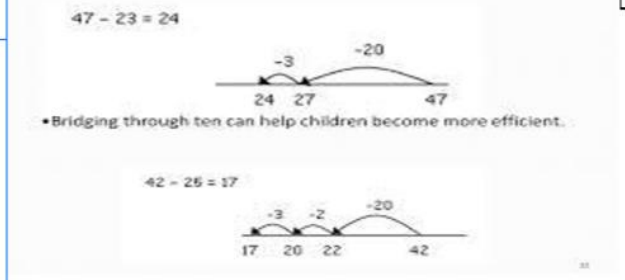
- **a two-digit number and ones**
- **a two-digit number and tens**
- **two two-digit numbers**
- **adding three one-digit numbers**

Jottings to support informal methods:



54—32 = 22

Written Calculations



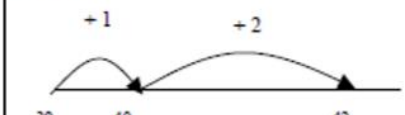
- = signs and missing numbers

Continue using a range of equations as in Year 1 but with appropriate numbers.

Extend to 14 + 5 = 20 - □

Find a small difference by counting up

42 – 39 = 3

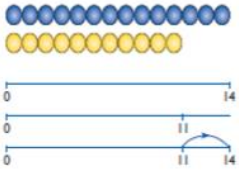


Representations to support mental and written calculations.

Informal methods to support written subtraction calculations

Practical portioning of a 2-digit number

In Year 1 leads to:



The difference between 11 and 14 is 3.

14 – 11 = 3

11 + □ = 14

Bundles of straws or dienes to represent and partition 2 digit numbers.

Subtract (without decomposition) using partitioning and equipment, e.g.

To calculate 35-22, remove 22.

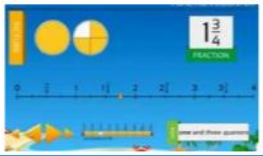
Then record: **35-22=13**.

Continue to use of a range of concrete and pictorial representations from Year 1—including Bar model to support understanding of **difference. (See below.)**

Fractions

Pupils should count in fractions up to 10, starting from any number and using the equivalence on the number line (for example, 1 ¼, 1 ½, 1 ¾, 2.)

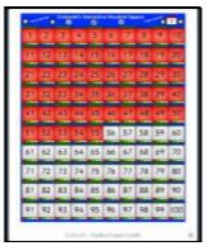
Use concrete and pictorial models of fractions to assist with counting e.g. paper cups, plates, shapes etc.



Links from other strands / bar modelling

Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100.

Pupils should partition to support subtraction.



55 + 45 = 100
45 + 55 = 100
35 + 65 = 100
100 – 55 = 45
100 – 45 = 55
100 – 35 = 65

Solve problems with addition and subtraction:

- **using concrete objects and pictorial representations, involving numbers, quantities and measures**
- **applying knowledge of mental and written methods**
- ***Pupils extend their understanding of the language of addition and subtraction to include sum and difference.***

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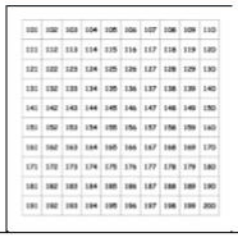
Y3 SUBTRACTION

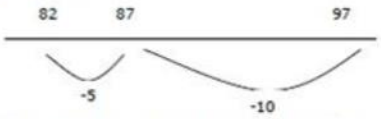
Mental Calculations

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. (See Representations section below.)

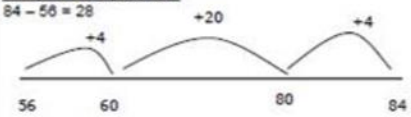


Use known number facts and place value to subtract
Continue as in Year 2 but with appropriate numbers e.g.
97 – 15 = 72



With practice, children will need to record less information and decide whether to count back or forward. It is useful to ask children whether counting up or back is the more efficient for calculations such as 57 – 12, 86 – 77 or 43 – 28.

Pencil and paper procedures
Complementary addition
84 – 56 = 28



Written Calculations

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

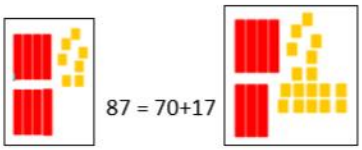
(1)Extended columnar - no exchange

Extended method 87 - 53 =

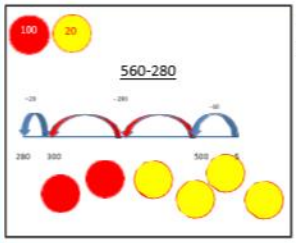
80 and 7
- 50 and 3
30 and 4 = 34

with exchange:
87-58 becomes

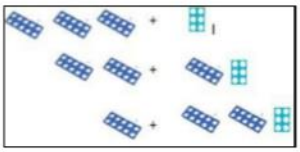
70 +1 7
-50 + 8
20 + 9



Representations to support mental and written calculations



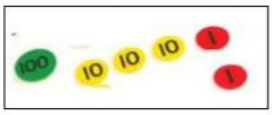
Partitioning and re- partitioning support the understanding of place-value.



All of these representations still comprise the amount 36

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

132 in dienes



132 in place value counters.

Revert to concrete and expanded methods whenever difficulties arise.

Fractions

Count up and down in tenths.

Subtract fractions with the same denominator within one whole.

Links from other strands/ bar modelling

Money and calculating duration of events
For example: ***"Add and subtract amounts of money to give change, using both £ and p in practical contexts."***

Use bar modelling to solve word problems - including missing number problems, using number facts, place value, and more complex subtractions

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Y4 SUBTRACTION

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Mental Calculations

Continue to practise mental methods with increasingly large numbers to aid fluency. *(From Non– Statutory Guidance).*

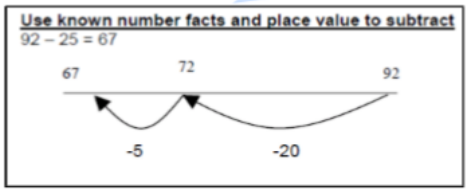
Methods to support fluent calculation and encourage efficiency of method:

- Find a small difference by counting up.

  E.g. 5003—4996
- Subtract nearest multiple of ten and adjust.
- Partition larger numbers

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

Whenever possible, children should be encouraged to visualise number lines and other basic, supporting representations to promote fluent work with- out jottings.



