SAINT JOHN'S

Saint John's Primary School

Calculation Policy

Spring 2018

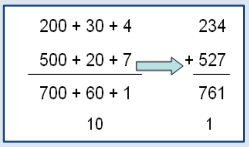
Y1 – Y6

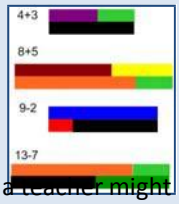
Saint John's Primary School – Calculation Policy 2018

Introduction and rationale

The Saint John's Primary School Calculation Policy has been written with the involvement of all staff to support the implementation of the new National Curriculum (2013). A document for each operation addresses what and how to teach year by year. The policy lays out expectations for both mental and written calculations (generally collated for Key Stage 1), including calculation of fractions, and includes statements from the national curriculum and supplementary guidance as below:

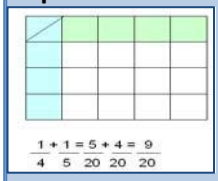
- National Curriculum statutory statements - in **bold**
- National Curriculum non-statutory guidance - in *italics*
- Additional/Supplementary guidance - plain text



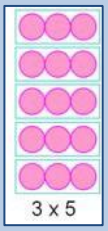


Orange boxes provide teaching guidance and tips, whilst speech bubbles denote examples either of key questions a teacher might ask or of children's thinking/ speaking. A vocabulary list is provided to encapsulate suggested vocabulary for each year group. This is not exhaustive. See 'Mathematics glossary for teachers in Key stages 1 to 3' on the NCETM https://www.ncetm.org.uk/resources/42990#glossary.

Representations



Key to successful implementation of a school calculation policy is consistent use of representations (model and images that support conceptual understanding of the mathematics) and this policy promotes a range of relevant representations, across the primary years. Mathematical understanding is developed through use of representations that are first of all concrete (e.g. Numicon, Dienes apparatus), and then pictorial (e.g. Array, place value counters) to then facilitate abstract working (e.g. Columnar addition, long multiplication). This policy guides teachers through an appropriate progression of representations, and if at any point a pupil is struggling they should revert to familiar pictorial and/or concrete materials/ representations as appropriate. Whilst a mathematically fluent child will be able to choose the most appropriate representation and procedure to carry out a calculation, whether written or mental, schools should support pupils with carefully selected representations that underpin calculation methods (as detailed in this policy), and ensure there is consistency across year groups. The 'Representations to support mental and written calculation' box on each page provides a range of models and images that underpin calculating in that year group. It is not an exhaustive collection, and applies to both mental and written calculation in most circumstances. Additional specific examples are included inside mental and written calculation boxes.



Progression in Calculation

The Saint John's Primary School calculation policy promotes particular methods and procedures with particular representations alongside to support understanding of calculation, in order to meet requirements (use of columnar methods from Year 3 onwards for all four operations, including long multiplication and long division in Year 5/6). It is recommended that schools ensure consistency in both procedure and conceptual understanding to ensure fluency and confidence with written methods. This policy guides schools in progression for each operation to ensure smooth transition. It is important that conceptual understanding, supported by the use of representations, is secure for procedures, and if at any point a pupil is struggling with a procedure, they should revert to concrete and/or pictorial resources and representations to solidify understanding.

Videos to support mathematical teaching and learning

Multiplication https://www.ncetm.org.uk/resources/40530 KS1 - Multiple Representations of Multiplication KS1- The commutative law for multiplication Lower KS2 - Grid multiplication as an interim step Upper KS2 - Moving from grid to a column	**Algebra** https://www.ncetm.org.uk/resources/43649 KS1 - Look at 'missing numbers' KS2 - Equations and substitution KS3 - Factorising*	**Number facts** https://www.ncetm.org.uk/resources/40533 KS1 - Number bonds to ten KS1 - Consolidation and practice (Addition and Subtraction) KS1 - Reinforcing Table Facts KS1 - Rapid recall of multiplication facts	**Division** https://www.ncetm.org.uk/resources/43589 KS1- Sharing and grouping KS 2 - Place value counters for division KS 3 - Group working on problems*
Number and Place value https://www.ncetm.org.uk/resources/40534 KS1 - Counting in steps of one and ten KS1 - Partitioning in different ways KS1 - Addition and Subtraction KS1 - Using resources to develop fluency and understanding KS2 - Partitioning (subtraction)	**Fractions** https://www.ncetm.org.uk/resources/43609 KS1 - Adding fractions and mixed numbers KS2 - Using an array to add fractions KS2 - Bar model dividing by fractions KS3 - Fraction wall to add fractions*	**Subtraction** https://www.ncetm.org.uk/resources/40532 Lower KS2 – Partitioning Lower KS2 - Discussing Subtraction Strategies Lower KS2 - Developing Column Subtraction Upper KS2- Column Subtraction	**Multiplicative reasoning** https://www.ncetm.org.uk/resources/43669 KS2 - Bar model for multiplication KS3 - Ratio and proportion*

*KS3 videos included for information and use to develop depth for most able pupils if appropriate.

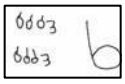
Saint John's Primary School Calculation Policy for addition: Year 1

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

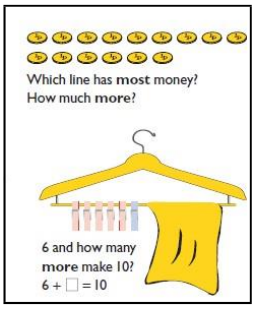
- Begin to compare (what's the same/different?) for commutative sums e.g 3 +7 = 7 + 3
- *Memorise and reason with number bonds to 10 & 20 in several forms*
- Add using objects, Numicon, cubes etc and number lines and tracks
- Check with everyday objects
- Ensure pre-calculation steps are understood,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

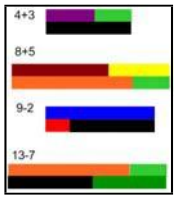


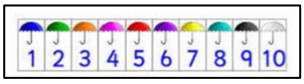
1 2 3

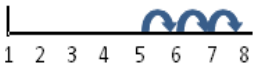
Representations to support mental and written calculations.

Use a range of concrete and pictorial representations, including:

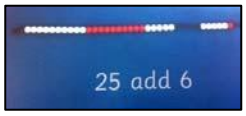








Number lines



Bead strings

Number tracks

Real everyday objects

Links from other strands

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

Saint John's Primary School 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**

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

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

Written Calculations

- **Demonstrate the commutative law of addition**

12 + 30 = 30 + 12
□ + 25 = 25 + 41

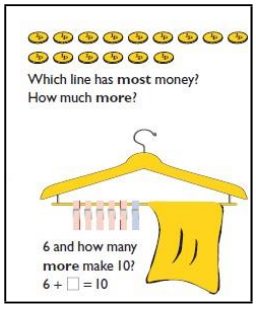
65 = 60 + 5
65 = 50 + 15
65 = 40 + 25
65 = 30 + 35
65 = 20 + 45
65 = 10 + 55

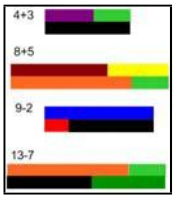
- Re-partition numbers eg.
- Use a hundred square
- *Check calculations using inverse and by adding numbers in different order*
- Using partitioning to separate tens and units, eg,

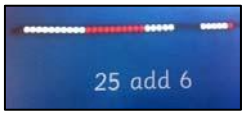
54 = 50 + 4

Representations to support mental and written calculations.

