

St Thomas More's Catholic Primary School



Calculation Policy 2019

***Ensuring
SUCCESS***

***Providing
OPPORTUNITY***

***Fostering
STEWARDSHIP***

Introduction and Rationale

This policy lays out expectations for both mental and written calculations, including calculation of fractions and includes statements from the national curriculum and supplementary guidance. There is a document for each operation which addresses what and how to teach year by year. 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 at:

<https://www.ncetm.org.uk/files/19226855/National+Curriculum+Glossary.pdf>

Representations

Key to successful implementation of a school calculation policy is consistent use of representations (models and images that support conceptual understanding of the mathematics). This policy promotes a range of relevant representations that are first of all concrete (e.g. Numicon, Dienes apparatus, place value counters etc), 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. While a mathematically fluent child will be able to choose the most appropriate representation and procedure to carry out a calculation, whether written or mental, teachers 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

It is important that teachers ensure consistency in both procedure and conceptual understanding to ensure fluency and confidence in written methods. This policy guides teachers 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>

Number and Place value

<https://www.ncetm.org.uk/resources/40534>

Algebra

<https://www.ncetm.org.uk/resources/43649>

Fractions

<https://www.ncetm.org.uk/resources/43609>

Number facts

<https://www.ncetm.org.uk/resources/40533>

Division

<https://www.ncetm.org.uk/resources/43589>

Subtraction

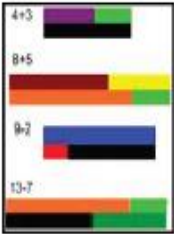
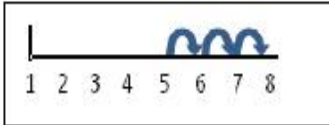
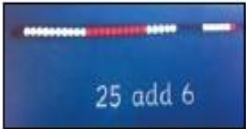
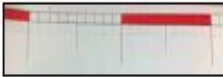
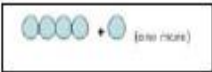
<https://www.ncetm.org.uk/resources/40532>

Multiplicative reasoning

<https://www.ncetm.org.uk/resources/43669>

St Thomas More's Catholic Primary School Calculation Policy for addition: Year 1

Addition and subtraction concepts must be linked continuously.

Mental Calculation	○ 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 $7 + \square = 9$ ○ Given a number, identify (and use the language) one more
Written Calculation	• <i>Begin to compare (what's the same/different?) for commutative sums e.g. $3 + 7 = 7 + 3$</i> • <i>Memorise and reason with number bonds to 10 & 20 in several forms</i> • <i>Add using objects, Numicon, cubes etc and number lines and tracks</i> • <i>Check with everyday objects</i> • <i>Ensure pre-calculation steps are understood, including:</i> ○ <i>Counting objects (including solving simple concrete problems)</i> ○ <i>Conservation of number:</i> ○ <i>Recognise place value in numbers beyond 20</i> ○ <i>Counting as reciting and as enumerating</i>
Representations to support Mental and written calculations	Use a range of concrete and pictorial representations, including:      Number lines     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.

St Thomas More's Catholic Primary School Calculation Policy for addition: Year 2

Addition and subtraction concepts must be linked continuously.

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

- a two-digit number and ones $17 + 2 = 19$ $12 + 4 = 16$
- a two-digit number and tens $57 + 2 = 59$ $32 + 34 = 66$
- two two-digit numbers
- adding three one-digit numbers

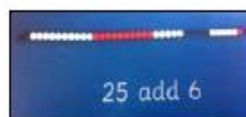
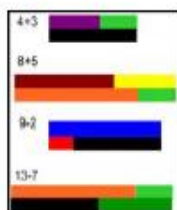
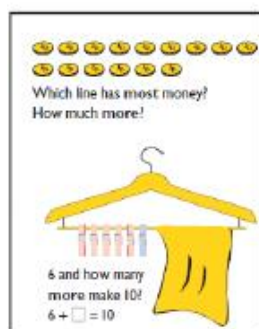
- Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100

- Demonstrate the commutative law of addition $12 + 30 = 30 + 12$
- Re-partition numbers e.g. $\square + 25 = 25 + 41$
- Use a hundred square
- Check calculations using the inverse and by adding numbers in different order
- Begin to record addition in columns to support place value and prepare for formal written methods with larger numbers.