Written Calculations

Add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate.

Build on formal, extended method (*See Year 3)* using exchange wherever necessary.
Continue to use representations and manipulatives to develop understanding of place value.

Moving to compact methods

372—147 =

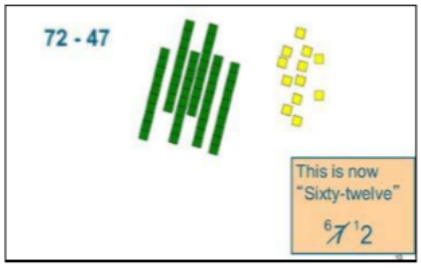
300 + 70 + 2
-100 + 40 + 7

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

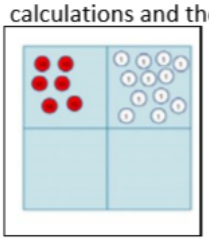
→ 60 1
300 + 70 + 2
- 100 + 40 + 7
200 + 20 + 5

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

Representations to support mental and written calculations.



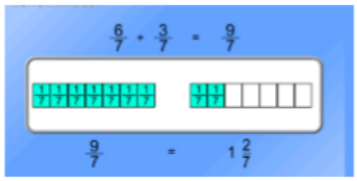
Dienes blocks or place value counters can be used to model calculations and the under-lying place value concepts.



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 in context. Pupils **decide which operations and methods to use and why.**

I would count on using a numberline 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 / bar modelling

Identify, represent and estimate numbers using different representations. (*Place value)*
Recognise the place value of each digit in a four-digit number.
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.

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Y5 SUBTRACTION

Mental Calculations

- **Subtract numbers mentally with large numbers**

  E.g. 12 462 – 2300 = 10 162

- **Use rounding to check answers to calculations In the context of a problem.**

Pupils practise adding and subtracting decimals Including a mix of whole numbers and decimals with different numbers of place values and complements to 1

(for example, 1 - 0.17 = 0.83).

- ***Pupils mentally add and subtract tenths, and one-digit whole numbers and tenths.***

Find difference by counting up
Partitioning
Applying known facts
Bridging through 10 and multiples of 10
Subtracting 9, 11 etc by compensating

Which method works best?

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

Written Calculations

Add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction).
(Pupils) practise adding and subtracting decimals.
Begin with three-digit numbers using formal, columnar method; then move into four-digit numbers.

As in Year 4, compare 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, (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?

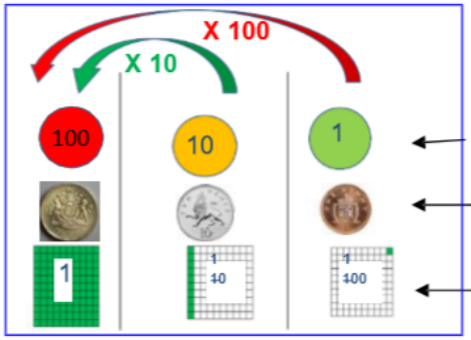
1000+700+20+14p
−1000+200+10+6p
500+10+ 8p

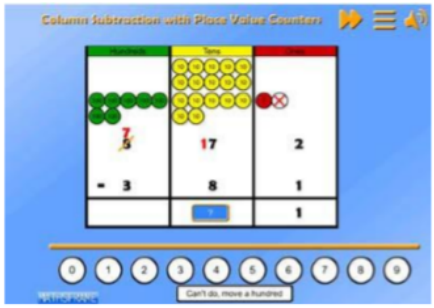
→ 2 1734p −1216p 518p →

£ 2 17.34 -12.16 5.18

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

Representations to support mental and written calculations.





Use physical and pictorial representations to stress the place value relationships between money, decimals and whole numbers. A place value mat such as this one could be used, moving away from the traditional: *Hundreds, tens and ones model* used in Lower KS2 and KS1.

Fractions

Subtract fractions with the same denominator and denominators that are multiples of the same number.
(Include fractions exceeding 1 as a mixed number.)
Solve problems involving number up to three decimal places.
They mentally add and subtract tenths, and one-digit whole numbers and tenths.

Links from other strands/ bar modelling

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

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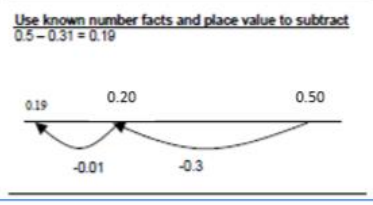
Y6 SUBTRACTION

Mental Calculations

Children:

- **Perform mental calculations, including with mixed operations and large numbers.**
- **Use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.**
- ***They undertake mental calculations with increasingly large numbers and more complex calculations.***

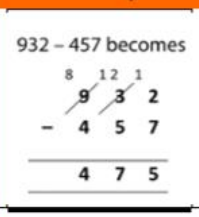
Children draw on basic, Mental subtraction Strategies, (See Year 5.)
Children use, or visualise, representation of choice.
Refer back to physical representations as required.



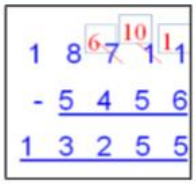
Written Calculations

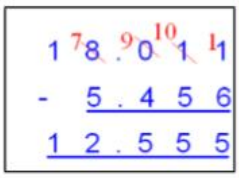
Add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction). Solve problems involving the calculation and conversions of units of measure, using decimal notation of up to three decimal places where appropriate. (MEASURES)

Move towards consolidation of formal, columnar method.
For more complex calculations, with increasingly larger or smaller numbers, compare representations and expanded algorithms alongside columnar methods. Ask: What is the same? What's different?
Compare and discuss the suitability of different methods, (mental or written), in context.
Revert to expanded methods whenever difficulties arise



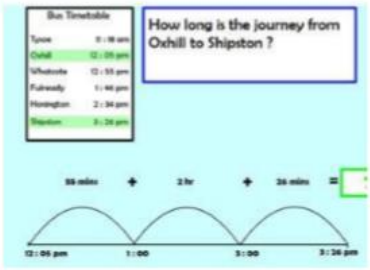
Consolidate columnar methods , paying particular attention to the occurrence of zeros as place holders.