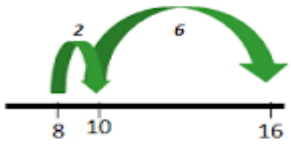
Use a range of concrete and pictorial representations, including:



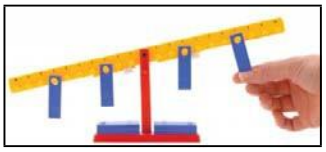


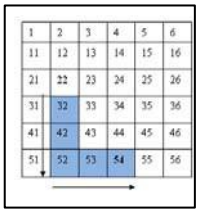


Bead strings



Number lines



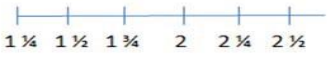


Number tracks

Real everyday objects

Fractions

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



Links from other strands / bar modelling

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

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

Saint John's Primary School 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
- Use hundred square, place value counters, number lines

Common mental calculation strategies:

Partitioning and recombining
Doubles and near doubles
Use number pairs to 10 and 100
Adding near multiples of ten and adjusting
Using patterns of similar calculations
Using known number facts
Bridging though ten, hundred

Written Calculations

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

Add to three digit numbers using physical and abstract representations;

- dienes, place value counters, empty number lines

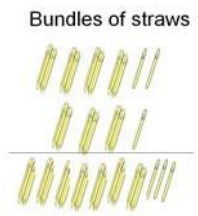
30 + 4	34
20 + 5	+25
50 + 9	59

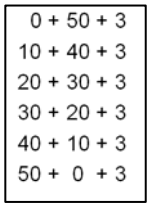
200 + 30 + 4	234
500 + 20 + 7	+ 527
700 + 60 + 1	761
10	1

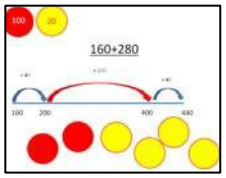
Revert to concrete representations if children find expanded/column methods difficult

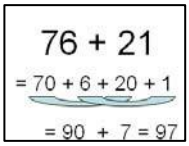
Representations to support mental and written calculations.

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





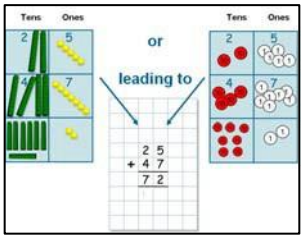




Partitioning and recombining

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

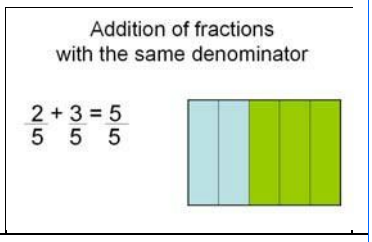
I can explain my method using representations



Dienes and place value counters

Fractions

Addition of fractions with the same denominator within one whole.



Links from other strands / bar modelling

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

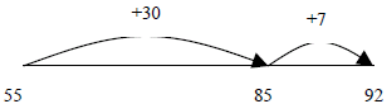
Use bar modelling to solve word problems - including missing number problems, using number facts, place value, and more complex addition

Saint John's Primary School Calculation Policy for addition: Year 4

Informal methods to support mental Calculations

Practise mental methods with increasingly large numbers

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



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

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

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

Written Calculations

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

789 + 642 becomes

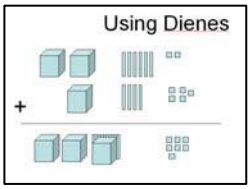
	7	8	9
+	6	4	2
1	4	3	1
	1	1	

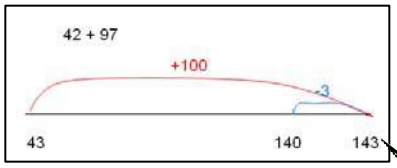
Answer: 1431

Revert to expanded methods if children find formal calculation method difficult

Representations to support mental and written calculations.

Use physical/pictorial representations alongside expanded and columnar methods.





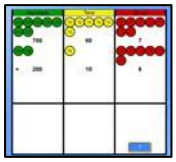
Compensating in mental addition

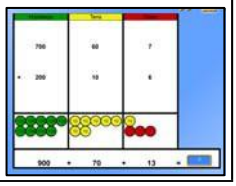
£12.32
+ £11.81
£24.13
1

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

Re-partitioning

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

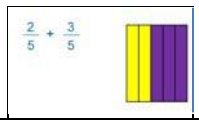




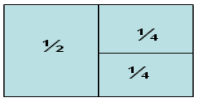
Ask what is the same and what is different about all these methods?

Fractions

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



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



Links from other strands / bar

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

Saint John's Primary School 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

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

Written Calculations

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

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

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

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

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

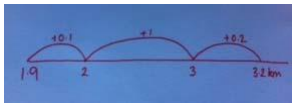
Representations to support mental and written

Use physical/pictorial representations alongside columnar methods where needed.

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

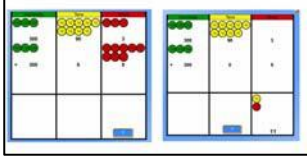
Partitioning and recombining

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



Jottings to support mental calculation

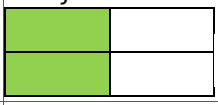
Place Value counters to support column addition



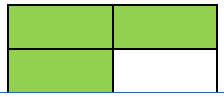
```
  393
+ 308
  1
  1
```

Fractions

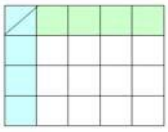
- **Add fractions with the same denominator and denominators that are multiples of the same number** *(to become fluent through a variety of increasingly complex problems and add fractions that exceed 1 as a mixed number)*



Add



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



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

Links from other strands / bar modelling

- Solve problems involving up to three decimal numbers.
- Solve addition and subtraction multi step problems in context, deciding which operations and methods to use and why
- Use all four operations to solve problems involving measure [e.g. length, mass, volume, money] using decimal notation,
- Calculate the perimeter of composite rectilinear squares in centimetres and metres
- Use angle sum facts and other properties to make deductions about missing angles
- Solve comparison, sun and difference problems using information presented in a line graph

Saint John's Primary School 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
Use compensation for adding too much/little and adjusting
Refer back to pictorial and physical representations when needed.

Common mental calculation strategies:

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

Written Calculations

Add larger numbers using the formal written (columnar) method

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

£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

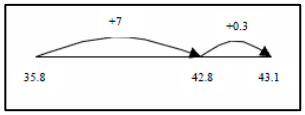
Revert to expanded methods if children find formal calculation method difficult (see Y3)

Representations to support mental and written

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

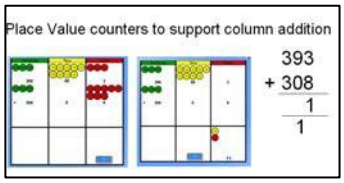
Partitioning and recombining



234 kg + 49 kg = 273 kg

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

I can explain my method using place value counters



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

Fractions

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

Links from other strands / bar modelling

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

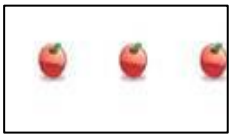
Saint John's Primary School Calculation Policy for subtraction Year 1

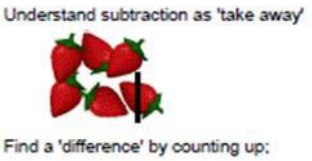
Mental Calculations

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





Written Calculations

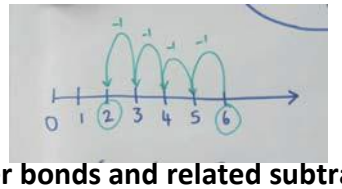
Subtract one-digit and two-digit numbers to 20, including zero.

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

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

$17 - \square = 4$

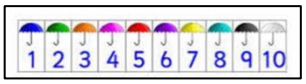
Read, write and interpret mathematical statements involving addition (+), subtraction (–) and equals (=) signs .



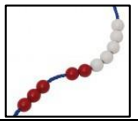
Represent and use number bonds and related subtraction facts within 20.

Representations to support mental and written calculations.

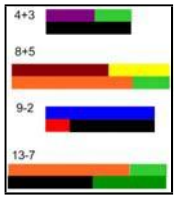
Use a range of concrete and pictorial representations, including:

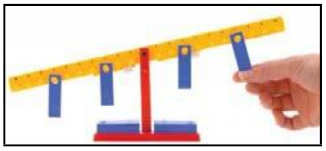


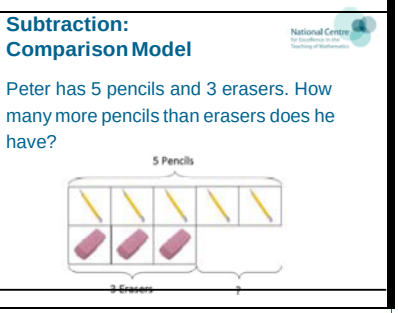
Hands, and children themselves.