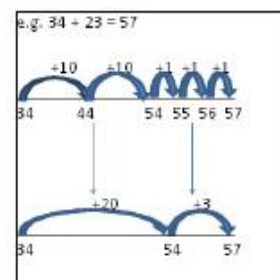
$$\begin{array}{r} 30 + 4 \\ 20 + 5 \\ \hline 50 + 9 \end{array}$$

$$\begin{array}{l} 65 = 60 + 5 \\ 65 = 50 + 15 \\ 65 = 40 + 25 \\ 65 = 30 + 35 \\ 65 = 20 + 45 \\ 65 = 10 + 55 \end{array}$$

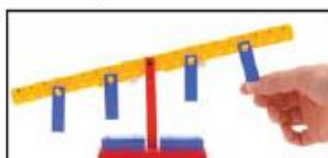
Use a range of concrete and pictorial representations, including:



Bead strings



Number lines



Real everyday objects



Number tracks

Counting in fractions up to 10, starting from any number and using the $\frac{1}{2}$ and $\frac{2}{4}$ equivalence on the number line.



- Solve problems:
 - Using concrete objects, pictorial representations (numbers, quantities & measures)
 - Applying increasing knowledge of mental & written methods
 - Partition numbers in different ways
 - Discuss and solve problems that emphasise the value of each digit in two-digit numbers
- (They should) develop the concept of addition and subtraction and ...use these operations flexibly.

St Thomas More's Catholic Primary School Calculation Policy for addition: Year 3

Addition and subtraction concepts must be linked continuously.

Mental calculation

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 straws, base 10, place value counters, empty number lines.

Common mental calculation strategies:

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

Written calculations

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

Add two three digit numbers using physical and abstract representations (e.g. straws, dienes, place value counters, empty number lines)

- raws, dienes, place value counters, empty number lines)

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

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

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

Representations to support mental and written calculations

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

Bundles of straws

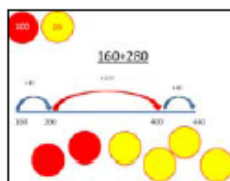


$$42 + 31 = 73$$

$$\begin{array}{r} 76 + 21 \\ = 70 + 6 + 20 + 1 \\ = 90 + 7 = 97 \end{array}$$

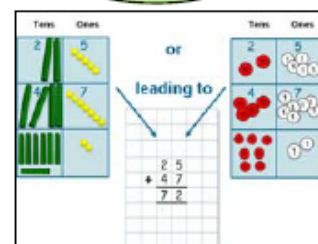
Partitioning and recombining

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



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

Addition of fractions with the same denominator

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



Links from other

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)

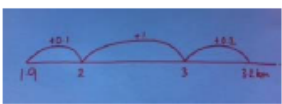
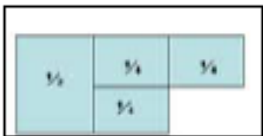
St Thomas More's Catholic Primary School Calculation Policy for addition: Year 4

Addition and subtraction concepts must be linked continuously.

Mental calculation	Practise mental methods with increasingly large numbers Consolidate partitioning and re-partitioning Use compensation for adding too much/little and adjusting Use straws, Dienes, place value counters, empty number lines etc. $55 + 37 = 55 + 30 + 7$ $= 85 + 7$ $= 92$ I know that $63 + 29$ is the same as $63 + 30 - 1$ Common mental calculation strategies: Partitioning and recombining Doubles and near doubles Use number pairs to 10 and 100 Adding near multiples of ten and adjusting Using patterns of similar calculations Using known number facts Bridging through ten, hundred Complementary addition															
Written calculation	Add numbers with up to four digits, using the formal written (columnar) method Include decimal addition for money $789 + 642$ becomes <table><tr><td>7</td><td>8</td><td>9</td></tr><tr><td>+</td><td>6</td><td>4</td><td>2</td></tr><tr><td>1</td><td>4</td><td>3</td><td>1</td></tr><tr><td>1</td><td>1</td><td></td><td></td></tr></table> Answer: 1431	7	8	9	+	6	4	2	1	4	3	1	1	1		
7	8	9														
+	6	4	2													
1	4	3	1													
1	1															
Representations to support mental and written calculations	Use physical/pictorial representations alongside expanded and columnar methods. Bundles of straws Using Dienes $42 + 31 = 73$ Compensating in mental addition $£12.32 + £11.81 = £24.13$ 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 $\frac{2}{5} + \frac{3}{5}$ $\frac{1}{2} + \frac{2}{4} = \frac{2}{4} + \frac{2}{4} = 1$ $\frac{1}{2} + \frac{1}{4} = \frac{3}{4}$															
Links from other	- 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 of money in £ and p (including fractions and decimals)															

St Thomas More's Catholic Primary School Calculation Policy for addition: Year 5

Addition and subtraction concepts must be linked continuously.

