Wandsworth LA
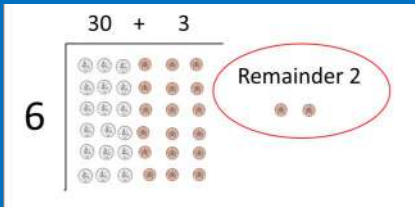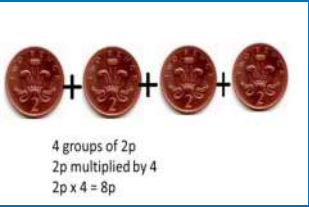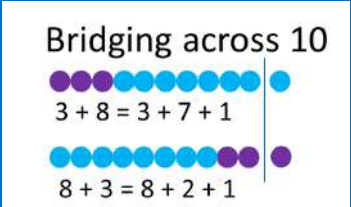
Calculation Policy

Revised & updated January 2016

Wandsworth LA Calculation Policy document written by **Nicki Ashton** & **Catherine Brown**, Primary Teaching & Learning Consultants (Mathematics).

Acknowledgements

With thanks to the contributions from the Wandsworth Primary Curriculum Development Group:

Wandsworth LA Calculation Policy for addition: Year 1

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
- Understand 'part whole' models (see below) to identify the numbers 'hidden' within a number
- Use knowledge of 'part whole' to bridge across 10.
- *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
- Teach equality and inequality alongside each other
- Ensure pre-calculation steps are understood, including:
  - Counting objects (including solving simple concrete problems
  - Conservation of number:
  - **Recognise place value in numbers beyond 20**
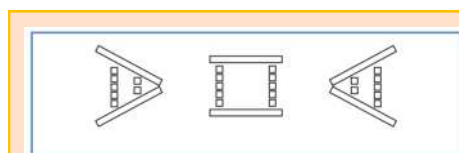 - **Counting** as reciting and as enumerating

$6 + 4 = 7 + \square$

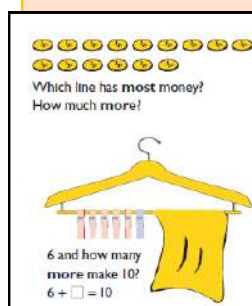$13 + 4 = 10 + \square$

$10 + 3$

★★★★★ = ★★★★★

1 2 3

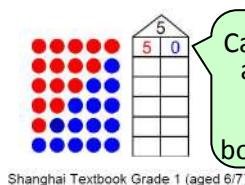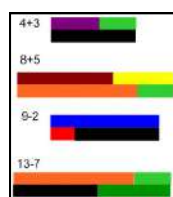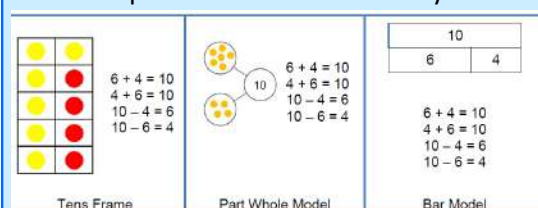## Representations to support mental and written calculations.

Use a range of concrete and pictorial representations, including:

Using concrete and visual representations to show that 5 is greater than 2. Balance scales can help too.

Which line has most money? How much more?

6 and how many more make 10? 6 + ☐ = 10

4+3
8+5
9-2
13-7

Shanghai Textbook Grade 1 (aged 6/7)

5 | 0

Can you see a pattern with the number bonds for 5?

'Part whole'
Making connections between models to help children understand the same maths represented in different ways.

Tens Frame	Part Whole Model	Bar Model

6 + 4 = 10
4 + 6 = 10
10 - 4 = 6
10 - 6 = 4

Staircase:

Can you see the numbers 'hidden' in each step? e.g. 2 + 7 inside 9

25 add 6

Bridging across 10
3 + 8 = 3 + 7 + 1

8 + 3 = 8 + 2 + 1
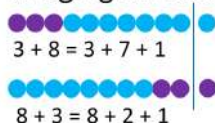
Children can explore this using multilink, Dienes, coins and bead strings etc

Bead strings

○○○○ + ○ (one more)
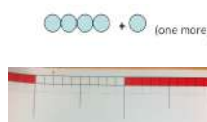
Number tracks

Number lines

1 2 3 4 5 6 7 8

1 2 3 4 5 6 7 8 9 10

Real everyday objects
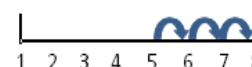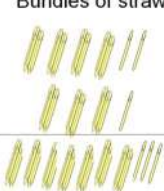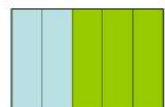
Links from other strands

- *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.

Wandsworth LA Calculation Policy for addition: Year 2

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**

Written Calculations

- **Recall and use addition addition and subtraction facts to 20 facts fluently, and derive and use related facts up to 100**
- **Demonstrate the commutative law of addition**
- Re-partition numbers eg. 65 (across page)
- Bridge across tens using knowledge of 'part whole'
- Use a hundred square
- *Check calculations using inverse and by adding numbers in different order*
- Begin to *record addition in columns to support place value and prepare for formal written methods with larger numbers*

12 + 30 = 30 + 12
□ + 25 = 25 + 41

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

$30 + 4$
$20 + 5$
$50 + 9$

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

Representations to support mental and written calculations.

Use a range of concrete and pictorial representations, including:

I know that 7 is greater than 6, so 5 plus 7 must be greater than 5 plus 6

Teaching equality/inequality:
Use examples that children can reason about without the need to calculate e.g.
5 + 7 □ 5 + 6
True or false? 4 + 6 + 8 > 3 + 7 + 9

Unitising in 10s

60 + 2 = 62
62 + 2 = □
62 + 12 = □
62 + 22 = □

62 + □ = 94
94
62 + 30 + 2
62 + 32

Which line has **most** money?
How much more?

6 and how many more make 10?
6 + □ = 10

Use questioning to develop reasoning e.g.
What's the same? what different?

| 23 + 10 | 23 + 20 | 23 + 30 | 23 + 40 |

How can I use a 100 square to add 32 + 22?

Number tracks

e.g. 34 + 23 = 57

I can use Dienes to balance this number sentence

$23 + 6 = 20 +$ □

Cuisennaire is a useful concrete resource that develops understanding of the pictorial bar model

94	
62	32

8+5
9-2
13-7

'Magic 10'
19 + 16
= 19 + 1 + 15
= 20 + 15
= 35

Bridging across tens
26 + 28:
- 26 + 4 + 24 = 30 + 24 = 54

Compensating using balance:
26 + 28
-2   +2
24 + 30 = 54

Fractions

Counting in fractions up to 10, starting from any numbers and using the ½ and $^2/_4$ equivalence on the number line