Bead strings, number tracks and lines







Fractions

Counting in fractions to 1

½ + ½ = 1 or ¼ + ¼ + ¼ + ¼ = 1 or ¼ + ¼ + ½ = 1

Links from other strands / bar modelling

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

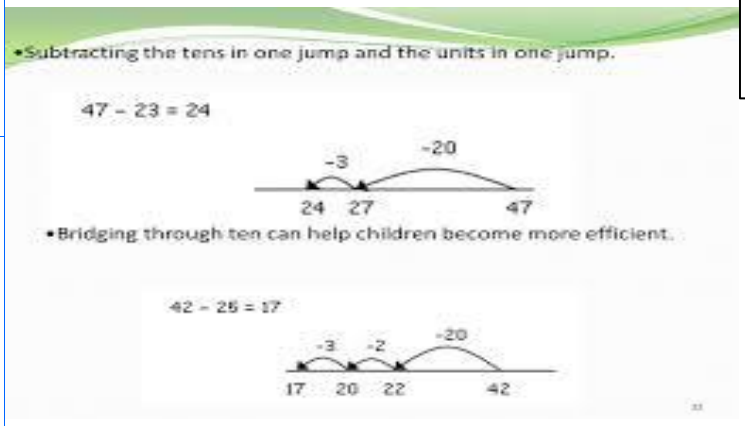
Saint John's Primary School Calculation Policy for subtraction Year 2

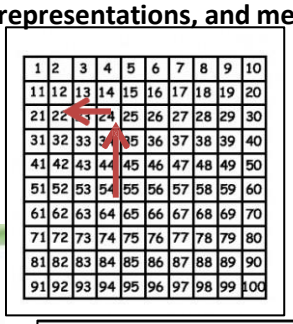
Mental Calculations

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**

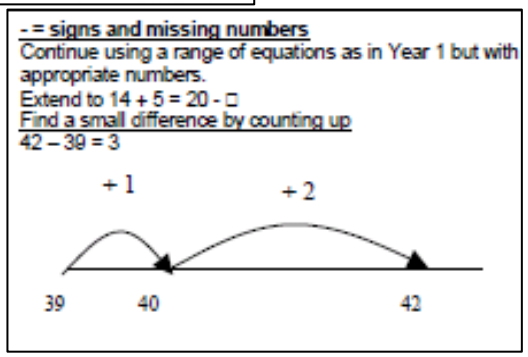
Jottings to support informal methods:





54—32 = 22

Written Calculations

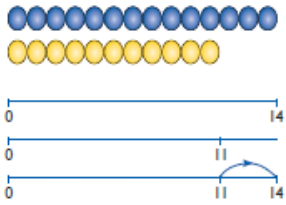


Representations to support mental and written calculations.

Informal methods to support written subtraction calculations

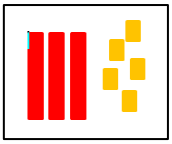
Practical portioning of a 2-digit number

In Year 1 leads to:

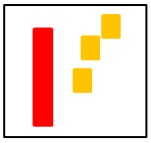


The difference between 11 and 14 is 3.
14 – 11 = 3
11 + □ = 14

Bundles of straws or dienes to represent and partition 2 digit numbers.
Subtract (without decomposition) using partitioning and equipment, e.g.



To calculate 35-22, remove 22.



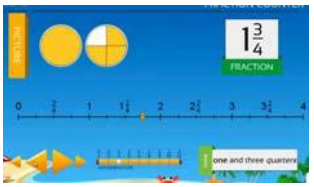
Then record: **35-22=13**.

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

Fractions

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

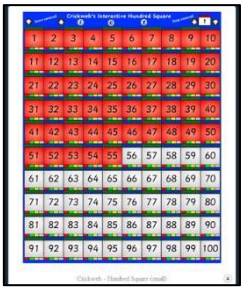
Use concrete and pictorial models of fractions to assist with counting e.g. paper cups, plates, shapes etc.



Links from other strands / bar modelling

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

Pupils should partition to support subtraction.



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

Solve problems with addition and subtraction:

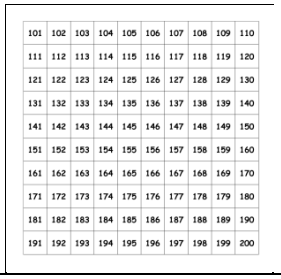
- **using concrete objects and pictorial representations, involving numbers, quantities and measures**
- **applying knowledge of mental and written methods**
- ***Pupils extend their understanding of the language of addition and subtraction to include sum and difference.***

Saint John's Primary School Calculation Policy for subtraction Year 3

Mental Calculations

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

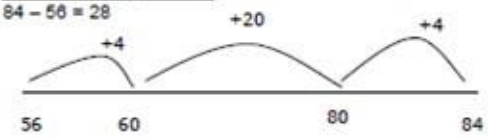
Use a number line, dienes, hundred squares, two-hundred squares, and similar representations, to support mental calculations. (See Representations section below.)



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

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

Pencil and paper procedures
Complementary addition
84 – 56 = 28



Written Calculations

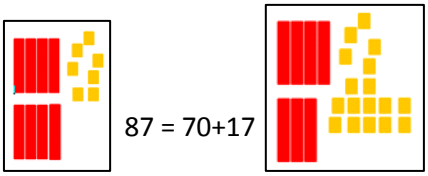
Subtract numbers with up to three digits, using formal written methods of columnar subtraction.

(1)Extended columnar - no exchange

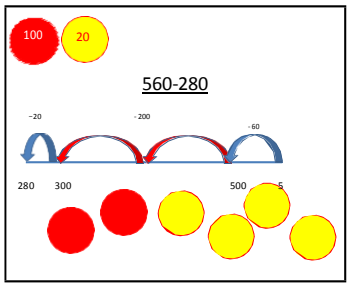
Extended method 87 - 53 =

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

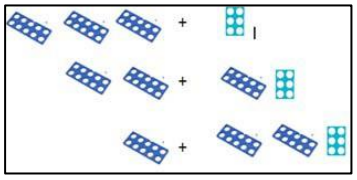
with exchange:
87-58 becomes
70 +1 7
-50 + 8
20 + 9



Representations to support mental and written calculations



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

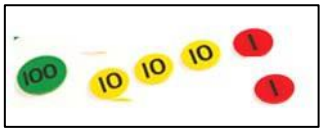


30 + 6
20 + 16
10 + 26

All of these representations still comprise the amount 36

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

132 in dienes



132 in place value counters.

Revert to concrete and expanded methods whenever difficulties arise.

Fractions

Count up and down in tenths.

Subtract fractions with the same denominator within one whole.

Links from other strands/ bar modelling

Money and calculating duration of events
For example: *"**Add and subtract amounts of money to give change, using both £ and p in practical contexts.**"*
Use bar modelling to solve word problems - including missing number problems, using number facts, place value, and more complex subtractions

Saint John's Primary School Calculation Policy for subtraction Year 4

Mental Calculations

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

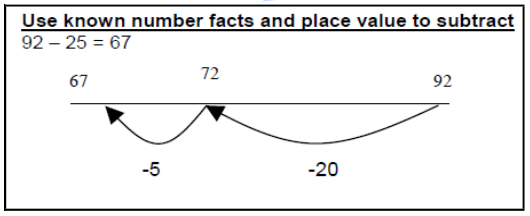
Methods to support fluent calculation and encourage efficiency of method:

- Find a small difference by counting up.

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

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

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



Written Calculations

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

Build on formal, extended method (*See Year 3)* using exchange wherever necessary.

Continue to use representations and manipulatives to develop understanding of place value.

Moving to compact methods

372—147 =

300 + 70 + 2
-100 + 40 + 7

→

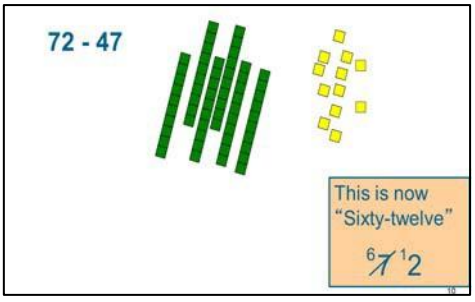
300 + 60 + 12
-100 + 40 + 7
200 + 20 + 5

→

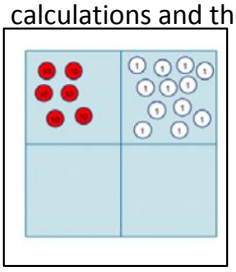
60 1
300 + 70 + 2
- 100 + 40 + 7
200 + 20 + 5

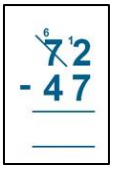
Apply understanding of subtraction with larger integers to that of decimals in context of money and measures. (See Year 5.)

Representations to support mental and written calculations.