Calculation	Informal methods to support Mental 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 representations of choice 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 Calculation Add whole numbers with more than four digits, using the formal written (columnar) method Include decimal addition for money.	Numbers to exceed 4 digits <table><tr><td>2</td><td>3</td><td>4</td><td>3</td><td>2</td></tr><tr><td>+</td><td>1</td><td>6</td><td>4</td><td>5</td></tr><tr><td>2</td><td>5</td><td>0</td><td>7</td><td>7</td></tr><tr><td></td><td>1</td><td></td><td></td><td></td></tr></table> <table><tr><td>£</td><td>1</td><td>9</td><td>5</td><td>0</td></tr><tr><td>+</td><td></td><td>6</td><td>4</td><td>5</td></tr><tr><td>£</td><td>2</td><td>5</td><td>9</td><td>5</td></tr><tr><td></td><td>1</td><td></td><td></td><td></td></tr></table> Ensure that children are lining up their columns correctly. The decimal point never moves. A zero can be used as a place holder for empty decimal places <table><tr><td>2</td><td>2</td><td>0</td><td>5</td></tr><tr><td></td><td>2</td><td>3</td><td>2</td></tr><tr><td>+</td><td>0</td><td>9</td><td>0</td></tr><tr><td>2</td><td>5</td><td>2</td><td>7</td></tr><tr><td></td><td>1</td><td></td><td></td></tr></table>	2	3	4	3	2	+	1	6	4	5	2	5	0	7	7		1				£	1	9	5	0	+		6	4	5	£	2	5	9	5		1				2	2	0	5		2	3	2	+	0	9	0	2	5	2	7		1		
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Calculation	Representations to support mental and written Use physical/pictorial representations alongside columnar methods where needed.	$\begin{aligned} 12\,462 + 2300 \\ = 12\,462 + 2000 + 300 \\ = 14\,462 + 300 \\ = 14\,762 \end{aligned}$ 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 <table><tr><td>3</td><td>9</td><td>3</td></tr><tr><td>+</td><td>3</td><td>0</td><td>8</td></tr><tr><td colspan="4">1</td></tr><tr><td colspan="4">7</td></tr></table>	3	9	3	+	3	0	8	1				7																																																
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	Fractions Add fractions with the same denominator and denominators that are multiples of the same numbers (to become fluent through a variety of increasingly complex problems and add fractions that exceed 1 as a mixed number.	$\frac{1}{2} + \frac{3}{4} = \frac{2}{4} + \frac{3}{4} = \frac{5}{4}$  <table><tr><td>1</td><td>+</td><td>1</td><td>=</td><td>5</td><td>+</td><td>4</td><td>=</td><td>9</td></tr><tr><td>4</td><td></td><td>5</td><td></td><td>20</td><td></td><td>20</td><td></td><td>20</td></tr></table>	1	+	1	=	5	+	4	=	9	4		5		20		20		20																																										
1	+	1	=	5	+	4	=	9																																																						
4		5		20		20		20																																																						
	Links from other strands	- Solve problems involving up to three decimal numbers. - Solve addition and subtraction multi-step problems in context, deciding which operations and methods to use and why - Use all four operations to solve problems involving measure (e.g. length, mass, volume, money) using decimal notation. - Calculate the perimeter of composite rectilinear squares in centimetres and metres - Use angle sum facts and other properties to make deductions about missing angles. - Solve comparison, sum and difference problems using information presented in a line graph.																																																												

St Thomas More's Catholic Primary School Calculation Policy for addition: Year 6

Addition and subtraction concepts must be linked continuously.

Calculation

Informal methods to support Mental

- Perform mental calculations, including with mixed operations and large numbers (more complex calculations)
- Children use representations 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 Calculation

- Add larger numbers using the formal written (columnar) method.

Children should apply their written methods in a range of contexts including money, measure etc.

Tenths, hundredths and thousandths should be correctly aligned.

£	1	9	5	0
£		6	4	5
£	2	5	9	5
	1			

3	2	5	6
2	4	0	0
1	6	4	0
7	2	9	6
1			

A zero can be used as a place holder for empty decimal places.

Children should be given opportunities to add larger numbers.