1 ¼   1 ½   1 ¾   2   2 ¼   2 ½

½   1   1½   2   2½

Links from other strands

- Solve problems:
- Using concrete objects, pictorial representations (numbers, quantities & measures)
- Applying increasing knowledge of mental & written methods
- Partition numbers in different ways
- *Discuss and solve problems that emphasise the value of each digit in two-digit numbers*
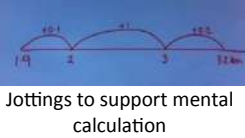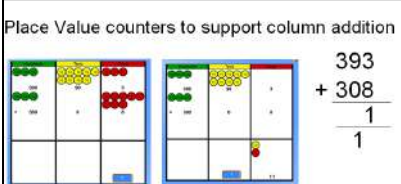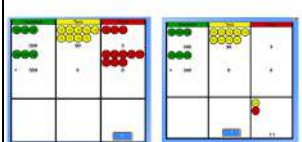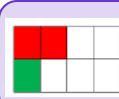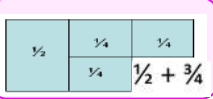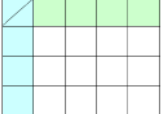
Wandsworth LA Calculation Policy for addition: Year 3

Mental Calculations

Add numbers mentally, including:

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

- Partition all numbers and recombine, start with TU + TU then HTU + TU
  Bridge across tens and hundress using 'part whole'
- Use straws, dienes, place value counters, coins empty number lines

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

Written Calculations

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

Add to three digit numbers using physical and abstract representations (e.g. straws, dienes, place value counters, empty number lines, coins)
Use manipulatives to support structure of the algorithm especially place value

$$
\begin{array}{ll}
30 + 4 & 34 \\
20 + 5 & +25 \\
\hline
50 + 9 & 59
\end{array}
$$

$$
\begin{array}{ll}
200 + 30 + 4 & 234 \\
500 + 20 + 7 & + 527 \\
\hline
700 + 60 + 1 & 761 \\
10 & 1
\end{array}
$$

Informal methods of recording are used as stepping stones to help children understand the logic of formal written methods.

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

Bundles of straws

$$
\begin{array}{l}
0 + 50 + 3 \\
10 + 40 + 3 \\
20 + 30 + 3 \\
30 + 20 + 3 \\
40 + 10 + 3 \\
50 + 0 + 3
\end{array}
$$

160+280

42 + 31 = 73

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

Partitioning and recombining

I can re-partition numbers mentally (& pictorially) to help with bridging through 10 and 100
E.g. 78 + 53 = 78 + 22 + 31 = 131

What is the same and what is different with these methods?

540
300   240

I can explain my method using representations

Doubles and near doubles, using intelligent practice:
40 + 40 =   130 + 130 =
45 + 45 =   130 + 131 =
45 + 46 =   129 + 130 =
                   129 + 129 =

Use intelligent practice:
164 + 33 =
264 + 33 =
264 + 34 =
64 + 33 =
65 + 33 =

64 + 33 = 97

Using empty box problems:
23 + ☐ = 67
23 + ☐ = 68
23 + ☐ = 69
23 + ☐ = 70
23 + ☐ = 71

423 + ☐ = 323 + 250
523 + 150 = ☐ + 250
623 + 50 = ☐ + ☐

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

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)

Wandsworth LA Calculation Policy for addition: Year 4

Informal methods to support mental Calculations

Practise mental methods with increasingly large numbers

Consolidate partitioning and re-partitioning
Bridge tens and hundreds using partitioning and 'part whole'
Use compensation for adding too much/little and adjusting
Use straws, Dienes, place value counters,
empty number lines etc.

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

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

+30   +7

55   85   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
Use manipulatives to support structure of the algorithm especially place value

Revert to expanded methods if children find formal calculation method difficult

789 + 642 becomes

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

Answer: 1431

Representations to support mental and written calculations.

Use physical/pictorial representations alongside expanded and columnar methods.

Bundles of straws   Using Dienes

42 + 31 = 73

42 + 97 Compensating in mental addition
+100
                    -3
140   143

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

£12.32
+ £11.81
£24.13
1

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

767 + 216 =
700 + 60 + 7
200 + 10 + 6

Make 9999
5000 + [ ] = 9999
4000 + [ ] = 9999
3000 + [ ] = 9999
2000 + [ ] = 9999
1000 + [ ] = 9999

Make 9990
5023 + [ ] = 9990
4023 + [ ] = 9990
3023 + [ ] = 9990

	1000	
	353	354

	2000	
493		754

2300	1240
3540	

[ ] + [ ] = [ ]
[ ] + [ ] = [ ]
[ ] − [ ] = [ ]
[ ] − [ ] = [ ]

Use the bar model to reinforce the inverse relationship between addition & subtraction

245 + 88

? + 90

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

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

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

½	¼
	¼

Links from other strands

- 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)
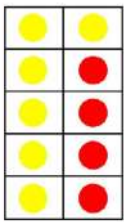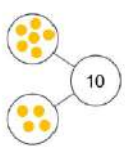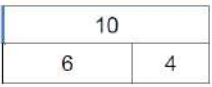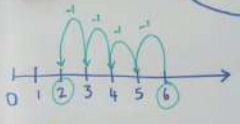
Wandsworth LA Calculation Policy for addition: Year 5

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.
Use concept of balance/equivalence to compensate
Bridge across boundaries by partitioning

> **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 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
Use manipulatives to support structure of the algorithm especially place value

```
  24172m
+  5929m
  30101m
  1 111
```

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

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

Represent-ations to support mental and written calculations.

Use physical/pictorial representations alongside columnar methods where needed.

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

Partitioning and recombining

Jottings to support mental calculation

Use the **bar model** to reinforce the inverse relationship between addition & subtraction:

This supports problem solving: Sam and Tom have £67.80 between them. If Sam has £6.20 more than Tom, how much does Tom have?

Sam   + £6·20
Tom   } £67·80
£67·80 – £6·20 = £61·60
£61·60 ÷ 2 = £30·80
Tom has £30·80

1.6 + 1.4 = 3
Write down three more pairs of decimal numbers that sum to 3

Place Value counters to support column addition

```
  393
+ 308
    1
    1
```

Compensating: true or false?
2741 + 1263 = 2742 + 1262
Why? Can you use resources or draw a picture to explain your answer? How can you adjust this to make the calculation easier? 3498 + 2067

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

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)

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

½ + ¾

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

Links from other strands

- 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
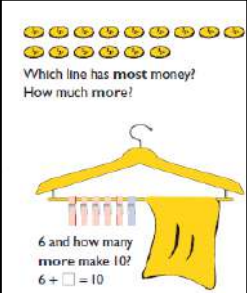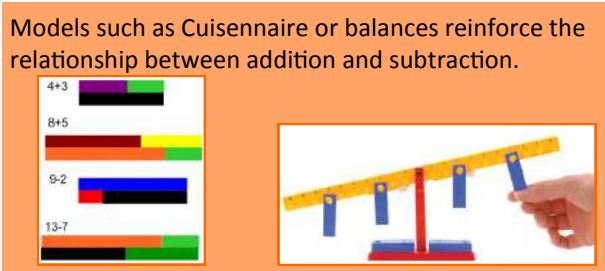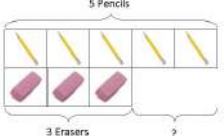- Solve comparison, sun and difference problems using information presented in a line graph
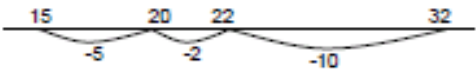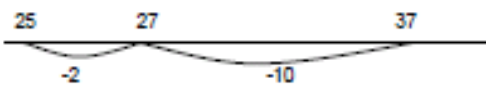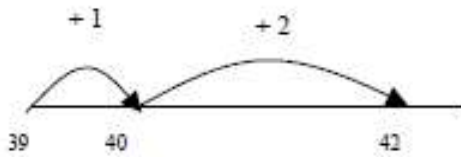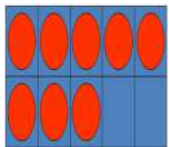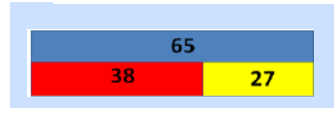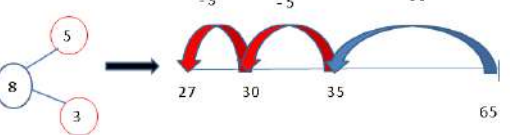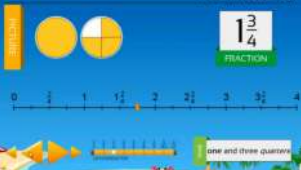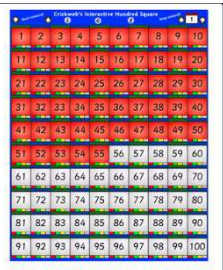
Wandsworth LA Calculation Policy for addition: Year 6