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

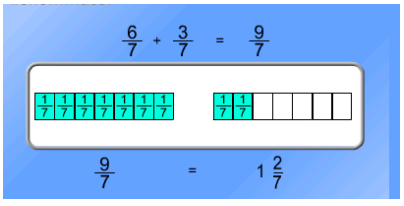




Use physical and / or pictorial representations and expanded algorithms alongside columnar methods. Ask: *What is the same? What's different?* Compare and discuss the suitability of different methods in context.
Pupils **decide which operations and methods to use and why.**

I would count on using a numberline to calculate 5003-4896 because the numbers are close together.

Fractions



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

Links from other strands / bar modelling

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

Saint John's Primary School Calculation Policy for subtraction Year 5

Mental Calculations

- **Subtract numbers mentally with large numbers**

  E.g. 12 462 – 2300 = 10 162

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

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

(for example, 1 - 0.17 = 0.83).

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

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

Which method works best?

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

Written Calculations

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

As in Year 4, compare physical and / or pictorial representations and expanded algorithms alongside columnar methods. Ask: *What is the same? What's different?*
Compare and discuss the suitability of different methods, (mental or written), in context.
Revert to expanded methods whenever difficulties arise

£17.34—£12.16

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

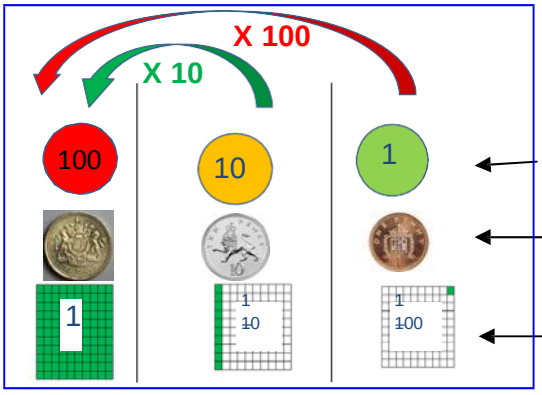
1000+700+20+14p
−1000+200+10+6p
500+10+8p

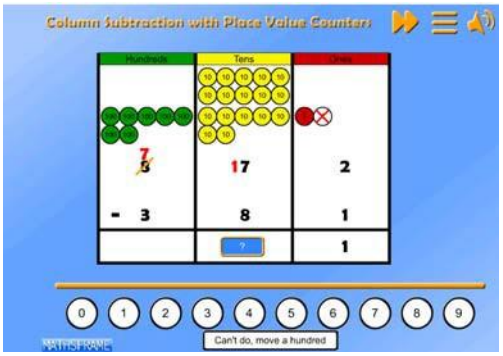
2
1734p
-1216p
518p

£ 2
17.34
-12.16
5.18

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

Representations to support mental and written calculations.





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

Fractions

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

Links from other strands/ bar modelling

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

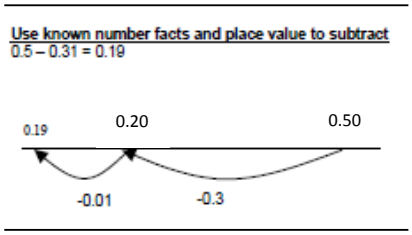
Saint John's Primary School Calculation Policy for subtraction Year 6

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.***

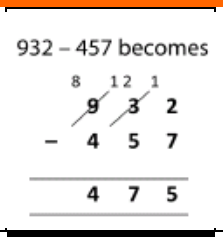
Children draw on basic, Mental subtraction Strategies, (See Year 5.)
Children use, or visualise, representation of choice.
Refer back to physical representations as required.



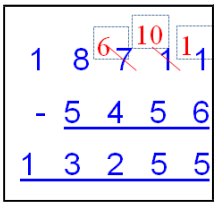
Written Calculations

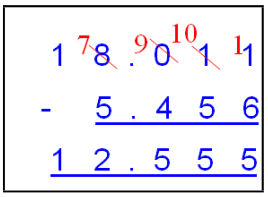
Add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction). Solve problems involving the calculation and conversions of units of measure, using decimal notation of up to three decimal places where appropriate. (MEASURES)

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



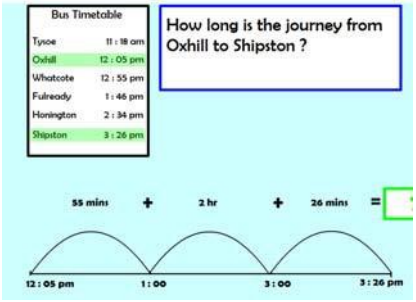
Consolidate columnar methods , paying particular attention to the occurrence of zeros as place holders.

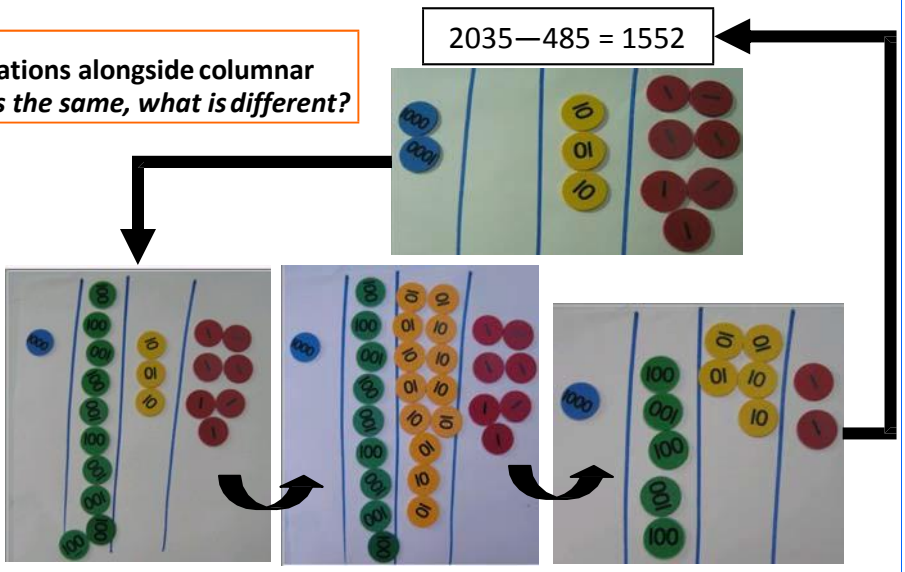




Representations to support mental and written calculations.

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





Fractions

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

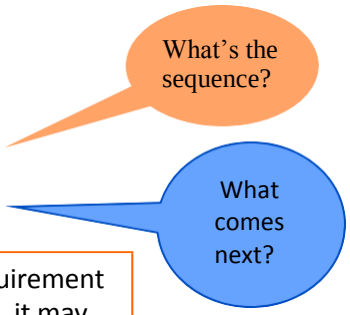
Links from other strands / bar modelling

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

Saint John's Primary School 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...)



Written Calculations

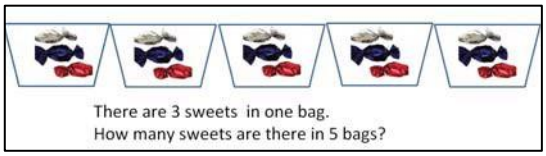
It is important to use a range of models to develop understanding of multiplication, and that children make connections between arrays, number patterns, and counting in twos, fives and tens

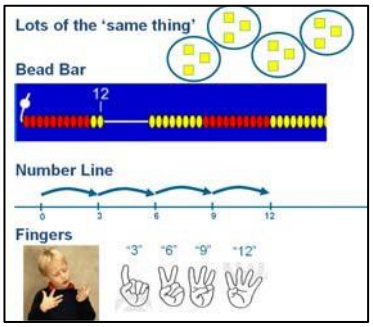
Although there is no statutory requirement for written multiplication in Year 1, it may be helpful to encourage children to begin to write it as a repeated addition sentence in preparation for Year 2

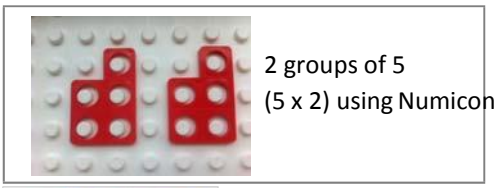
E.g. 2 + 2 + 2 + 2 = 8 or 4 x 2 = 8

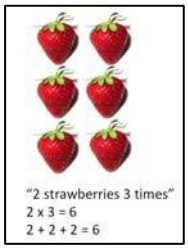
Representations to support mental and written calculations.