1	2	7	0	5
	2	6	3	2
8	0	5	9	0
9	5	9	2	7
1				

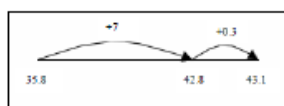
calculation

Representations to support mental and written

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

$$\begin{aligned} 12\,462 + 2300 \\ = 12\,462 + 2000 + 300 \\ = 14\,462 + 300 \\ = 14\,762 \end{aligned}$$

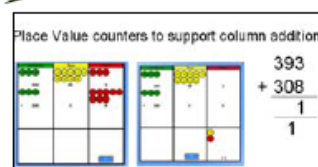
Partitioning and recombining



$$234\text{ kg} + 49\text{ kg} = 273\text{ kg}$$

$$\begin{array}{r} 200 + 30 + 4 \\ 40 + 9 \\ \hline 200 + 70 + 13 \end{array}$$

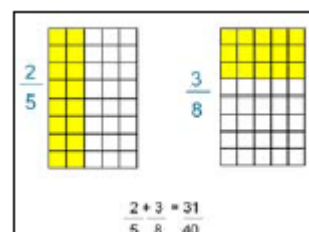
I can explain my method using place value counters



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

Fractions

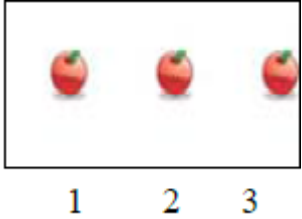
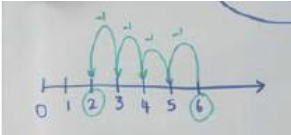
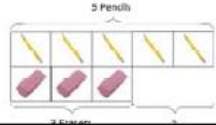
- Add fractions with different denominators and mixed numbers, using the concept of equivalent fractions.
- Start with fractions where the denominator of one fraction is a multiple of the other (e.g. $\frac{1}{2} + \frac{1}{8} = \frac{5}{8}$) and progress to varied and increasingly complex problems.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



Links from other strands	• Use their knowledge of the order of operations to carry out calculations involving the four operations (BIDMAS) • Solve problems involving all four operations • Algebra: use symbols and letters to represent variable and unknowns e.g. $a+b=b+a$ • Solve problems involving the calculation and conversions of units of measure, using decimal notation of up to three decimal places where appropriate • Using the number line, pupils use, add and subtract positive and negative integers for measures such as temperature • Calculate and interpret the mean as an average • Interpret and construct pie charts and line graphs and use these to solve problems • Find missing angles, and express geometry relationships algebraically (e.g. $d=2xr$)
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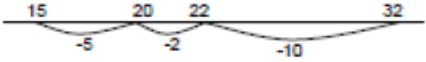
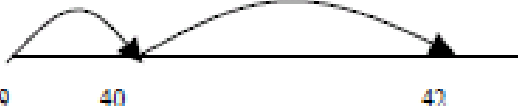
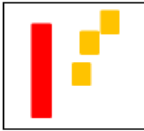
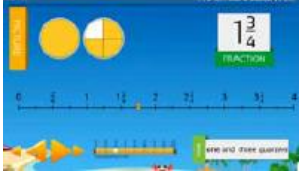
St Thomas More's Catholic Primary School Calculation Policy for subtraction: Year 1

Addition and subtraction concepts must be linked continuously.

Mental Calculation	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 $7 = \square - 9$ Memorise and reason with number bonds Add using objects, Numicon, cubes etc and number lines and tracks Check with everyday objects Ensure pre-calculation steps are understood, including: Counting objects, Conservation of number.   Understand subtraction as 'take away'  Find a 'difference' by counting up;
Written Calculation	Subtract one-digit and two-digit numbers to 20, including zero $7 - 3 = \square$ $7 - \square = 4$ $\square - 3 = 4$ $4 = \square - 3$  Read, write and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs.  $6 - 4 = 2$ The difference between 6 and 4 is 2. 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:  Straw bundles  Hands, and children themselves.  Bead strings, number tracks and lines  Which line has most money? How much more?  6 and how many more make 10? $6 + \square = 10$ $4 + 3$ $8 + 5$ $9 - 2$ $13 - 7$  Subtraction: Comparison Model Peter has 5 pencils and 3 erasers. How many more pencils than erasers does he have? 
Fractions	
Links from other strands.	Pupils should combine and increase numbers, counting forwards and backwards. (They should) develop the concept of addition and subtraction and...use these operations flexibly. Problems should include the terms: put together, add, altogether, total, take away, distance between, difference between, more than and less than, so that pupils develop the concept of addition and subtraction and are enabled to use these operations flexibly. Pupils discuss and solve problems in familiar practical contexts. Pupils compare, describe and solve practical (measurement) problems.

St Thomas More's Catholic Primary School Calculation Policy for subtraction: Year 2

Addition and subtraction concepts must be linked continuously.