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 for bridging boundaries (tens, hundreds, thousands, tenths, hundredths …)

Use compensation for adding too much/little and adjusting

Refer back to pictorial and physical representations when needed.

Apply the rules of BIDMAS

> **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

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

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 (see Y3)

Representations to support mental and written calculations.

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

```
12 462 + 2300
= 12 462 + 2000 + 300
= 14 462 + 300
= 14 762
```
Jottings to support mental strategies

+7 ... +0.3
35.8 ... 42.8 ... 43.1

234 kg + 49 kg = 273 kg

200 + 30 + 4
40 + 9
200 + 70 + 13

> x and y represent whole numbers. Their sum is 1000.
> x is 250 more than y.
> What are the values of x and y?
>
> Using the bar model to solve problems
>
> | X | 1000 |
> | Y + 250 | |

I can explain my method using place value counters

Place Value counters to support column addition

```
  393
+ 308
    1
    1
```

Follow the BIDMAS order of operations!
Brackets
Indices (powers of e.g. 2^2)
Division
Multiplication
Addition
Subtraction

Compare $31 + 9 \times 7$ and $(31 + 9) \times 7$
What's the same? What's different?

$14\ 781 - 6\square 53 = 8528$
$23 \cdot 12 + 22 \cdot \square = 45 \cdot 23$

> Can you use five of the digits 1 to 9 to make this number sentence true?
> $\square\square \cdot \square + \square \cdot \square = 31 \cdot 7$
> Can you find other sets of five of the digits 1 to 9 that make the sentence true?

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

$\frac{3}{5} + \frac{7}{10}$

$\frac{2}{5}$ $\frac{3}{8}$

$\frac{2+3}{5\ \ 8} = \frac{31}{40}$

Links from other strands

- Use their knowledge of the order of operations to carry out calculations involving the four operations (BIDMAS)
- Solve problems involving all four operations
- Algebra: use symbols and letters to represent variable and unknowns *e.g. a + b = b + a*
- 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)*

Wandsworth LA Calculation Policy for subtraction Year 1

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

Understand subtraction as 'take away'

Find a 'difference' by counting up;

1 2 3

Written Calculations

Subtract one-digit and two-digit numbers to 20, including zero.
Read, write and interpret mathematical statements involving addition (+), subtraction (−) and equals (=) signs .

6 + 4 = 10
4 + 6 = 10
10 − 4 = 6
10 − 6 = 4

Tens Frame

6 + 4 = 10
4 + 6 = 10
10 − 4 = 6
10 − 6 = 4

Part Whole Model

10	
6	4

6 + 4 = 10
4 + 6 = 10
10 − 4 = 6
10 − 6 = 4

Bar Model

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, fingers and children themselves.

Straw bundles

1 2 3 4 5 6 7 8 9 10

Bead strings, number tracks and lines

6 − 4 = 2
The difference between 6 and 4 is 2.

Difference or comparison model

Counting on or back.

6 - 4= ☐

Part Whole

Which line has most money? How much more?

6 and how many more make 10?
6 + ☐ = 10

Models such as Cuisennaire or balances reinforce the relationship between addition and subtraction.

4+3
8+5
9-2
13-7

Subtraction: Comparison Model

Peter has 5 pencils and 3 erasers. How many more pencils than erasers does he have?

5 Pencils

3 Erasers ?

Links from other strands

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, difference 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)

Wandsworth LA Calculation Policy for subtraction Year 2

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:

Bridge through 10 where necessary
32 - 17

$$54 - 32 = 22$$

- = 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

Written Calculations

Written recording:

37 – 12 = 37 – 10 - 2
= 27 – 2
= 25

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

Representations to support mental and written calculations.

Informal methods to support written subtraction calculations
Practical partitioning of a 2-digit number

In Year 1 leads to:

The difference between 11 and 14 is 3.
14 – 11 = 3
11 + ☐ = 14

which can lead to exploration and variation

4 - 1 = 3
14 -11 = 3
24 -21 = 3
☐

Subtract (without decomposition) using partitioning and manipulatives, e.g. Dienes or straw bundles

To calculate 35-22, remove 22.   Then record: **35-22=13**.

Pupils experience bridging through 10 using number bonds and the Part Whole model.

65 – 38 = ...

65
38   27

8 can be partitioned using the Part Whole model.

Fractions

Pupils should count in fractions up to 10, starting from any number and using the and 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.

$1\frac{3}{4}$

Links from other strands

Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100.
Pupils should partition numbers in different ways (for example, 23 = 20 + 3 and 23 = 10 + 13) 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, including those involving numbers, quantities and measures**
- **applying their increasing knowledge of mental and written methods**
- *Pupils extend their understanding of the language of addition and subtraction to include sum and difference.*

Wandsworth LA Calculation Policy for subtraction Year 3

Mental Calculations

Add and subtract numbers mentally, including:
***a three-digit number and ones**
***a three-digit number and tens**
***a three-digit number and hundreds.**

247	
173	74

$173 + 74 = 247$

$74 + 173 = 247$

$247 - 173 = 74$

$247 - 74 = 173$

101	102	103	104	105	106	107	108	109	110
111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130
131	132	133	134	135	136	137	138	139	140
141	142	143	144	145	146	147	148	149	150
151	152	153	154	155	156	157	158	159	160
161	162	163	164	165	166	167	168	169	170
171	172	173	174	175	176	177	178	179	180
181	182	183	184	185	186	187	188	189	190
191	192	193	194	195	196	197	198	199	200

Use a number line, Dienes, 100 squares, 200 hundred squares, and similar representations, to support mental calculations. (See 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
$84 - 56 = 28$
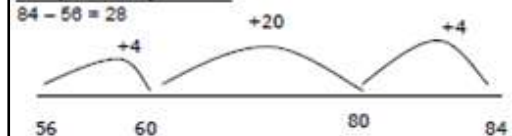
Written Calculations

Add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction.