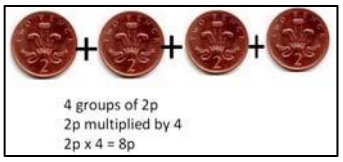
Use a range of concrete and pictorial representations, including:

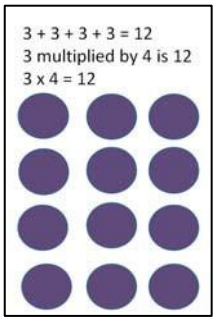


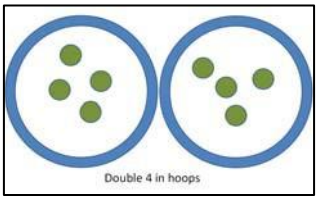


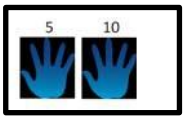












Links from other strands / bar modelling

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

Saint John's Primary School 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
- Counting in 3s – odd / even pattern

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

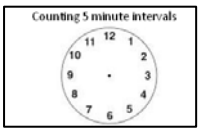
Written Calculations

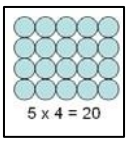
- **calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs**
- *Begin to use other multiplication tables and recall facts to perform written calculations*
- *Use a range of materials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

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

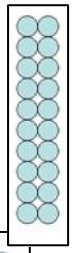
Representations to support mental and written calculations.

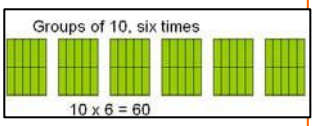
Use a range of concrete and pictorial representations, including:

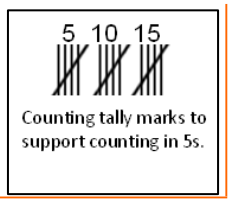


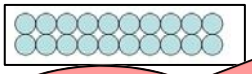


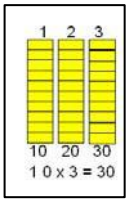
I want five, four times



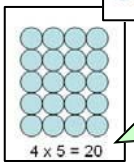




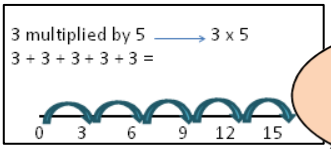




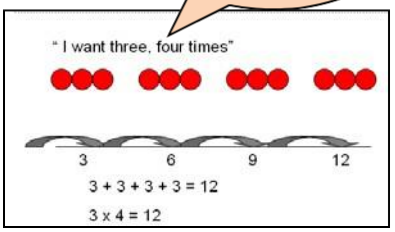
What arrays can you make with 20 counters?

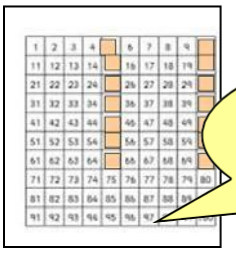


I want four, five times

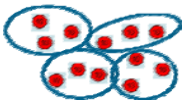


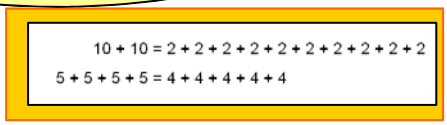
3 multiplied by 4

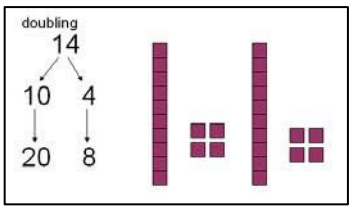




What do you notice about the numbers covered up? Is there a pattern? What number is next?







Fractions

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

Links from other strands / bar modelling

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

Saint John's Primary School 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 x 6 = (50 x 6) + (7 x 6) = 300 + 42 = 342
- Children can apply these skills to solve spoken word problems too,
- Include missing number statements e.g 72 ÷ ☐ = 8

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

The commutative law:
4 x 12 = 12 x 4

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

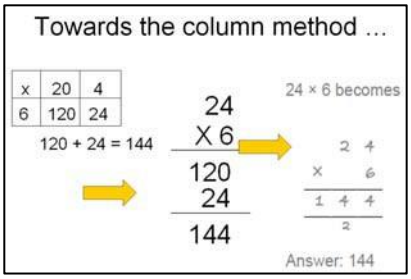
Ensure opportunities to learn multiplication tables through use of visual models, images and also rote learning.

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

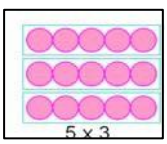
Deriving related facts:
3 x 2 = 60, 6 ÷ 3 = 2, 6 ÷ 2 = 3
➡ 30 x 2 = 60, 60 ÷ 3 = 20, 20 = 60 ÷ 3

Written Calculations

- **write and calculate mathematical statements for multiplication using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, progressing to formal written methods**
- Estimate before calculating
- Ensure written methods build on/relate to mental methods



Representations to support mental and written calculations.



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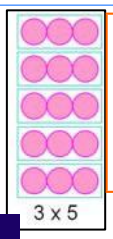
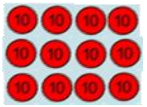
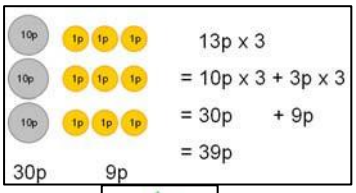




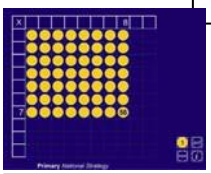
3 groups of 40

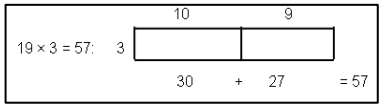


2 digit x 1 digit number:
e.g. 7 x 38 = 266

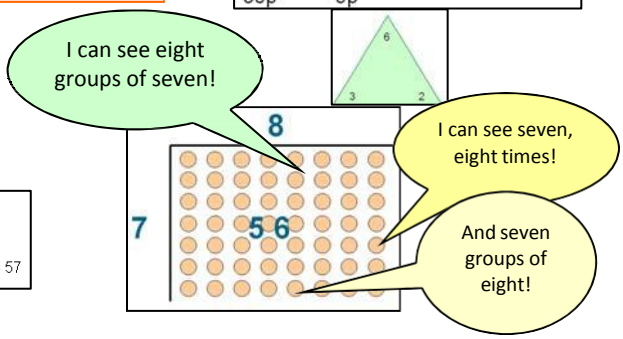
x	30	8
7	210	56

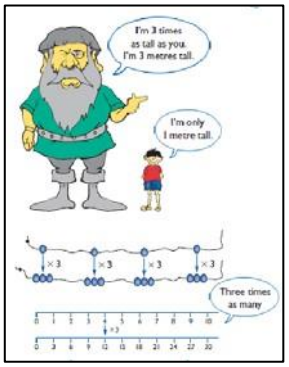
210 + 56 = 266





Use arrays for partitioning too

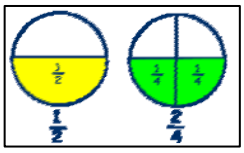




Fractions

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

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



Links from other strands / bar modelling

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

Saint John's Primary School Calculation Policy for multiplication: Year 4

Informal methods to support mental Calculations

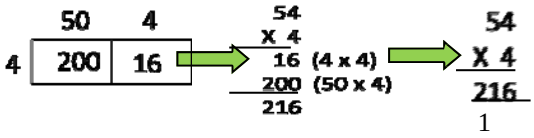
- **recall multiplication and division facts for multiplication tables up to 12 × 12**
- **use place value, known and derived facts to multiply and divide mentally, including:**
  - **multiplying by 0 and 1;**
  - **dividing by 1;**
  - **multiplying together three numbers**
- **recognise and use factor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

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

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

Written Calculations

- **multiply two-digit and three-digit numbers by a one-digit number using formal written layout**
- Estimate before calculating
- Ensure written methods build on/relate to mental methods (e.g. grid method)
- Introduce alongside grid and expanded column methods



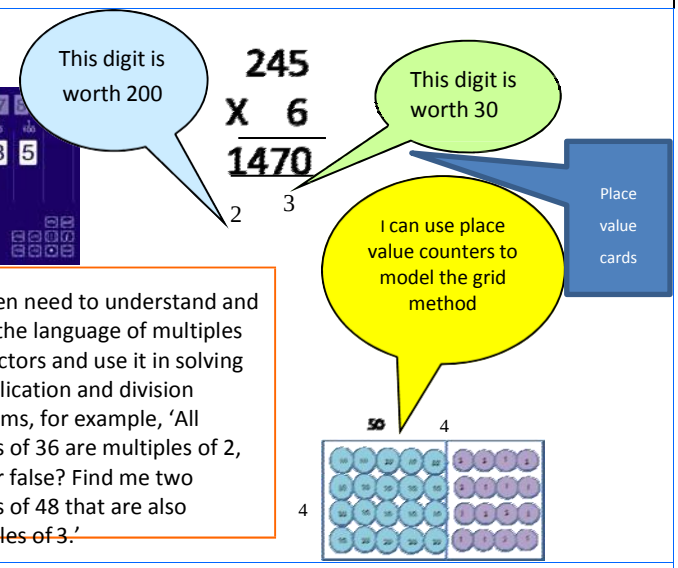
Key skills to support:
- know or quickly recall multiplication facts up to 12 × 12
- understand the effect of multiplying numbers by 10, 100 or 1000
- multiply multiples of 10, for example, 20 × 40;
- approximate, e.g. recognise that 72 × 38 is approximately 70 × 40 = 2800 and use this information to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

Revert to expanded methods if children find formal calculation method difficult

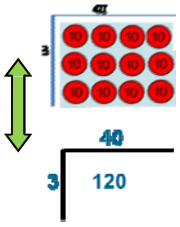
Representations to support mental and written calculations.