Mental Calculation	Add and subtract numbers using concrete objects, pictorial representations, and mentally, including: - a two-digit number and ones - a two-digit number and tens - two two-digit numbers - adding three one-digit numbers. Jottings to support informal methods: Bridge through 10 where necessary 32 - 17  <u>- = signs and missing numbers</u> Continue using a range of equations as in Year 1 but with appropriate numbers. Extend to $14 + 5 = 20 - \square$ Find a small difference by counting up $42 - 39 = 3$
Written Calculation	 Written recording: $37 - 12 = 37 - 10 - 2$ $= 27 - 2$ $= 25$ 
Representations to support mental and written calculations	<u>Informal methods to support written subtraction calculations</u> <u>Practical partitioning of a 2-digit number</u> In Year 1 leads to:  Which line has most money? How much more?  The difference between 11 and 14 is 3. $14 - 11 = 3$ $11 + \square = 14$ 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, $1\frac{1}{4}$, $1\frac{1}{2}$, $1\frac{3}{4}$, 2.) Use concrete and pictorial models of fractions to assist with counting e.g. paper, cups, plates, shapes, Cuisenaire Rods. 
Links from other strands.	Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100. Pupils should partition numbers in different ways (for example, $23 = 20 + 3$ and $23 = 10 + 13$) to support subtraction. Solve problems with addition and subtraction: - using concrete objects and pictorial representations, including those involving numbers, quantities and measures - applying their increasing knowledge of mental and written methods - Pupils extend their understanding of the language of addition and subtraction to include sum and difference. $55 + 45 = 100$ $45 + 55 = 100$ $35 + 65 = 100$ $100 - 55 = 45$ $100 - 45 = 55$ $100 - 35 = 65$

St Thomas More's Catholic Primary School Calculation Policy for subtraction: Year 3

Addition and subtraction concepts must be linked continuously.

Mental Calculation

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.)

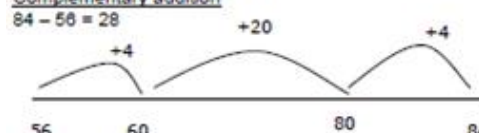
Use known number facts and place value to subtract
Continue as in Year 2 but with appropriate numbers e.g.
 $97 - 15 = 72$



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



Written Calculation

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

(1) Extended columnar - no exchange

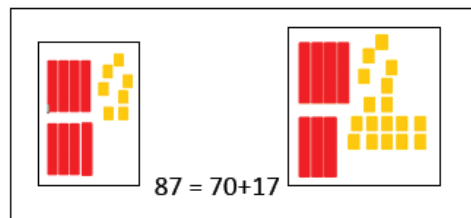
Extended method $87 - 53 =$

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

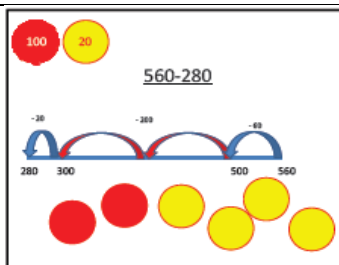
(2) Extended columnar - with exchange:

$87 - 58$ becomes

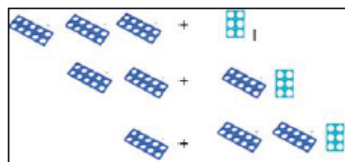
$70 + 17$
 $- 50 + 8$
 $20 + 9$



Representations to support mental and written calculations



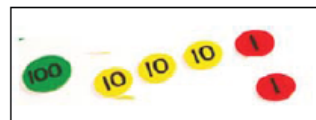
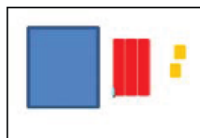
Partitioning and re-partitioning support the understanding of place-value.



$30 + 6$
 $20 + 16$
 $10 + 26$

All of these representations still comprise the amount of 36.

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



132 in dienes 132 in place value counters.

Revert to concrete manipulatives and expanded methods whenever difficulties arise

Fractions

Count up and down in tenths.

Add and subtract fractions with the same denominator within one whole.

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



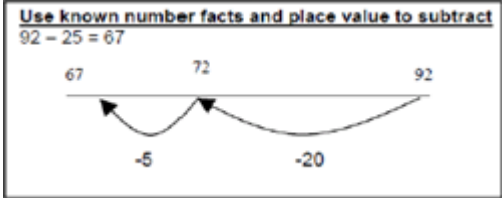
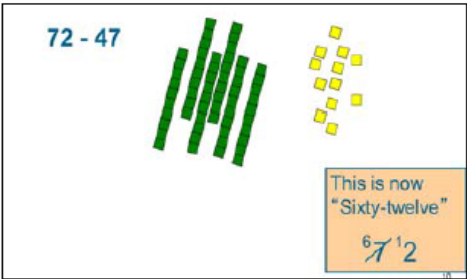
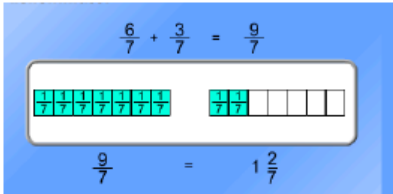
Links from other

Money and calculating duration of events (with number lines)

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

St Thomas More's Catholic Primary School Calculation Policy for subtraction: Year 4

Addition and subtraction concepts must be linked continuously.