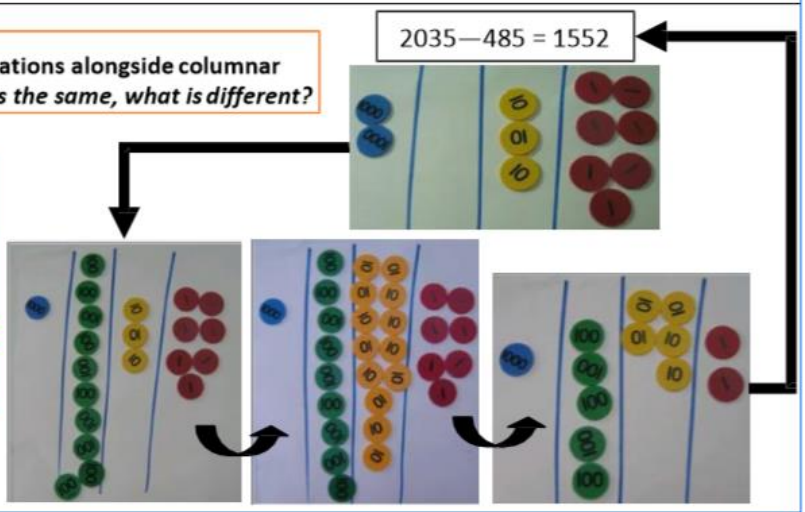




Representations to support mental and written calculations.

Use physical/pictorial representations alongside columnar methods where needed. *What is the same, what is different?*





Fractions

Add and subtract fractions with different denominators and mixed numbers.
They practise calculations with simple fractions and decimal fraction equivalents to aid fluency.

Links from other strands / bar modelling

Use their knowledge of the order of operations to carry out calculations involving the four operations (BODMAS)
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.

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EYFS MULTIPLICATION

The link between addition and multiplication can be introduced through doubling.

If available, Numicon is used to visualise the repeated adding of the same number.
These can then be drawn around or printed as a way of recording.

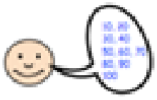
Children begin with mostly pictorial representations:

How many groups of 2 are there?

Real life contexts and use of practical equipment to count in repeated groups of the same size:

How many wheels are there altogether?

How much money do I have?

Count in twos; fives; tens both aloud and with  objects

Children are given multiplication problems set in a real life context. Children are encouraged to visualise the problem.

How many fingers on two hands? How many sides on three triangles? How many legs on four ducks?

Children are encouraged to read number sentences aloud in different ways "five times two makes ten" "ten is equal to five multiplied by two"

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Calculation Policy
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Y1 MULTIPLICATION

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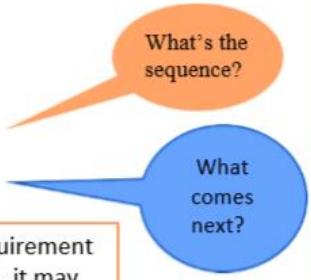
Mental Calculations

- **solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.**
- **Count in multiples of twos, fives and tens** with equipment, songs & rhythms, and including by rote
  - Counting 2s e.g. counting socks, shoes, animal legs...
  - Counting in 5 s e.g. counting fingers, fingers in gloves, toes ...
  - Counting in 10s e.g. counting fingers, toes ...
- Doubles up to 10
- Recognising odd and even numbers
- Write as a number pattern (e.g. 5, 10, 15...; 2, 4, 6...; 10, 20, 30...)



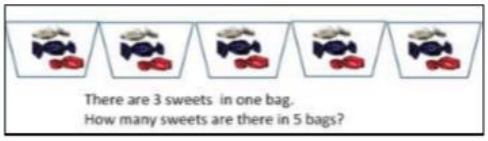
Written Calculations

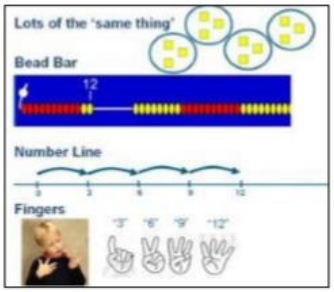
It is important to use a range of models to develop understanding of multiplication, and that children make connections between arrays, number patterns, and counting in twos, fives and tens

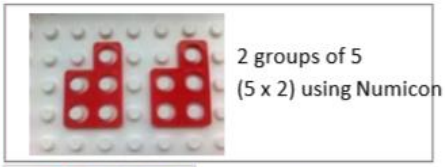
Although there is no statutory requirement for written multiplication in Year 1, it may be helpful to encourage children to begin to write it as a repeated addition sentence in preparation for Year 2
E.g. 2 + 2 + 2 + 2 = 8 or 4 x 2 = 8

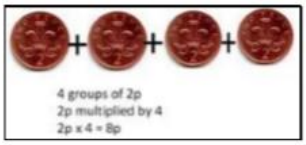
Representations to support mental and written calculations.

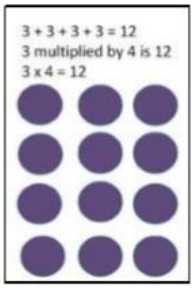
Use a range of concrete and pictorial representations, including:

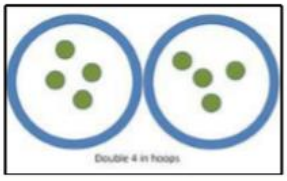


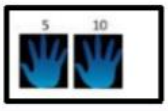












Links from other strands / bar modelling

- **Count in multiples of twos, fives and tens (**from Number and place value), as above
- *Counting in twos, five and tens from different multiples to develop their recognition of patterns in the number system*
- *They discuss and solve problems in familiar practical contexts, including using quantities.*
- Using bar modelling to solve simple problems – how many sweets in 5 bags?

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Calculation Policy
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Y2 MULTIPLICATION

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Calculation Policy
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Mental Calculations

- **Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables,** *connecting the 2, 5 and 10 multiplication tables to each other*
- *Connect the 10 multiplication table to place value*
- **Recognise odd and even numbers**
- **show that multiplication of two numbers can be done in any order (commutative)**
- *Use a variety of language to describe multiplication and division*
- Apply doubling of numbers up to ten to doubling larger numbers
- Counting in 3s – odd / even pattern

I know that the multiples of 2/5/10 are always / never ….

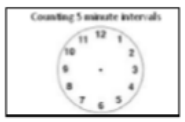
Written Calculations

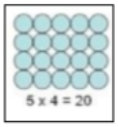
- **calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs**
- *Begin to use other multiplication tables and recall facts to perform written calculations*
- *Use a range of materials and contexts … including arrays and repeated addition*

7 x 2 = □
7 x □ = 14
□ x 2 = 14
△ x □ = 14

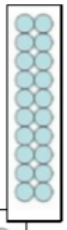
Representations to support mental and written calculations.