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

Moving digits ITP



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



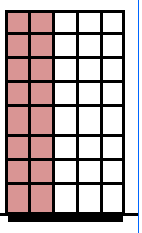
Children need to understand and apply the language of multiples and factors and use it in solving multiplication and division problems, for example, 'All factors of 36 are multiples of 2, true or false? Find me two factors of 48 that are also multiples of 3.'

Fractions

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

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

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



Links from other strands / bar modelling

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

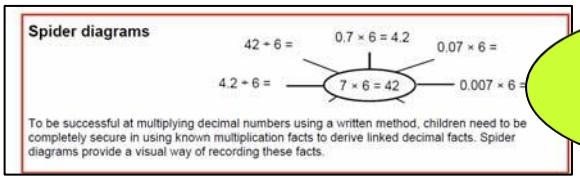
Saint John's Primary School Calculation Policy for multiplication: Year5

Informal methods to support mental Calculations

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

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

24 x 15 = ?

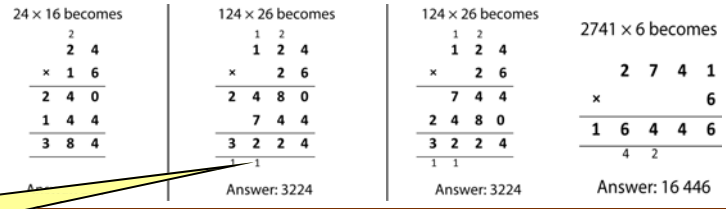


I did: 24 × 5 = 120 (half of 24 × 10), then multi-plied 120 by 3 to get 360

I did: (24 × 10) + (24 × 5).

Written Calculations

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



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

Does your answer seem reasonable?

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

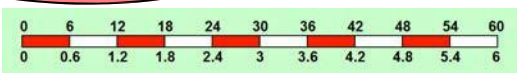
Representations to support mental and written calculations.

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

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

3567
x24
14268
71340
85608

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



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

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

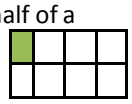
Fractions

- **multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams**
- **identify, name and write equivalent fractions of a given fraction, represented visually, including tenths and hundredths**

Pupils connect multiplication by a fraction to using fractions as operators (fractions of), and to division, building on work from previous years. This relates to scaling by simple fractions, including fractions > 1.

¼ x ½

Scaling by ½ "finding a half of a quarter"

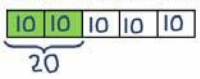


½ x ¼

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

Encourage children to draw diagrams to represent situations or problems involving fractions
Model how to do this, for example:

$\frac{2}{5}$ of a number is 20. What is the number?



Links from other strands / bar modelling

- **identify multiples & factors, including finding all factor pairs of a number, & common factors of two numbers**
- **know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers**
- **establish whether a number up to 100 is prime and recall prime numbers up to 19**
- **solve problems involving multiplication and division including using their knowledge of factors and multiples, squares and cubes, and including understanding the meaning of the equals sign**
- **solve problems involving multiplication and division, including scaling by simple fractions and problems involving simple rates**
- **use all four operations to solve problems involving measure [for example, length, mass, volume, money] using decimal notation, including scaling.**
- **convert between different units of metric measure; problems including money,.**

Other links: ratio,

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

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

Pupils calculate the area from scale drawings using given measurements.

Saint John's Primary School 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 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

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

Children should know the square numbers up to 12 × 12 & derive the corresponding squares

of multiples of 10 e.g. 80 × 80 = 6400

What is the best approximation for 4.4 x 18.6?

Written Calculations

- **multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication** *(short & long multiplication)*
- **multiply one-digit numbers with up to two decimal places by whole numbers**

£	6.23
x	27
	43.61
	124.60
£	168.21

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

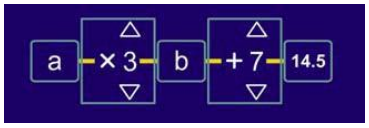
Representations to support mental and written calculations.

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

x	8	0.4	0.06	
11	88	4.4	0.66	= 93.06

8.46
X 11
93.06

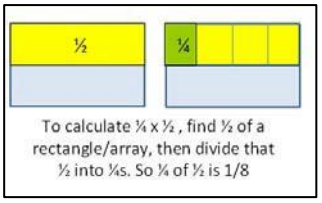
What's the same? What's different?



Fractions

- **multiply simple pairs of proper fractions, writing the answer in its simplest form e.g. ¼ x ½ = 1/8**

Three key applications of understanding:
- Recognise that ¼ of 12, ¼ x 12 and 12 divided by 4 are equivalent
- Use cancellation to simplify the product of a fraction and an integer e.g. ⅓ x 15 = 3, ⅗ x 15 = 2 x ⅓ x 15 = 2x3 = 6
- Work out how many ⅓s in 15, how many ⅗s in 15, how many 2/5s in 1 etc.



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

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

Links from other strands / bar modelling

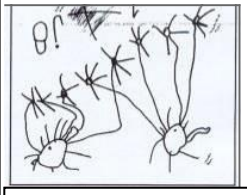
- **identify common factors, common multiples and prime numbers**
- **use their knowledge of the order of operations to carry out calculations involving the four operations**
- **solve problems involving addition, subtraction, multiplication and division**
- *explore the order of operations using brackets;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

Saint John's Primary School Calculation Policy for division: Year 1

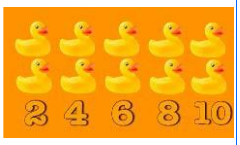
Mental Calculations

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.

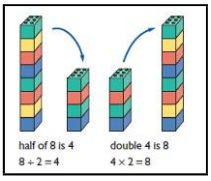


Count on or back in 2s, 5s and 10s and useful look for patterns.

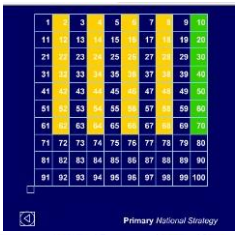


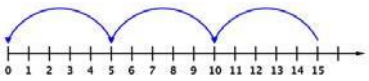
Written Calculations

Pictorial jottings to support the calculation of 8 ÷ 4



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





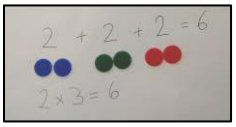
The relationship between multiplication and division must be continually considered.

Representations to support mental and written calculations.

Use a range of concrete and pictorial representations, including:

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

"*How can we share 6 cakes between 3 people?*



Here, the cakes are placed in an array formation.

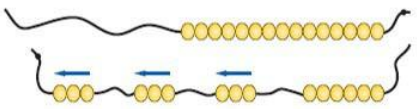
How many 2 tiles can we fit on the 6 tile?

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

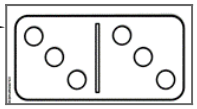
- Manipulatives, and real-life objects to support children's own recording; and understanding of *grouping* and the link with multiplication.

Coat hangers and socks support calculation of 8÷2

Bead strings



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



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

Fractions

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

Links from other strands / bar modelling

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

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

Saint John's Primary School 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, 10, 3s multiplication tables, including recognising odd and even numbers .**
- **Calculate mathematical statements for multiplication and division within**
- **the multiplication tables and write them using the multiplication (x), division (÷) and equals (=) signs**

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

Written Calculations

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

½ of 26 = 13
26 ÷ 2 = 13

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

Representations to support mental and written calculations.