Mental Calculation	Continue to practise mental methods with increasingly large numbers to aid fluency. Methods to support fluent calculation and encourage efficiency of method: - Find a small difference by counting up. E.g. $5003 - 4996$ - Subtract nearest multiple of ten and adjust. <i>Whenever possible, children should be encouraged to visualise number lines and other basic, supporting representations to promote fluent work without jottings.</i> <i>This could be done using an empty number line. Children should recall and use number facts to reduce the number of steps.</i> - Partition larger numbers. <i>Use known number facts and place value to subtract</i> $92 - 25 = 67$ 
Written Calculation	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. Move to more compact columnar method when confident. $\begin{array}{r} 300 + 70 + 2 \\ - 100 + 40 + 7 \\ \hline \end{array}$ → $\begin{array}{r} 300 + 60 + 12 \\ - 100 + 40 + 7 \\ \hline 200 + 20 + 5 \end{array}$ → $\begin{array}{r} 300 + \cancel{70} + 2 \\ - 100 + 40 + 7 \\ \hline 200 + 20 + 5 \end{array}$ 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.  <i>This is now "Sixty-twelve"</i> Use physical and / or pictorial representations and expanded algorithms alongside columnar methods. Ask: <i>What is the same? What's different?</i> Compare and discuss the suitability of different methods in context. Pupils decide which operations and methods to use and why. <i>I would count on using a number line to calculate $5003 - 4896$; because the numbers are close together.</i>
Fractions	Count up and down in hundredths. Add and subtract fractions with the same denominator . Solve simple measure and money problems involving fractions and decimals to two decimal places. 
Links from other strands.	Identify, represent and estimate numbers using different representations. (Place value) 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.

St Thomas More's Catholic Primary School Calculation Policy for subtraction: Year 5

Addition and subtraction concepts must be linked continuously.

Mental Calculation

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

Basic Mental Strategies for Subtraction

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

National Curriculum 1999

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

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

Written Calculation

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

$$£17.34 - £12.16$$

$$\begin{array}{r} 1000 + 700 + 20 + 14p \\ - 1000 + 200 + 10 + 6p \\ \hline 500 + 10 + 8p \end{array}$$

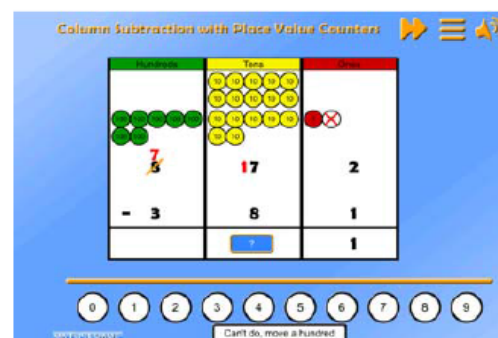
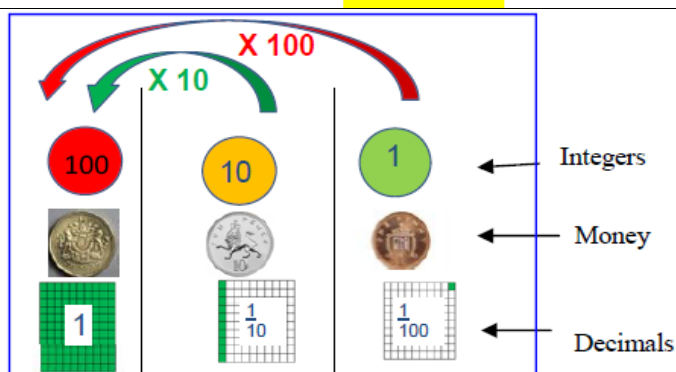
$$\begin{array}{r} 1734p \\ - 1216p \\ \hline 518p \end{array}$$

$$\begin{array}{r} £ 2 \\ 17.34 \\ - 12.16 \\ \hline 5.18 \end{array}$$

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

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 the this one could be used, moving away from the traditional: *Hundreds, tens and ones* model used in Lower KS2 and KS1.

Fractions

Subtract fractions with the same denominator and denominators that are multiples of the same number. (Including fractions exceeding 1 as a mixed number.)