(1) Extended columnar - no exchange

Extended method $87 - 53 =$

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

(2) Extended columnar – with exchange:
$87-58$ becomes

```
  70 +17
- 50 + 8
  20 + 9
```

$87 = 70+17$

Representations to support mental and written calculations.

560-280
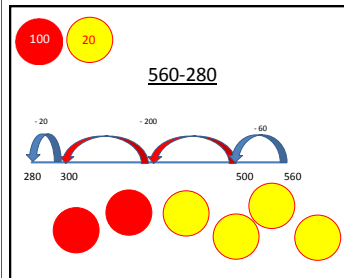
Partitioning and re- partitioning support the understanding of place-value.
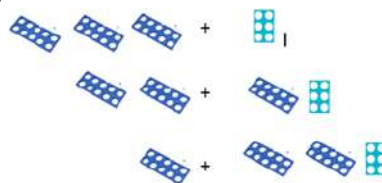
$30 + 6$

$20 + 16$

$10 + 26$

All of these representations still comprise the amount of 36.

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

Revert to concrete manipulatives and expanded methods whenever difficulties arise

132 in Dienes   132 in place value counters.

Fractions

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

$$\frac{1}{6} + \frac{1}{6} + \frac{1}{6} = \frac{3}{6} = \frac{1}{2}$$

Adding Fractions
Bar model
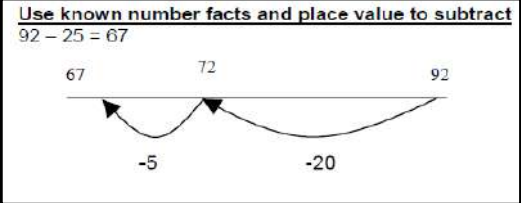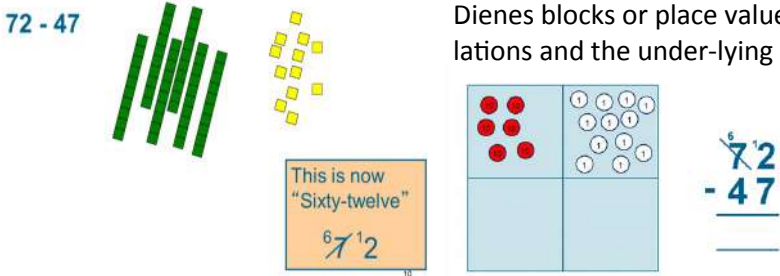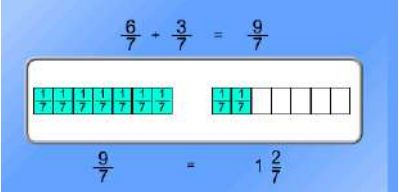
Links from other strands

Money and calculating duration of events (with number lines.)

For example: *"**Add and subtract amounts of money to give change, using both £ and p in practical contexts.**"*
"Compare durations of events [for example to calculate the time taken by particular events or tasks]." (Measurement)

Wandsworth LA Calculation Policy for subtraction Year 4

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

Whenever possible, children should be encouraged to visualise number lines and other basic, supporting representations to promote fluent work without jottings.

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

Use known number facts and place value to subtract
92 – 25 = 67

67   72   92

-5   -20

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.

372—147 =

$$300 + 70 + 2$$
$$-100 + 40 + 7$$

$$300 + 60 + 12$$
$$\underline{-100 + 40 + \ 7}$$
$$200 + 20 + \ 5$$

$$300 + 70 + \ \ 2$$
$$\underline{- \ \ 100 + 40 + \ \ 7}$$
$$200 + 20 + \ 5$$

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.

72 - 47

This is now "Sixty-twelve"

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

72
- 47

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 number line to calculate 5003-4896; because the numbers are close together.

Fractions

$$\frac{6}{7} + \frac{3}{7} = \frac{9}{7}$$

$$\frac{9}{7} = 1\frac{2}{7}$$

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

Links from other strands

Identify, represent and estimate numbers using different representations. (*Place value*)
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.

Wandsworth LA Calculation Policy for subtraction Year 5

Mental Calculations

- **Subtract numbers mentally with increasingly large numbers.**
  E.g. 12 462 – 2300 = 10 162
- **Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy .**
- *Pupils practise adding and subtracting decimals, including a mix of whole numbers and decimals, decimals with different numbers of decimal places, and complements of 1 (for example, 1 - 0.17 = 0.83).*
- *Pupils mentally add and subtract tenths, and one-digit whole numbers and tenths.*

Basic Mental Strategies for Subtraction
- Find differences by counting up
- Partitioning
- Applying known facts
- Bridging through 10 and multiples of 10
- Subtracting 9, 11 etc. by compensating
- Counting on to, or back from the largest number
  National Curriculum 1999

Which method works best? Why? How else could we do it?

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          1734p           £  2
- 1000+200+10+ 6p        - 1216p            17.34
   500+10+ 8p              518p          - 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.

X 100
X 10
100 — Integers
10 — Money
1 — Decimals
$\frac{1}{10}$
$\frac{1}{100}$
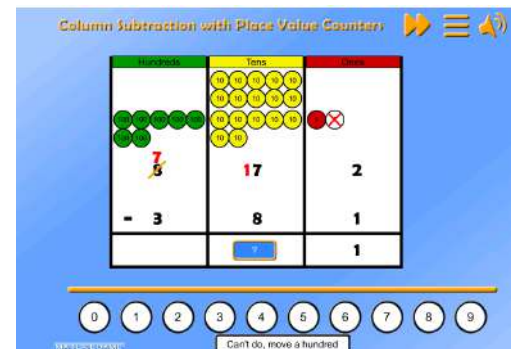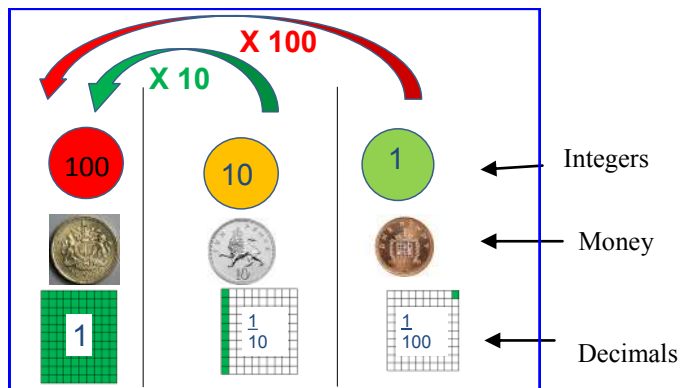
Use physical and pictorial representations to stress the place value relationships between money, decimals and whole numbers. A place value mat such as the this one could be used, moving away from the traditional: *Hundreds, tens and ones* model used in Lower KS2 and KS1.

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

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.)

Wandsworth LA Calculation Policy for subtraction Year 6

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.

Use known number facts and place value to subtract
$0.5 - 0.31 = 0.19$

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

932 – 457 becomes

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

Representations to support mental and written calculations.

Bus Timetable

How long is the journey from Oxhill to Shipston ?

$2037 - 485 = 1552$

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

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

Wandsworth LA Calculation Policy for multiplication: Year 1

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...)

> What's the sequence?

> What comes next?

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

> Plan for short daily focus sessions on number facts

Representations to support mental and written calculations.