Use a range of concrete and pictorial representations, including:

- Arrays

7 x 2 = 14 2 x 7 = 14

14 ÷ 2 = 7 14 ÷ 7 = 2

Is 14 an odd number?
How do you know?

- Number lines to support grouping

How many groups of 5 minutes have passed when the minute

Representations to support multiplicative reasoning:

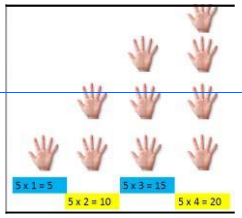
Using Dienes: "*If 40 ÷ 10 = 4 and 30 ÷ 10 = 3, what do you think 70 ÷ 10 would be? Why?*"

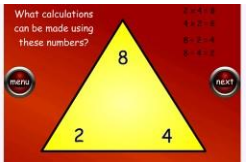
Fractions

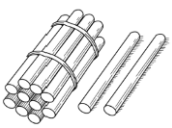
Recognise, find, name and write fractions ⅓, ¼, ¾, 2/4 of a length, shape, set of objects or quantity Write simple fractions for example, ½ of 6 = 3 and recognise the equivalence of ½ and 2/4.

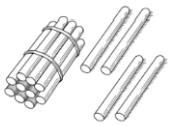
Links from other strands / bar modelling

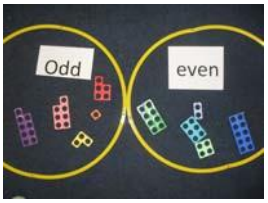
- **Count in steps of 2, 3, and 5 from 0, and in tens from any number, forward and backward.**
- **Recognise the place value of each digit in a two-digit number (tens, ones) (PLACE VALUE).**
- **Tell and write the time to five minutes, including quarter past/to the hour and draw the hands on a clock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

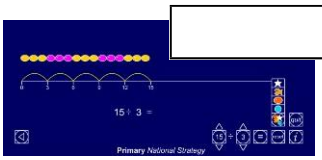


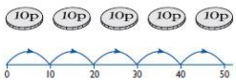




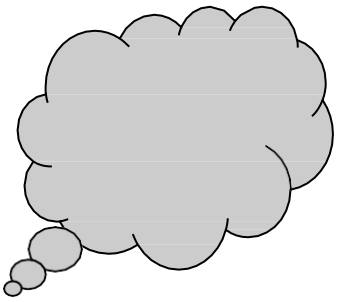


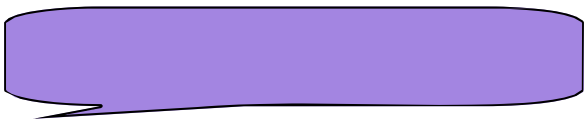






10p + 10p + 10p + 10p + 10p = 50p
10p × 5 = 50p
5 hops of 10





Saint John's Primary School 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.

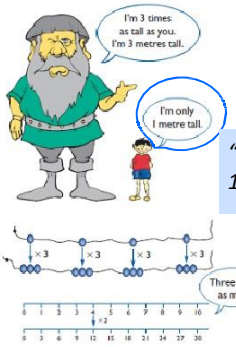
Pupils continue to practise their mental recall of multiplication tables... in order to improve fluency.
Pupils develop efficient mental methods, for example, using commutativity and associativity (e.g., 4 × 12 × 5 = 4 × 5 × 12 = 20 × 12 = 240) and multiplication and division facts to derive related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

36 ÷3 = 12

30 6

30 ÷3=10 6 ÷3=2

+



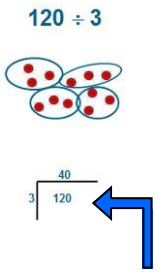
"4 x 3 is 12, so 12 ÷ 3 = 4."

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 Links from other strands, below.)

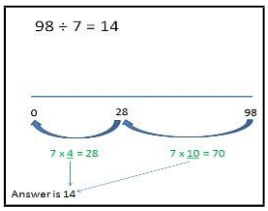
"I know 6÷3=2, so 60÷3=20."
"I know 12÷3=4, so 120÷3=40."



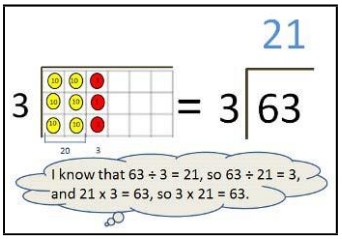
New written methods can be modelled alongside mental or informal methods to ensure understanding.

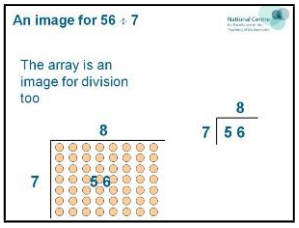
Representations to support mental and written calculations.

Use a range of concrete and pictorial resources, including:



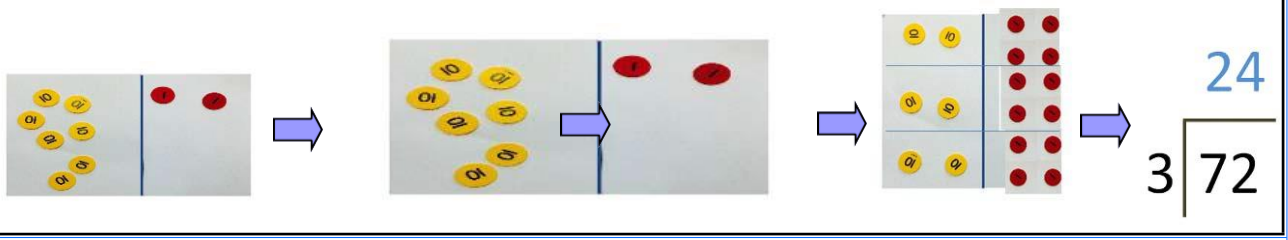
63 ÷ 3 equals three groups of 2 tens and a one.





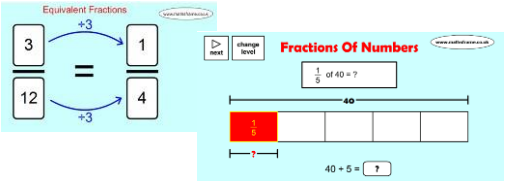
How could I calculate 72÷3 ?

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



Fractions

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



Links from other strands / bar modelling

Solving fraction of amount word problems – including simple equivalents

Solve problems, including missing number problems division,

Saint John's Primary School Calculation Policy for division: Year 4

Informal methods to support mental Calculations

Pupils should be taught to:

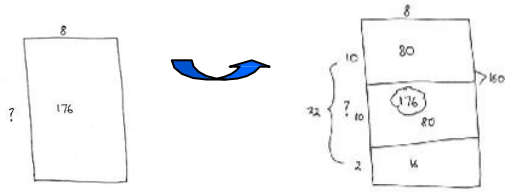
- **recall multiplication and division facts for multiplication tables up to 12 × 12**
- **use place value, known and derived facts to multiply and divide mentally,**

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:

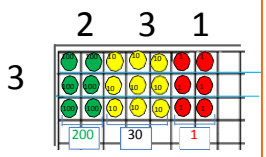
- **solve problems involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects.**
-

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

Revert to expanded methods if children find formal calculation method difficult

Representations to support mental and written calculations.

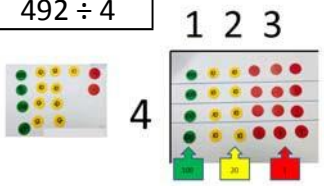
693 ÷ 3



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

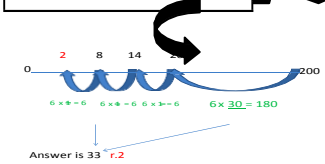
By working through larger number calculations with manipulatives, children gain experience of ex-change (re-partitioning) within division algorithms.

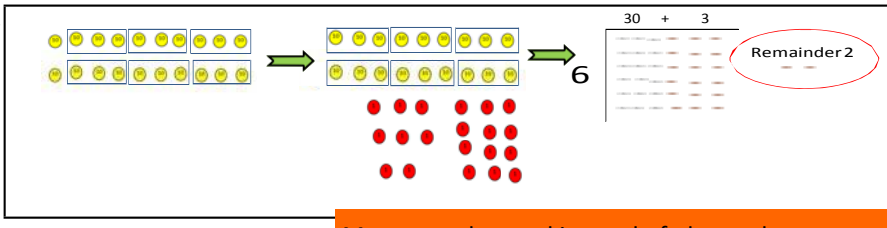
492 ÷ 4



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

200 ÷ 6 = 33 r.2



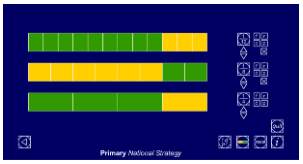


Money can be used instead of place value counters.