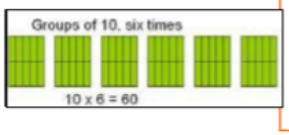
Use a range of concrete and pictorial representations, including:

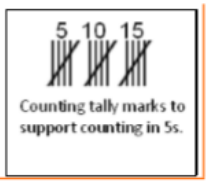


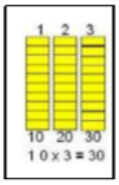


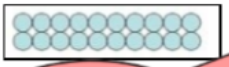
I want five, four times



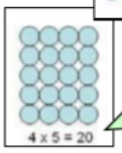




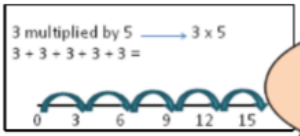




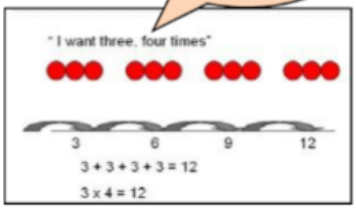
What arrays can you make with 20 counters?

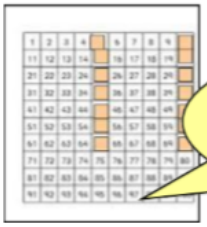


I want four, five times

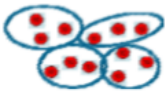


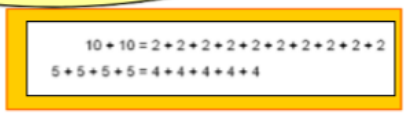
3 multiplied by 4

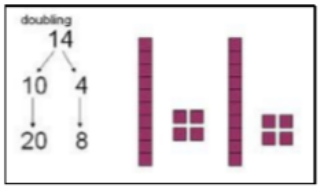




What do you notice about the numbers covered up? Is there a pattern? What number is next?







Fractions

- **write simple fractions for example, 1/2 of 6 = 3 and recognise the equivalence of 2/4 and 1 /2**
- *Begin to relate multiplication and division models to fractions and measures*

Links from other strands / bar modelling

- **solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts.**
- *Use commutativity and inverse relations to develop multiplicative reasoning (e.g. 4 x 5 = 20 and 20 ÷ 5 = 4)*
- **Statistics—interpret and construct simple pictograms, tally charts and block diagrams**
- Measurement— counting 5 minute intervals on a clockface
- Place value **count in steps of 2, 3 and 5 from 0 and in tens from any number, forwards and backwards**

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Y3 MULTIPLICATION

Mental Calculations

- **recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables** (and 2, 5 and 10 multiplication tables from Y2)
- Use doubling to connect 2, 4 and 8 multiplication tables
- Develop efficient mental methods using commutativity and associativity
- Derive related multiplication and division facts
- **calculate mathematical statements for multiplication using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental methods**
- Partitioning: multiply the tens first and then multiply the units,
  e.g. 57 x 6 = (50 x 6) + (7 x 6) = 300 + 42 = 342
- Children can apply these skills to solve spoken word problems too,
- Include missing number statements e.g 72 ÷ □ = 8

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

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?'

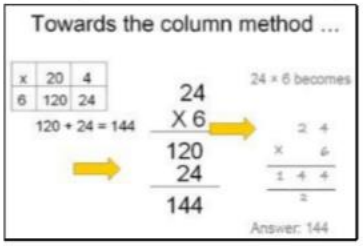
Ensure opportunities to learn multiplication tables through use of visual models, images and also rote learning.

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

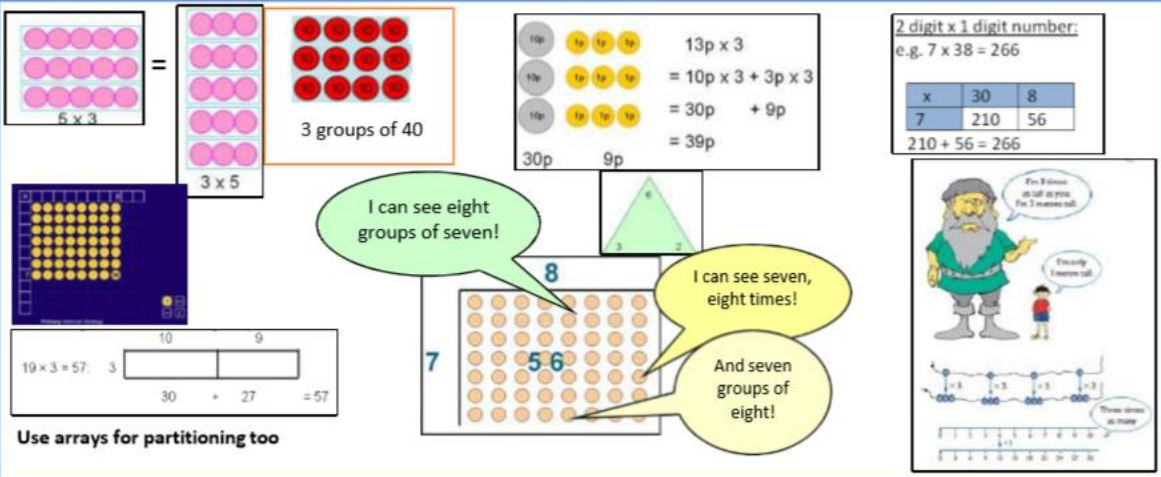
Deriving related facts:
3 x 2 = 60, 6 ÷ 3 = 2, 6 ÷ 2 = 3
➡ 30 x 2 = 60, 60 ÷ 3 = 20, 20 = 60 ÷ 3

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
- Ensure written methods build on/relate to mental methods



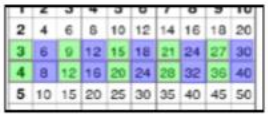
Representations to support mental and written calculations.