Use a range of concrete and pictorial representations, including:

Lots of the 'same thing'

Bead Bar
12

There are 3 sweets in one bag.
How many sweets are there in 5 bags?

2 groups of 5 (5 x 2) using Numicon

4 groups of 3
3 groups of 4

Number Line

Fingers
"3" "6" "9" "12"

4 groups of 2p
2p multiplied by 4
2p x 4 = 8p

> Can I use doubling?

> Anna is counting in fives:
> 5, 10, ☐, 20, ☐, ☐, …

5   10   15

4 x 3 = 12
"4 cakes, 3 times"
4 multiplied by 3

Concrete to pictorial: counting in 5s

0   5   10   15   20   25

3 + 3 + 3 + 3 = 12
3 multiplied by 4 is 12
3 x 4 = 12

"2 strawberries 3 times"
2 x 3 = 6
2 + 2 + 2 = 6

10   13
11   14

> What do you notice about odd numbers?

Double 4 in hoops

Contextualise the mathematics:
Susie invites 6 friends to her birthday party.
How many cherries are there on the plate?
How many biscuits will we need if we eat 2 each?
There are 5 sweets for each party bag. How many sweets to I need altogether?

> How do they count? In 1s? 2s? 5s? 10s?

Links from other strands

- **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.*

Wandsworth LA Calculation Policy for multiplication: Year 2

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

> 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*

$7 \times 2 = \square$
$7 \times \square = 14$
$\square \times 2 = 14$
$\triangle \times \square = 14$

Representations to support mental and written calculations.

Use a range of concrete and pictorial representations, including:

Concrete to pictorial: counting in 10s

Groups of 10, six times
$10 \times 6 = 60$

$5 \times 4 = 20$

> I want five, four times

$4 \times 5 = 20$

> I want four, five times

> What multiplication sentences can you write with these numbers: 5, 10, 50?

Counting 5 minute intervals

5 10 15
Counting tally marks to support counting in 5s.

3 multiplied by 5 → 3 × 5
$3 + 3 + 3 + 3 + 3 =$

5×6 $? \times 5$

$1 \quad 2 \quad 3$
$10 \quad 20 \quad 30$
$1 \, 0 \times 3 = 30$

> What arrays can you make with 20 counters?

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

doubling
14
10   4
20   8

Using the **bar model** to solve problems

A book costs £5.
Rosie buys twice as many as Jim.
How much do they spend altogether?

Rosie
Jim
?
$5 \times 3 = 15$
They spend £15 altogether.

Develop an understanding of the equals sign:
$10 + 10 = 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2$
$5 + 5 + 5 + 5 = 4 + 4 + 4 + 4 + 4 + 4$

10p × 6 = 60p   Using coins:

$5 + 5 + 5$
$= 5 \times 4$
$= 20$

2p × 6 = 12p

> **Contextualise the maths:**
> Would you rather have:
> 4 packets of biscuits with 5 in each packet, or 3 packets of biscuits with 10 in each packet?
> Explain your answer.

Fractions

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

½
¼

Fact families
$4 \times 2 = 8$
$2 \times 4 = 8$
$8 \div 2 = 4 \rightarrow ½ \text{ of } 8 = 4$
$8 \div 4 = 2 \rightarrow ¼ \text{ of } 8 = 2$

Links from other strands

- **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 consttruct simple pictograms, tally charts and block diagrams**
- Measurement— coiunting 5 minute intervals on a clock face
- Place value **count in steps of 2, 3 and 5 from 0 and in tens from any number, forwards and backwards**

Wandsworth LA Calculation Policy for multiplication: Year 3

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. $57 \times 6 = (50 \times 6) + (7 \times 6) = 300 + 42 = 342$
- Children can apply these skills to solve spoken word problems too,
- Include missing number statements e.g $72 \div \square = 8$

The associative law:
$4 \times 12 \times 5 = 4 \times 5 \ 12$
$= 20 \times 12$
$= 240$

The commutative law:
$4 \times 12 = 12 \times 4$

> 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:
$8 \times 4 = 32, 4 \times 8 = 32, 32 \div 4 = 8, 32 \div 8 = 4$

Deriving related facts:
$3 \times 2 = 60, 6 \div 3 = 2, 6 \div 2 = 3$
$30 \times 2 = 60, 60 \div 3 = 20, 20 = 60 \div 3$

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

Towards the column method ...

x	20	4
6	120	24

$120 + 24 = 144$

24×6 becomes

$$\begin{array}{r} 24 \\ \times\ 6 \\ \hline 120 \\ 24 \\ \hline 144 \end{array}$$

Answer: 144

Representations to support mental and written calculations.

5×3

3 groups of 40

3×5

Using arrays

> I can see seven, eight times!

> I can see eight groups of seven!

True or false?
$4 \times 6 = 6 \times 4$

> I can use this fact family to write two multiplication sentences!

8

7   5 6

> And seven groups of eight!

> So I can use 7 x 8 to help me work out 8 x 7!

$19 \times 3 = 57$:

	10	9
3	30	27

$30 + 27 = 57$

$13p \times 3$
$= 10p \times 3 + 3p \times 3$
$= 30p + 9p$
$= 39p$

30p   9p

2 digit x 1 digit number:
e.g. $7 \times 38 = 266$

x	30	8
7	210	56

$210 + 56 = 266$

Use arrays for partitioning too

Use intelligent practice e.g.
$3 \times \square + 2 = 20$
$3 \times \square + 2 = 23$
$3 \times \square + 2 = 26$
$3 \times \square + 2 = 29$
$3 \times \square + 2 = 35$
$4 \times 5 = 10 \ \square \ 10$
$6 \ \square \ 5 = 15 + 15$
$6 \ \square \ 5 = 20 \ \square \ 10$
$8 \ \square \ 5 = 20 \ \square \ 20$
$8 \ \square \ 5 = 60 \ \square \ 20$

> I'm 3 times as tall as you. I'm 3 metres tall.

> I'm only 1 metre tall.

Three times as many

Spot the pattern!
Multiples of 2: 2 4 6 8 10 12 14 16 ....
Multiples of 4:   4   8   12   16 ....
Multiples of 8:   8   16 ....

> What's the same? what's different about these two times tables?

4×7 $? \times 4$

"I want three, four times"

$3 + 3 + 3 + 3 = 12$
$3 \times 4 = 12$

> Which is the odd one out? Why?
> 24×3
> 36×4
> 13×5
> 32×2

Fractions

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

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

½
¼

Links from other strands

- **solve problems, including missing number problems, involving multiplication, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects.**
- *The comparison of measures includes simple scaling by integers (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.*

Wandsworth LA Calculation Policy for multiplication: Year 4

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)
- apply understanding of the equals sign
- link facts within the tables (e.g. 5× is half of 10×)

> 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) based on an understanding of place value
- Use grid and expanded column methods as stepping stones alongside

> 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 multiply & 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

> I can use place value counters to model the grid method

Three ways to calculate 7 x 6:

7 x 6 = 7 x 5 + □   7 x 6 = 7 x 7 - □   7 x 6 = □ x □

Now find the answer to 6 x 9 in three different ways.