Solve problems involving numbers up to three decimal places.

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

Links from other strands.

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

St Thomas More's Catholic Primary School Calculation Policy for subtraction: Year 6

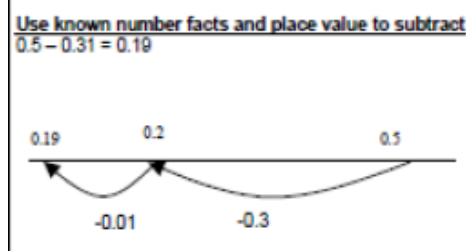
Addition and subtraction concepts must be linked continuously.

Mental Calculation

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 Calculation

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

Move towards consolidation of formal, columnar method.

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

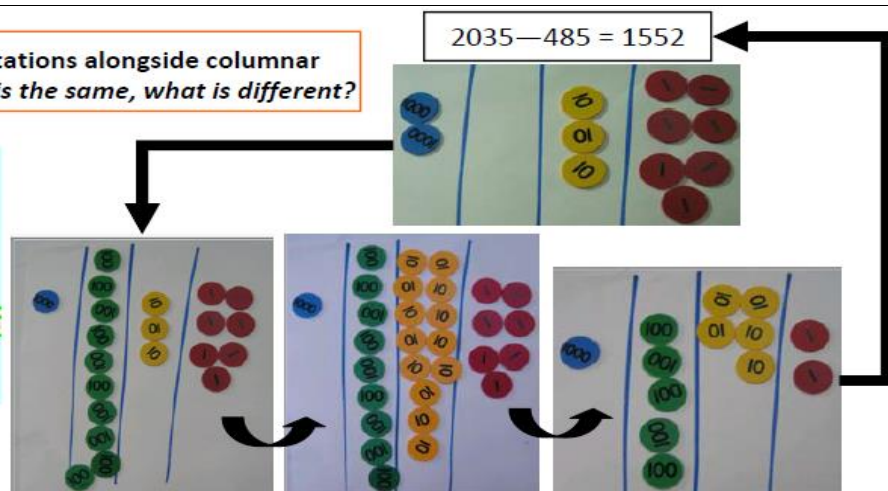
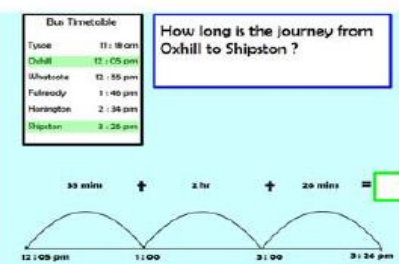
Revert to expanded methods whenever difficulties arise

932 - 457 becomes

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

Representations to support mental and written calculations

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



Fractions

Add and subtract fractions with different denominators and mixed numbers.

They practise calculations with simple fractions and decimal fraction equivalents to aid fluency

Links from other strands.

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

Solve problems involving all four operations

Algebra: use symbols and letters to represent variable and unknowns e.g. $a+b = b+a$

Using the number line, pupils use, add and subtract positive and negative integers for measure such as temperature.

St Thomas More's Catholic Primary School Calculation Policy for Multiplication: Year 1

Division and multiplication concepts must be linked continuously.

Mental Calculation

- 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 and rhythms, and including by rote
 - Counting 2s e.g. counting socks, shoes, animal legs...
 - Counting in 5s e.g. counting fingers, fingers in gloves, toes...
 - Counting in 10s e.g. counting fingers, toes...
- Doubles up to 10
- Recognising odd and even numbers
- Write as a number pattern (e.g. 5, 10, 15...; 2, 4, 6...; 10, 20, 30)

What's the sequence?

What comes next?

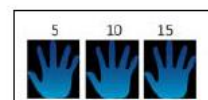
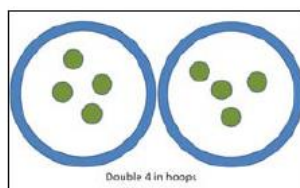
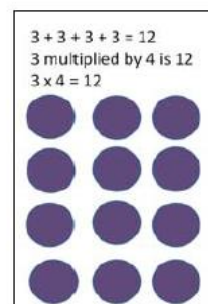
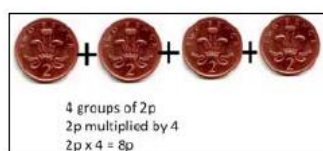
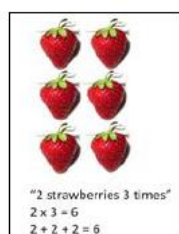
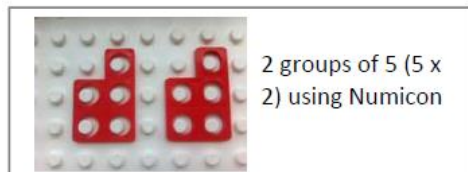
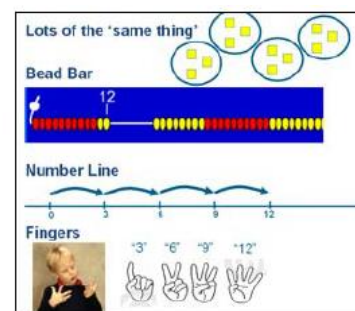
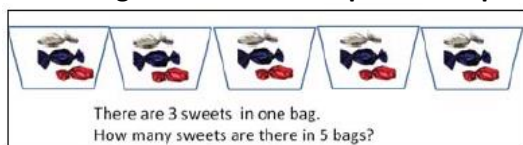
Written