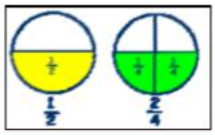


Use arrays for partitioning too

Fractions

- recognise and show, using diagrams, equivalent fractions with small denominators





Links from other strands / bar modelling

- The comparison of measures includes simple scaling by integers (for example, a given quantity or measure 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 (for example, 2, 5, 10 units per cm) in pictograms and bar charts with increasing accuracy
- 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

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Y4 MULTIPLICATION

Informal methods to support mental Calculations

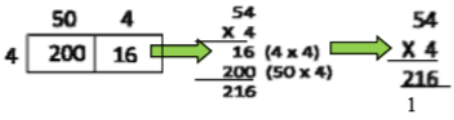
- **recall multiplication and division facts for multiplication tables up to 12 × 12**
- **use place value, known and derived facts to multiply and divide mentally, including:**
  - **multiplying by 0 and 1;**
  - **dividing by 1;**
  - **multiplying together three numbers**
- **recognise and use factor 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)

Using the **distributive** law:
39 x 7 = 30 x 7 + 9 x 7
Using the **associative** law:
(2 x 3) x 4 = 2 x (3 x 4)

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 formal written layout**
- Estimate before calculating
- Ensure written methods build on/relate to mental methods (e.g. grid method)
- Introduce alongside grid and expanded column methods



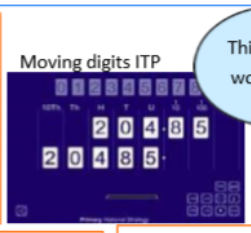
Key skills to support:
- know or quickly recall multiplication facts up to 12 × 12
- understand the effect of multiplying numbers by 10, 100 or 1000
- multiply multiples of 10, for example, 20 × 40;
- approximate, e.g. recognise that 72 × 38 is approximately 70 × 40 = 2800 and use this information to check whether their answer appears sensible

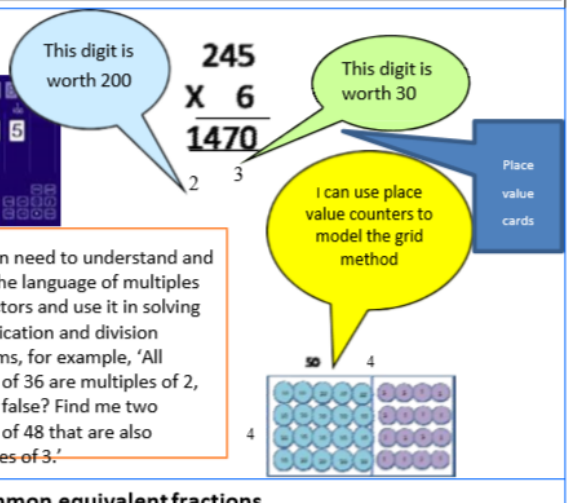
Revert to expanded methods if children find formal calculation method difficult

Representations to support mental and written calculations.

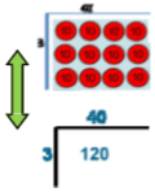
Ensure children can confidently multi- ply & divide by 10 and 100, that multiplying by 10 makes the number bigger and all digits move one place to the left, while dividing by 10 makes the number smaller and all the digits move one place to the right.

Moving digits ITP





Use arrays made with place value counters to demonstrate the link between multi- plication and division. This will support 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 me 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 / bar modelling

- **solve problems involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects.**
- **Convert between different units of measure (e.g. km to m) -** use multiplication to convert from larger to smaller units
- *Understand the relation between non-unit fractions and multiplication/division of quantities. With particular emphasis on tenths and hundredths*
- *relate area to arrays and multiplication.*
- Problem solving work can involve finding all possibilities and combinations drawing on knowledge of multiplication tables facts
- *Pupils understand and use a greater range of scales in their representations* (Statistics)

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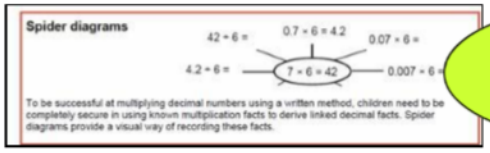
Y5 MULTIPLICATION

Informal methods to support mental Calculations

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

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

24 x 15 = ?

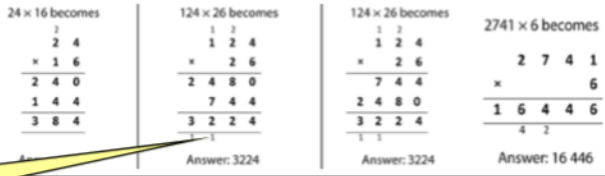


I did: 24 × 5 = 120 (half of 24 × 10), then multi-plied 120 by 3 to get 360

I did: (24 × 10) + (24 × 5).

Written Calculations

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

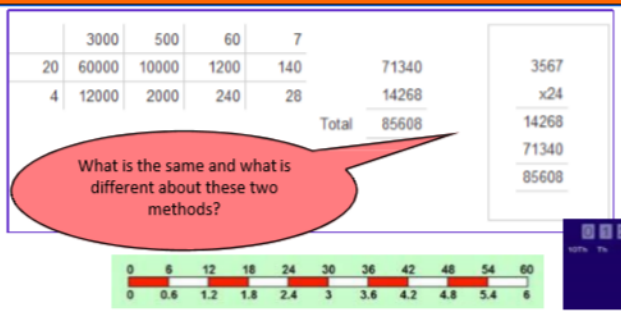


Compact methods for multiplication are efficient but often do not make the value of each digit explicit. When introducing multiplication of decimals, it is sensible to take children back to an expanded form such as the grid method where the value of each digit is clear, to ensure that children understand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

Does your answer seem reasonable?

Revert to expanded methods if children find formal calculation method difficult (see Y3/Y4)

Representations to support mental and written calculations.



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 write 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 relates 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 / bar modelling

- 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) numbers
- 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
- solve problems involving multiplication and division, including scaling by simple fractions and problems involving simple rates
- 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,

Pupils use their knowledge of place value and multiplication and division to convert between standard units.

Pupils calculate the perimeter of rectangles and related composite shapes, including using the relations of perimeter or area to find unknown lengths. Missing measures questions such as these can be expressed algebraically, for example 4 + 2b = 20 for a rectangle of sides 2 cm and b cm and perimeter of 20cm.

Pupils calculate the area from scale drawings using given measurements.