> This digit is worth 200

> This digit is worth 30

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

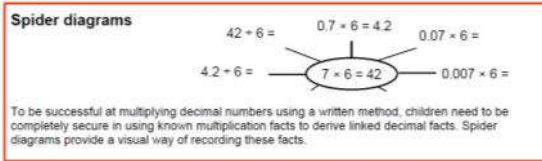Children need to understand and apply the language of multiples and factors and use it in solving multiplication and division problems e.g.
'All factors of 36 are multiples of 2, true or false?
Find me two factors of 48 that are also multiples of 3.'

Use intelligent practice e.g.

2 × 3 =	6 × 7 =	9 × 8 =
2 × 30 =	6 × 70 =	9 × 80 =
2 × 300 =	6 × 700 =	9 × 800 =
20 × 3 =	60 × 7 =	90 × 8 =
200 × 3 =	600 × 7 =	900 × 8 =

Using the bar model to solve problems:

Sam has 12 football cards.
Sally has 6 times as many football cards as Sam.
How many cards do Sally and Sam have altogether?

12 x 7 = 78
Altogether they have 78 football cards

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

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

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

Links from other strands

- **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)

Wandsworth LA Calculation Policy for multiplication: Year 5

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)**
- Use factors and multiples as connected ideas: 48 is a multiple of 6 and 6 is a factor of 48.

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

Spider diagrams

$42 \div 6 =$ $0.7 \times 6 = 4.2$ $0.07 \times 6 =$

$4.2 \div 6 =$ $7 \times 6 = 42$ $0.007 \times 6 =$

To be successful at multiplying decimal numbers using a written method, children need to be completely secure in using known multiplication facts to derive linked decimal facts. Spider diagrams provide a visual way of recording these facts.

24 x 15 = ?

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

I did: $(24 \times 10) + (24 \times 5)$.

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

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**

24×16 becomes

```
      2
    2 4
  × 1 6
  2 4 0
  1 4 4
  3 8 4
```
Answer: 384

124×26 becomes

```
    1 2
  1 2 4
  ×   2 6
  2 4 8 0
    7 4 4
  3 2 2 4
    1 1
```
Answer: 3224

124×26 becomes

```
    1 2
  1 2 4
  ×   2 6
    7 4 4
  2 4 8 0
  3 2 2 4
    1 1
```
Answer: 3224

2741×6 becomes

```
  2 7 4 1
  ×     6
  1 6 4 4 6
    4  2
```
Answer: 16 446

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.

	3000	500	60	7	
20	60000	10000	1200	140	71340
4	12000	2000	240	28	14268
				Total	85608

```
   3567
   ×24
  14268
  14268
  71340
  85608
```

What is the same and what is different about these two

$4 \times 6 \times 2 = \square \times 3 \times 4$

Complete the pyramid:

```
      108
        6
      3
    2
```

8 is a multiple of 4 and a factor of 16
6 is a multiple of 3 and a factor of □
□ is a multiple of 5 and a factor of □
□ is a multiple of □ and a factor of □

$12 \times 6 = 24 \times 3$
True or false? Prove it!

0	6	12	18	24	30	36	42	48	54	60
0	0.6	1.2	1.8	2.4	3	3.6	4.2	4.8	5.4	6

Start multiplying by 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.

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?

| 10 | 10 | 10 | 10 | 10 | Whole = 50

Two ways to calculate ¼ x 8:

What is ¼ of 8 objects? What is ¾ of 8 objects?

¼ x 8 = 8 ÷ 4 = 2
1 part = 2,
3 parts = 2 x 3
So ¾ x 8 = (8 ÷ 4) x 3 = 6

¼ X 8 = (3 X 8)/4
We find the number of ¼ s in ¾ X 8
There are 24 quarters in ¾ X 8.
That is equal to 6
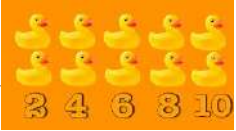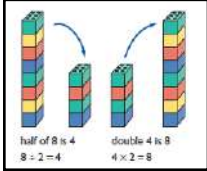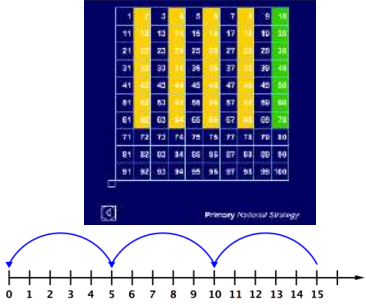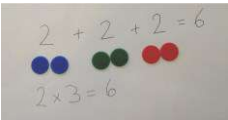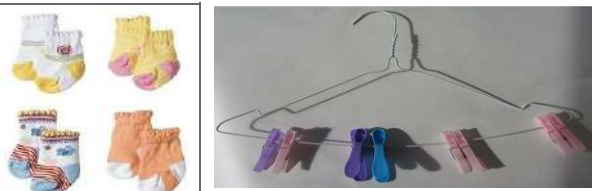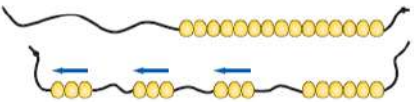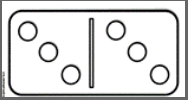
Links from other strands

- **identify multiples & factors, including finding all factor pairs of a number, & common factors of two numbers**
- **know and use the vocabulary of prime numbers, prime factors and composite (non-prime) 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.

Wandsworth LA Calculation Policy for multiplication: Year 6

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 and apply connections between factors, multiples and prime numbers and between fractions, division and ratios.

> Use mental strategies to solve problems e.g.
> - x4 by doubling and doubling again
> - x5 by x10 and halving
> - x20 by x10 and doubling
> - x9 by multiplying by 10 and adjusting
> - x6 by multiplying by 3 and doubling

> What is the best approximation for 4.4 x 18.6?

> 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?

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**
- understand that standard written multiplication method involves a number of partial products e.g. 36 × 24 is made up of four partial products 30 × 20, 30 × 4, 6 × 20, 6 × 4.
- Use manipulatives to support structure of the algorithm especially place value

```
£      6.23
x        27
      43.61
   1  2
    124.60
£    168.21
   1
```

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

> What's the same? What's different?

Using the bar model to solve problems:
A gardener plants tulip bulbs in a flower bed. She plats 3 red bulbs for every 4 white bulbs. She plants 60 red bulbs.
How many white bulbs does she plant?

> Use empty box questions:
> ☐ × ☐ = 864
> ☐ × ☐ × ☐ = 864

a —×3— b —+7— 14.5

x	8	0.4	0.06
11	88	4.4	0.66

= 93.06

```
   8.46
 X 11
 93.06
```

> Use questioning to develop conceptual understanding e.g.
> Which is the odd one out?
> 24 x 3   36 x 4   13 x 5   32 x 2

BODMAS
- $8.4 × 3 + 8.4 × 7$
- $6.7 × 5 − 0.67 × 50$
- $93 × 0.2 + 0.8 × 93$
- $7.2 × 4 + 3.6 × 8$

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. ⅕ x 15 = 3, ⅖ x 15 = 2 x ⅕ x 15 = 2x3 = 6
> - Work out how many ½s in 15, how many ⅔s in 15, how many 2/5s in 1 etc.