Fractions

Pupils should be taught to:

- ***recognise and show, using diagrams, families of common equivalent fractions***
- ***recognise that hundredths arise when dividing an object by one hundred and dividing tenths by ten.***
- ***solve problems involving increasingly harder fractions to calculate quantities, and fractions to divide quantities, including non-unit fractions where the answer is a whole number***
- ***find the effect of dividing a one- or two-digit number by 10 and 100, identifying the value of the digits in the answer as ones, tenths and hundredths***



Links from other strands / bar modelling

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

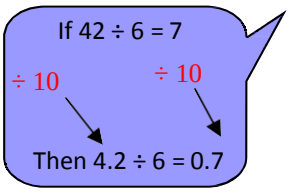
Saint John's Primary School Calculation Policy for division: Year 5

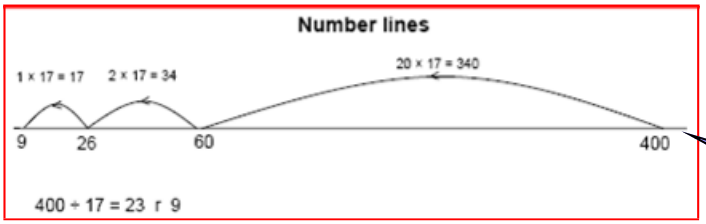
Informal methods to support mental Calculations

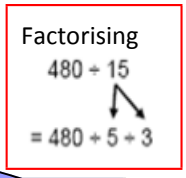
. Pupils should be taught to:

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

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







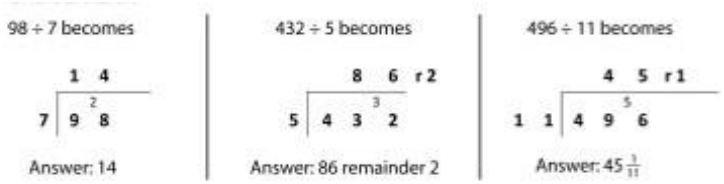
"I know that the answer to 138 ÷ 6 will be close to 20, because 2 x 6 = 12, so 20 x 6 = 120."

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

Written Calculations

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

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



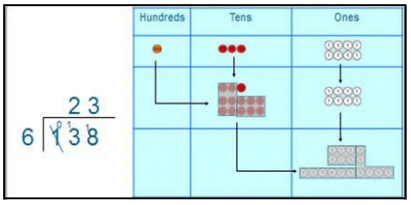
- **Pupils interpret non-integer answers to division by expressing results in different ways according to the context, including with remainders, as fractions, as decimals or by rounding. (See Representations below.)**

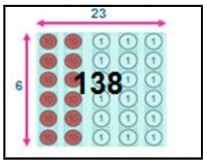
Revert to expanded methods if children find formal calculation method difficult

Representations to support mental and written calculations.

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

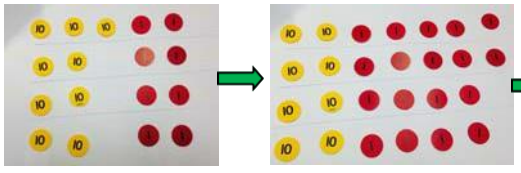
Short division with exchange.

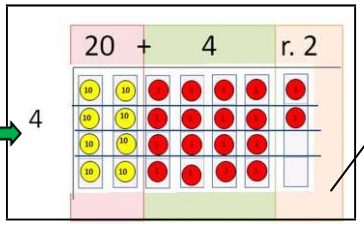




Practical experience with manipulatives is vital for children to talk through the language of division e.g. *exchange, remainder*; and to embed conceptual understanding.

Understanding remainders.





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

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

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

Fractions

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

Links from other strands / bar modelling

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

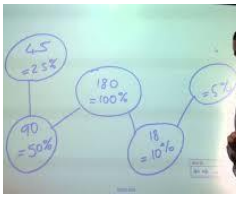
- **establish whether a number up to 100 is prime and recall prime numbers up to 19**
- **recognise and use square numbers and cube numbers, and the notation for squared (2) and cubed (3)**
- **solve problems involving multiplication and division including using their knowledge of factors and multiples,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

Saint John's Primary School Calculation Policy for division: Year 6

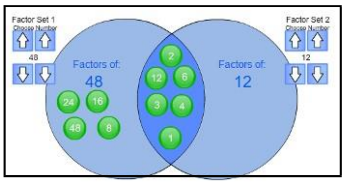
Informal methods to support mental Calculations

.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.



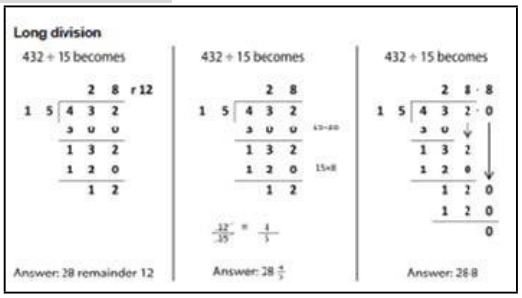
I know that 366 will divide by 6 because it has 2 and 3 as factors



- 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.

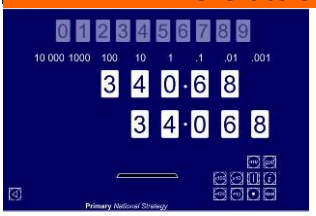
Written Calculations

- 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.*



Revert to expanded methods if children find formal calculation method difficult

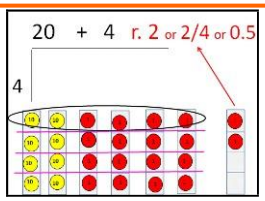
Representations to support mental and written calculations.

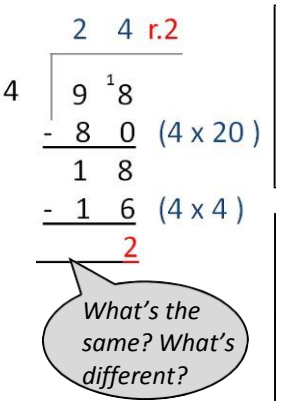


To introduce the long division model, use a calculation which can be represented both with manipulatives and by a short division algorithm. Use questioning and discussion to compare written methods.

£1362.72 ÷ 40 = ?

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



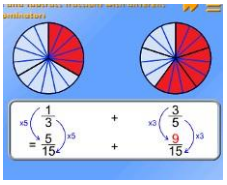


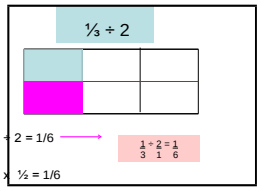
Fractions

- use common factors to simplify fractions,
- compare and order fractions, including fractions > 1
- add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions
- divide proper fractions by whole numbers [for example, 1/3 ÷2 = 1/6 and by fractions – 2/3 ÷1/3
- associate a fraction with division and calculate decimal fraction equivalents [for example, 0.375.]
- *Pupils use their understanding of the relationship between unit fractions and division to work backwards*

Use written division methods in cases where the answer has up to 2 dp.

Multiply mixed number fractions - 2 ¼ x 4





Links from other strands

- *Pupils are introduced to the division of decimal numbers by one-digit whole number, initially, in practical contexts involving measures and money. They recognise division as the inverse of multiplication.*
- *Pupils also develop their skills of rounding and estimating. This includes rounding answers to a specified degree of accuracy and checking the reasonableness of their answers. (FRACTIONS)*

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

- *solve problems involving the calculation and conversion of units of measure, using decimal notation up to three decimal places where appropriate.*
- *use, read, write and convert between standard units….using decimal notation to up to 3d.p. (MEASURES)*
- *interpret and construct pie charts and line graphs and use these to solve problems*
- *calculate and interpret the mean as an average. (STATISTICS)*
- *solve problems involving the relative sizes of two quantities where missing values can be found by using integer multiplication and division facts (RATIO AND PROPORTION)*

Calculation Policy References

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 • 'Thinking blocks' – website and ipad app for bar modelling, fractions and word problems • Mathinenglish – for missing digits in long multiplication and long division