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Y6 MULTIPLICATION

Informal methods to support mental Calculations

- **perform mental calculations, including with mixed operations and large numbers** *(increasingly large numbers & more complex calculations)*
- *use all the multiplication tables to calculate mathematical statements in order to maintain fluency.*
- **use estimation to check answers to calculations & determine, in the context of a problem, an appropriate degree of accuracy.**
- **identify the value of each digit in numbers given to three decimal places and multiply and divide numbers by 10, 100 and 1000 giving answers up to three decimal places.**

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

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

How many different x/÷ facts can you make using 72? 7.2? 0.72?

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 whole number using the formal written method of long multiplication** *(short & long multiplication)*
- **multiply one-digit numbers with up to two decimal places by whole numbers**

£	6.23
x	27
	43.61
	124.60
£	168.21

Revert to expanded methods if children find formal calculation method difficult (see Y4/Y5)

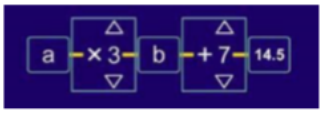
Representations to support mental and written calculations.

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

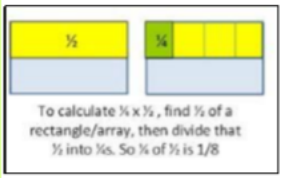
What's the same? What's different?



Fractions

- **multiply simple pairs of proper fractions, writing the answer in its simplest form e.g. ¼ x ½ = 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, ⅜ x 15 = 2 x ⅓ x 15 = 2x3 = 6
- Work out how many ⅓s in 15, how many ⅜s 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 / bar modelling

- **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; for example, 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 [for example, of measures, and 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 & volume
- **Statistics** including pie charts, line charts and calculating the mean

EYFS DIVISION

The ELG states that children **solve problems, including doubling, halving and sharing.**

Children need to see and hear representations of division as both grouping and sharing.

Division can be introduced through halving.

Children begin with mostly pictorial representations linked to real life contexts:

Grouping model
Mum has 6 socks. She grouped them into pairs – how many pairs did she make?

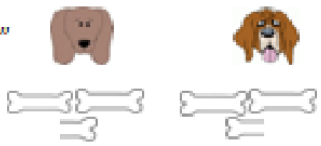
Sharing model
I have 10 sweets. I want to share them with my friend. How many will we have each?

Children have a go at recording the calculation that has been carried out.

Although not explicit in the Development Matters document, the sharing model is a useful way of introducing young children to fractions and calculating with fractions.

Setting the problems in real life context and solving them with concrete apparatus will support children's understanding.

"I have got 5 bones to share between my two dogs. How many bones will they get each?"



Children have a go at recording the calculation that has been carried out.

2 ½ + 2 ½ = 5

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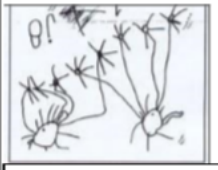
Y1 DIVISION

Mental Calculations

Solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.

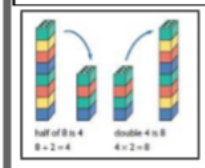
(Pupils) make connections between arrays, number patterns, and counting in twos, fives and tens.



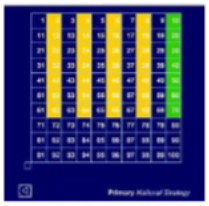
Count on or back in 2s, 5s and 10s and useful look for patterns.

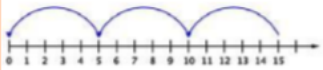
Written Calculations

Pictorial jottings to support the calculation of 8 ÷ 4



Children should experiment with the concepts of sharing and grouping in a number of contexts. Initially they use their own recording—moving towards fluent, symbolic notation in Year 2.
Conceptual understanding and recording should be continuously supported by the use of **arrays** as a default model, as well as other representations, (see below.)





The relationship between multiplication and division must be continually considered.

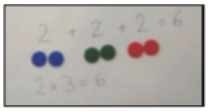
Representations to support mental and written calculations.

Use a range of concrete and pictorial representations, including:

- Manipulatives to support children's own recording; and understanding of *sharing* and the link with multiplication.

"How can we share 6 cakes between 3 people?

Here, the cakes are placed in an array formation.



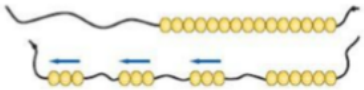
How many 2 tiles can we fit on the 6 tile?

Moving from concrete to pictorial, counters to represent the cakes to reinforce the relationship between multiplication and division.

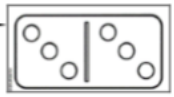
- Manipulatives, and real-life objects to support children's own recording; and understanding of *grouping* and the link with multiplication.

Coat hangers and socks support calculation of 8÷2

Bead strings



"Double 3 is 6. Half of 6 is 3."



- Dominoes and dice to reinforce concepts of doubling and halving.

Fractions

Recognise, find and name a half as one of two equal parts of an object, shape or quantity
Recognise, find and name a quarter as one of four equal parts of an object, shape or quantity. (*See* Representations *above.)*

Links from other strands / bar modelling

They practise counting as reciting numbers and counting as enumerating objects, and counting in twos, fives and tens from different multiples to develop their recognition of patterns in the number system (for example, odd and even numbers). (PLACE VALUE).

Pupils are taught half and quarter as 'fractions of' by solving problems using shapes, objects and quantities. (FRACTIONS)

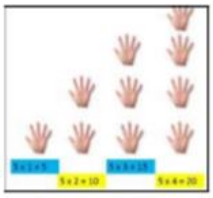
Y2 DIVISION

Mental Calculations

The relationship between multiplication and division must be continually considered.

- **Recall and use multiplication and division facts for the 2, 5, 10, 3s multiplication tables, including recognising odd and even numbers .**
- **Calculate mathematical statements for multiplication and division within**
- **the multiplication tables and write them using the multiplication (x), division (÷) and equals (=) signs**

"5, one time", "5, two times" and so on.



Written Calculations

- **Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot**
- **Solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts. (*See below.*)**

½ of 26 = 13
26 ÷ 2 = 13

Pupils decode a problem first, represent it using manipulatives and jottings; and finally record it symbolically.

Representations to support mental and written calculations.

Use a range of concrete and pictorial representations, including:

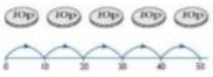
- Arrays

7 x 2 = 14
14 ÷ 2 = 7

2 x 7 = 14
14 ÷ 7 = 2

Is 14 an odd number? How do you know?