½   ¼

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

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

Links from other strands

- **identify common factors, common multiples and prime numbers**
- **use their knowledge of the order of operations to carry out calculations involving the four operations**
- **solve problems involving addition, subtraction, multiplication and division**
- *explore the order of operations using brackets; 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

Wandsworth LA Calculation Policy for division: Year 1

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 look for patterns.

Songs are useful for counting in steps.

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.)

half of 8 is 4   double 4 is 8
8 ÷ 2 = 4   4 × 2 = 8

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 2 people?*"

Here, the cakes are placed in an array formation.

2 + 2 + 2 = 6
2 × 3 = 6

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

Moving from concrete to pictorial, counters 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.

Bead strings

15 ÷ 2 using grouping model

Coat hangers and socks support calculation of 8÷2

"*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

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)

Wandsworth LA Calculation Policy for division: Year 2
Division and multiplication concepts must be linked continuously.

The relationship between multiplication and division must be continually considered.

Mental Calculations

- **Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers .**
- **Calculate mathematical statements for multiplication and division within**
- **the multiplication tables and write them using the**

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

$5 \times 1 = 5$
$5 \times 2 = 10$
$5 \times 3 = 15$
$5 \times 4 = 20$

$10 \div 2 = 5$

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.*)**

"There are 26 straws. ½ of the straws is equal to 13 straws."

½ of 26 = 13
26 ÷ 2 = 13

What calculations can be made using these numbers?

8
2   4

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

$7 \times 2 = 14$
$14 \div 2 = 7$

$2 \times 7 = 14$
$14 \div 7 = 2$

Is 14 an odd number? How do you know?

Odd   even

- Number lines to support grouping

Grouping ITP

10p 10p 10p 10p 10p
$10p + 10p + 10p + 10p + 10p = 50p$
$10p \times 5 = 50p$
5 hops of 10

"How many groups of 5 minutes have passed when the minute hand reaches twenty past?"

- 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

- **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).**

Wandsworth LA Calculation Policy for division: Year 3

Mental Calculations

Pupils should be taught to recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables.
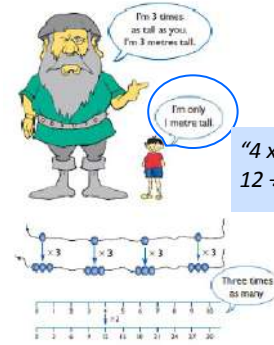
Pupils continue to practise their mental recall of multiplication tables... in order to improve fluency. Pupils develop efficient mental methods, for example, using commutativity and associativity (e.g., 4 × 12 × 5 = 4 × 5 × 12 = 20 × 12 = 240) and multiplication and division facts to derive related facts.

$36 \div 3 = 12$

30	6

$30 \div 3 = 10$ $6 \div 3 = 2$

+

"4 x 3 is 12, so 12 ÷ 3 = 4."

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 <u>Links from other strands</u>, below.)
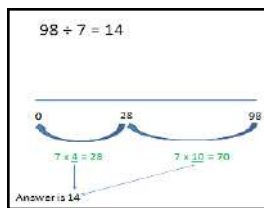
"I know 6÷3=2, so 60÷3=20."
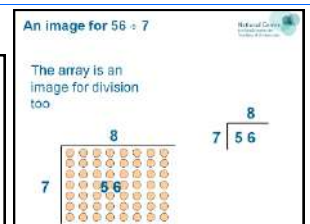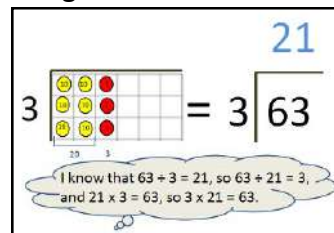"I know 12÷3=4, so 120÷3=40."

$120 \div 3$
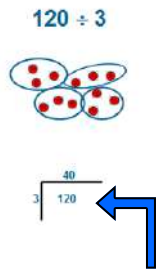
New written methods can be modelled alongside mental or informal methods to ensure understanding.

Representations to support mental and written calculations.

Use a range of concrete and pictorial resources, including:

$98 \div 7 = 14$

$7 \times 4 = 28$ $7 \times 10 = 70$

Answer is 14

63 ÷ 3 equals three groups of 2 tens and a one.

21    $3 \overline{) 63}$

I know that 63 ÷ 3 = 21, so 63 ÷ 21 = 3, and 21 x 3 = 63, so 3 x 21 = 63.

An image for 56 ÷ 7

The array is an image for division too

$7 \overline{) 56}$ = 8
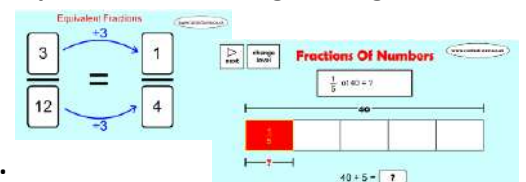
How could I calculate 72÷3 ?

Informal exploration with manipulatives supports the progression to formal written methods—which is continued in Year 4.
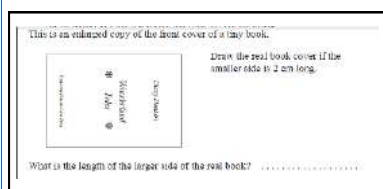
24    $3 \overline{) 72}$
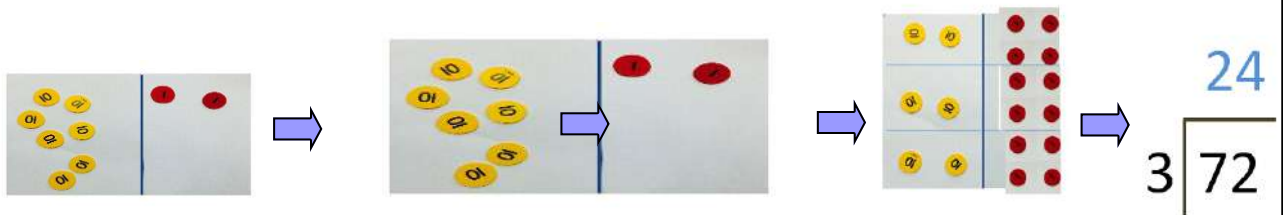
Fractions

• 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.

Equivalent Fractions

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

Fractions Of Numbers

$\frac{1}{5}$ of 40 ÷ ?

40 ÷ 5 = ?

Links from other strands

This is an enlarged copy of the front cover of a tiny book.

Draw the real book cover if the smaller side is 2 cm long.

What is the length of the larger side of the real book? ....
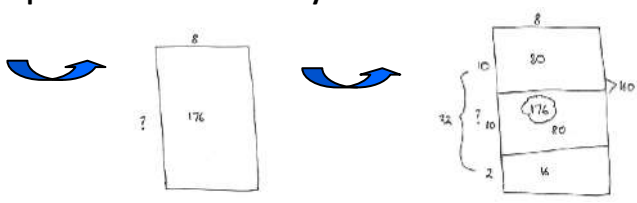
Pupils solve simple problems in contexts, including measuring and scaling contexts, (e.g., four times as high etc.) and correspondence problems.

This is the ground plan of a room.

Scale: 1 mm on the plan means 10 cm in real life.

a)   In the plan, measure the
  i)   width of the room: ....
  ii)   length of the room: ....

Wandsworth LA Calculation Policy for division: Year 4

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
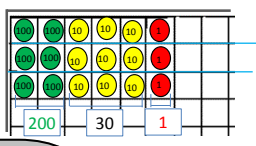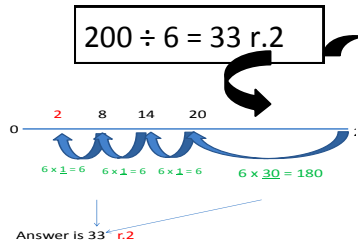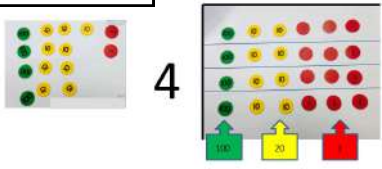
> I know that 6÷3=2, so 600÷3=2.

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

176÷8 = 22

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

Written Calculations

Pupils should be taught to:
- multiply two-digit and three-digit numbers by a one-digit number using formal written layout
- 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

2 3 1

3

200 30 1

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 exchange (re-partitioning) within division algorithms.

492 ÷ 4

1 2 3

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

0   2   8   14   20
6 x 1 = 6   6 x 1 = 6   6 x 1 = 6   6 x 30 = 180

Answer is 33 r.2

30 + 3

6

Remainder 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

- **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)**
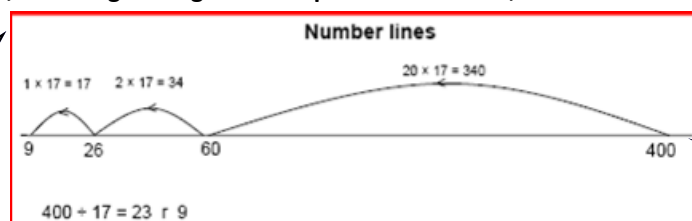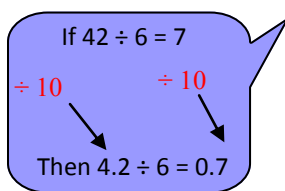
Informal methods to support mental Calculations

. 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 .

If $42 \div 6 = 7$

$\div 10$ $\div 10$

Then $4.2 \div 6 = 0.7$

Number lines

$1 \times 17 = 17$ $2 \times 17 = 34$ $20 \times 17 = 340$

9   26   60   400

$400 \div 17 = 23$ r 9

Factorising
$480 \div 15$
$= 480 \div 5 \div 3$

"I know that the answer to $138 \div 6$ will be close to 20, because $2 \times 6 = 12$, so $20 \times 6 = 120$."

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.

$98 \div 7$ becomes

1   4

7 | 9 ²8

Answer: 14

$432 \div 5$ becomes

8   6   r2

5 | 4 ³3 2

Answer: 86 remainder 2

$496 \div 11$ becomes

4   5   r1

1 1 | 4 9 ⁵6

Answer: $45\frac{1}{11}$

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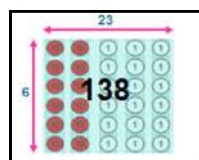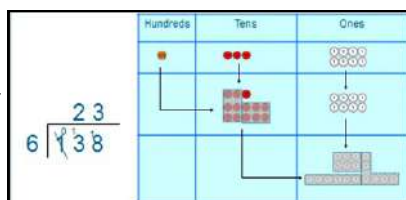
Practical experience with manipulatives is vital for children to talk through the language of division e.g. *exchange, remainder;* and to embed conceptual understanding.

Understanding remainders.

20 + 4 r. 2
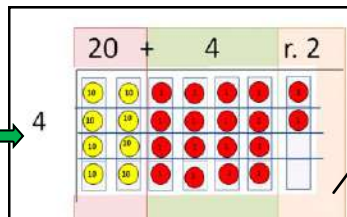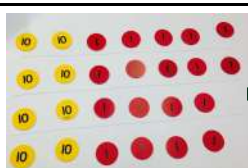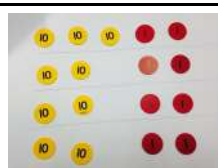
2 out of a whole group of $4 = \frac{2}{4} = \frac{1}{2} = 0.5$

$98 \div 4 = \frac{98}{4} = 24$ 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

- *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)

Wandsworth LA Calculation Policy for division: Year 6

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.

Spider diagrams

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.

What's the same? What's different?

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, $1/3 ÷ 2 = 1/6$.]
- 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.*

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

Links from other strands

- *Pupils are introduced to the division of decimal numbers by one-digit whole 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)**
- *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)*

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

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Calculation Policy References

As much as possible, the supporting images used throughout this document have been created by the Wandsworth Curriculum Development Group. Where this has not been possible, the images are referenced as follows:

Addition

- Number track www.sparklebox.co.uk (Year 1)
- Straw bundles image www.idoradesign.blogspot.com (Years 1 and 2)
- Addition with place value counters http://mathsframe.co.uk/en/resources/resource/241/Expanded_Addition_using_Place_Value_Counters (Year 5)

Subtraction

- Interactive hundred square   http://www.crickweb.co.uk/ks1numeracy.html (Year 2, subtraction)
- http://langfordmath.com/ECEMath/BasicFacts/CuisenaireAddSubText.html: http://mathsframe.co.uk/en/resources/resource/242/Column_Subtraction_using_Place_Value_Counters (Year 5)
- http://mathsframe.co.uk/en/resources/resource/24/timetable (Year 5, Links with other strands)

Multiplication

- Mumsnet.com
- Socks image www.boden.co.uk (Year 1)
- ITP Multiplication array http://www.teachfind.com/national-strategies/mathematics-itp-multiplication-array (Year 3)
- Moving digits ITP http://www.taw.org.uk/lic/itp/mov_digits.html (Years 4 and 5)
- Function machine ITP http://mathsframe.co.uk/en/resources/resource/70/itp_function_machine (Year 6)

Division

- Socks image http://www.comparestoreprices.co.uk/dolls/zapf-creation-baby-annabell-2-pairs-of-socks-759950-.asp (year 1)
- Counting by 2 song http://www.youtube.com/watch?v=hae10bsW_CM (Year 1)
- Domino doubles www.yescoloring.com   (Year 1)
- Division triangles http://www.topmarks.co.uk/Flash.aspx?f=triangularcardsv4 (Year 2)
  Clock face www.wyzant.com (Year 2)
- http://www.cimt.plymouth.ac.uk/projects/mepres/primary/pb3b_2.pdf (Links from other strands year 3)
- Fractions http://mathsframe.co.uk/en/resources/resource/144/fractions_of_numbers (Year 3)
- Arrays, Multiplication and Division article by Jennie Pennant http://nrich.maths.org/8773 (Year 4)
- Fractions ITP http://www.taw.org.uk/lic/itp/fractions.html (Year 4)
- Adding and Subtracting Fractions www.mathsframe.co.uk (Year 6, fractions)
- Factors www.teacherled.com (Year 6)

Additional Materials used throughout:

- DfE Models and images for understanding and manipulating numbers in Years 1 to 3 (2003)
- DCSF Overcoming Barriers in Mathematics (2007) Crown Copyright; materials from CD-Roms
- NCETM, images to support the teaching of the 4 operations from PD Lead Support Programme training

- NCETM Calculation Guidance for Primary Schools (2015)