- Number lines to support grouping



How many groups of 5 minutes have passed when the minute

Representations to support multiplicative reasoning:

Using Dienes: *"If 40 ÷ 10 = 4 and 30 ÷ 10 = 3, what do you think 70 ÷ 10 would be? Why?"*

Fractions

Recognise, find, name and write fractions ⅓, ¼, ¾, 2/4 of a length, shape, set of objects or quantity Write simple fractions for example, ½ of 6 = 3 and recognise the equivalence of ½ and 2/4.

Links from other strands / bar modelling

- **Count in steps of 2, 3, and 5 from 0, and in tens from any number, forward and backward.**
- **Recognise the place value of each digit in a two-digit number (tens, ones) (PLACE VALUE).**
- **Tell and write the time to five minutes, including quarter past/to the hour and draw the hands on a clock face to show these times, (MEASURES).**

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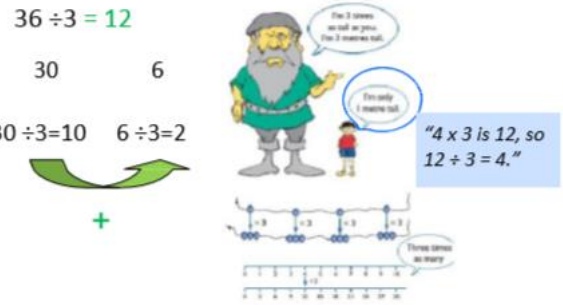
Y3 DIVISION

Mental Calculations

Pupils should be taught to recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables.

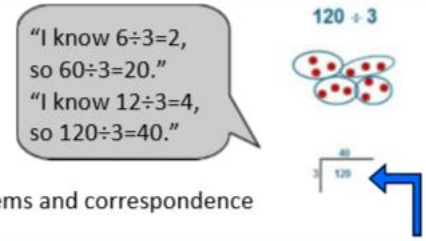
Pupils continue to practise their mental recall of multiplication tables... in order to improve fluency. Pupils develop efficient mental methods, for example, using commutativity and associativity (e.g., 4 × 12 × 5 = 4 × 5 × 12 = 20 × 12 = 240) and multiplication and division facts to derive related facts.



Written Calculations

Pupils should be taught to:

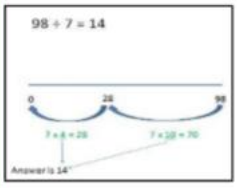
- write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods.
- solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects, (see Links from other strands, below.)

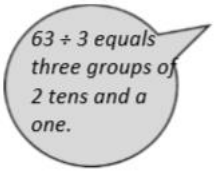


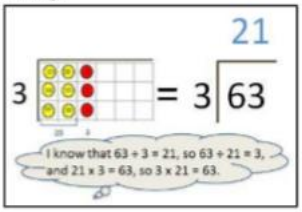
New written methods can be modelled alongside mental or informal methods to ensure understanding.

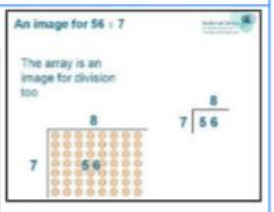
Representations to support mental and written calculations.

Use a range of concrete and pictorial resources, including:



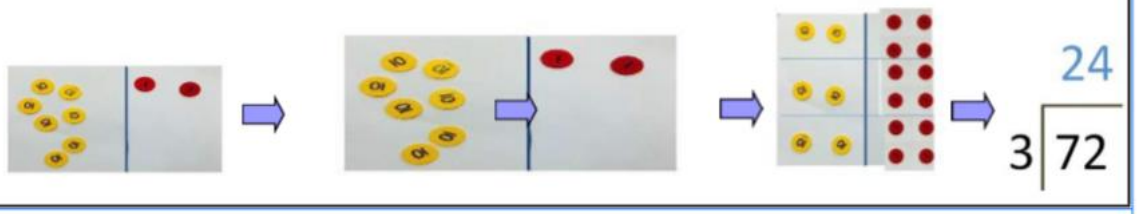






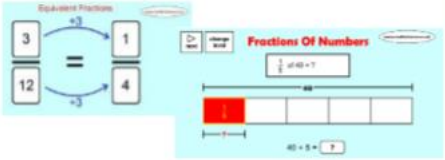
How could I calculate 72÷3 ?

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 / bar modelling

Solving fraction of amount word problems – including simple equivalents

Solve problems, including missing number problems division,

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Y4 DIVISION

Informal methods to support mental Calculations

Pupils should be taught to:

- **recall multiplication and division facts for multiplication tables up to 12 × 12**
- **use place value, known and derived facts to multiply and divide mentally,**

including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers

- **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.

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

Written Calculations

Pupils should be taught to:

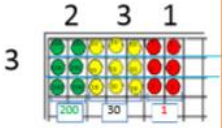
- **solve problems involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects.**
-

Pupils practise to become fluent in the formal written method of short multiplication and short division with exact answers .

Revert to expanded methods if children find formal calculation method difficult

Representations to support mental and written calculations.

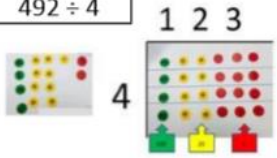
693 ÷ 3



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.

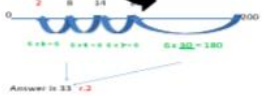
By working through larger number calculations with manipulatives, children gain experience of ex-change (re-partitioning) within division algorithms.

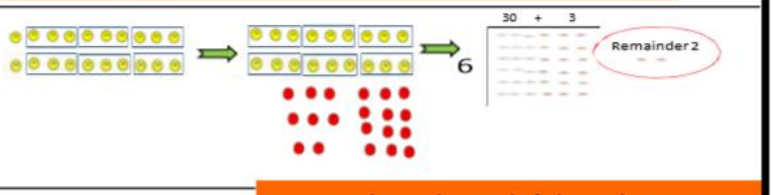
492 ÷ 4



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

Pupils should be taught to:

- ***recognise and show, using diagrams, families of common equivalent fractions***
- ***recognise that hundredths arise when dividing an object by one hundred and dividing tenths by ten.***
- ***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 / bar modelling

- **Convert between different units of measure [for example, kilometre to metre; hour to minute]**
- **Estimate, compare and calculate different measures, including money in pounds and pence (MEASURES)**
- **Recognise that hundreths arise when dividing an object by one hundred and dividing tenths by ten. (FRACTIONS)**

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Y5 DIVISION

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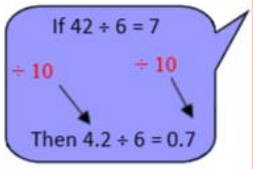
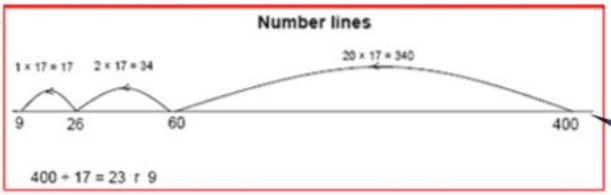
Informal methods to support mental Calculations

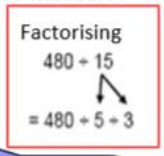
. Pupils should be taught to:

- **multiply and divide whole numbers and those involving decimals by 10, 100 and 1000**
- **multiply and divide numbers mentally drawing upon known facts**

identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers .







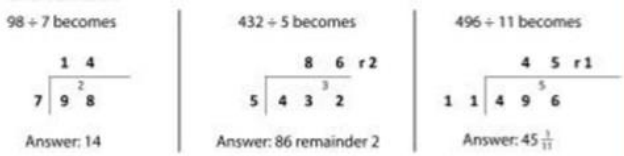
"I know that the answer to 138 ÷ 6 will be close to 20, because 2 x 6 = 12, so 20 x 6 = 120."

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

Written Calculations

Pupils practise and extend their use of the formal written methods of short multiplication and short division.

- **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.**



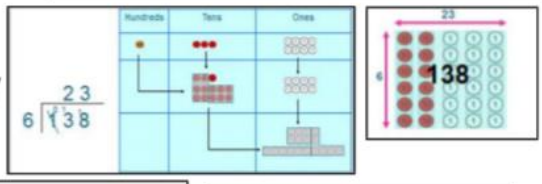
- **Pupils interpret non-integer answers to division by expressing results in different ways according to the context, including with remainders, as fractions, as decimals or by rounding. (See Representations below.)**

Revert to expanded methods if children find formal calculation method difficult

Representations to support mental and written calculations.

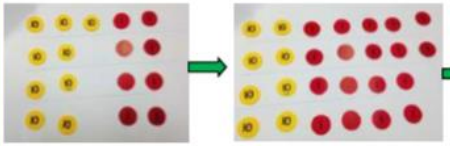
Can we divide this 100 token into 6 equal groups? , then we must exchange it for ten 10 tokens. Can we divide into 6 groups now?

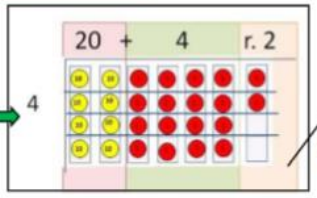
Short division with exchange.



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

$98 \div 4 = \frac{98}{4} = 24\text{ r }2 = 24\frac{1}{2} = 24.5$

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 percentages, fractions and decimals***

Links from other strands / bar modelling

- ***Pupils use all four operations in problems involving time and money, including conversions. .....using decimal notation, including scaling.***
- ***calculate and compare the area of rectangles (including squares). (MEASURES)***

- **establish whether a number up to 100 is prime and recall prime numbers up to 19**
- **recognise and use square numbers and cube numbers, and the notation for squared (2) and cubed (3)**
- **solve problems involving multiplication and division including using their knowledge of factors and multiples, squares and cubes and including scaling by simple fractions and problems involving simple rates.**
- **solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign. (NUMBER—MULTIPLICATION AND DIVISION)**

Great Wilbraham C of E Primary School

Calculation Policy
2022

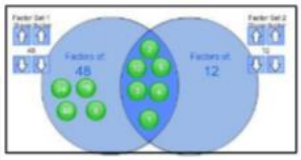
Y6 DIVISION

Informal methods to support 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.

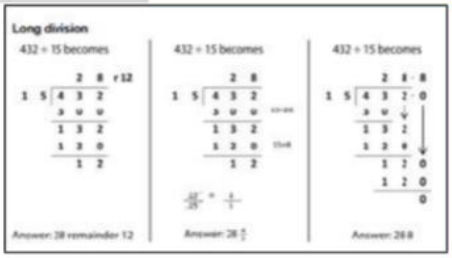
I know that 366 will divide by 6 because it has 2 and 3 as factors



- Solve problems involving addition, subtraction, multiplication and division
- use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.

Written Calculations

- divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context
- divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context.
- *Pupils practise division for larger numbers, using the formal written methods of short and long division.*



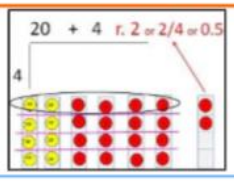
Representations to support mental and written calculations.

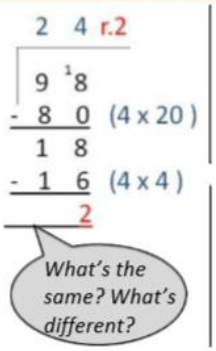
Revert to expanded methods if children find formal calculation method difficult

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.

£1362.72 ÷ 40 = ?

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

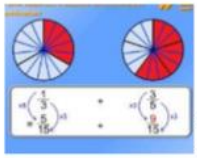


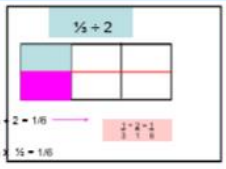


Fractions

- 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 [for example, 1/3 ÷2 = 1/6 and by fractions – 2/3 ÷1/3
- associate a fraction with division and calculate decimal fraction equivalents [for example, 0.375.]
- *Pupils use their understanding of the relationship between unit fractions and division to work backwards*

Use written division methods in cases where the answer has up to 2 dp.
Multiply mixed number fractions - 2 ¼ x 4





Links from other strands

- *Pupils are introduced to the division of decimal numbers by one-digit whole number, 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. (FRACTIONS)*

"8 is the best estimate for 72.34 ÷ 8.91; because the numbers in the algorithm can be rounded to 72 ÷ 9."

- *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 3d.p. (MEASURES)*
- *interpret and construct pie charts and line graphs and use these to solve problems*
- *calculate and interpret the mean as an average. (STATISTICS)*
- *solve problems involving the relative sizes of two quantities where missing values can be found by using integer multiplication and division facts (RATIO AND PROPORTION)*