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. $2 + 2 + 2 + 2 = 8$

Representations to support mental and written calculations

Use a range of concrete and pictorial representations, including:



Links from other strands

- Count in multiples of twos, fives and tens (From Number and place value), as above
- Counting in twos, five and tens from different multiples to develop their recognition of patterns in the number system.
- They discuss and solve problems in familiar practical contexts, including using quantities.

St Thomas More's Catholic Primary School Calculation Policy for multiplication: Year 2

Division and multiplication concepts must be linked continuously.

Mental Calculation	- Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, connecting the 2, 5 and 10 multiplication tables to each other - Connect the 10 multiplication table to place value - Recognise odd and even numbers - Show that multiplication of two numbers can be done in any order (commutative) - Use a variety of language to describe multiplication and division - Apply doubling of numbers up to ten to doubling larger numbers. I know that the multiples of 2/5/10 are always/never
Written Calculation	- Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (x), division (÷) and equals (=) signs. - Begin to use other multiplication tables and recall facts to perform written calculations - Use a range of materials and contexts...including arrays and repeated addition. $7 \times 2 = \square$ $7 \times \square = 14$ $\square \times 2 = 14$ $\triangle \times \square = 14$
Representations to support mental and written calculations	Use a range of concrete and pictorial representations, including: Counting 5 minute intervals $5 \times 4 = 20$ I want five, four times Groups of 10, six times $10 \times 6 = 60$ 5 10 15 Counting tally marks to support counting in 5s. 10 20 30 $10 \times 3 = 30$ What arrays can you make with 20 counters? $4 \times 5 = 20$ 3 multiplied by 5 $\rightarrow 3 \times 5$ $3 + 3 + 3 + 3 + 3 =$ I want four, five times 3 multiplied by 4 "I want three, four times" $3 + 3 + 3 + 3 = 12$ $3 \times 4 = 12$ What do you notice about the numbers covered up? Is there a pattern? What number is next? $10 + 10 = 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2$ $5 + 5 + 5 + 5 = 4 + 4 + 4 + 4 + 4$ doubling
Fractions	- Write simple fractions for example, $\frac{1}{2}$ of 6 = 3 and recognise the equivalence of $\frac{2}{4}$ and $\frac{1}{2}$ - Begin to relate multiplication and division models to fractions and measures.
Links from other strands.	- Solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts. - Use commutative and inverse relations to develop multiplicative reasoning (e.g. $4 \times 5 = 20$ and $20 \div 5 = 4$) - 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.

St Thomas More's Catholic Primary School Calculation Policy for multiplication: Year 3

Division and multiplication concepts must be linked continuously.

Mental Calculation

- 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 commutative rules and associativity
- Derive related multiplication and division facts
- Calculate mathematical statements for multiplication using the multiplication tables that they know, including for two digit numbers times one digit numbers, using mental methods.**
- Partitioning: multiply the tens first and then multiply the units, e.g. $57 \times 6 = (50 \times 6) + (7 \times 6) = 300 + 42 = 342$
- Children can apply these skills to solve spoken word problems too,
- Include missing number statements e.g. $72 \div \square = 8$

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

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

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

Multiplication and division facts:
 $8 \times 4 = 32$, $4 \times 8 = 32$, $32 \div 4 = 8$, $32 \div 8 = 4$

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

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

Written Calculation

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

Towards the column method ...

x	20	4
6	120	24

$120 + 24 = 144$

24×6 becomes

24	6
120	
24	
144	

Answer: 144

Representations to support mental and written calculations

$5 \times 3 = 15$

$3 \times 5 = 15$

3 groups of 40

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

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

x	30	8
7	210	56

$210 + 56 = 266$

Use arrays for partitioning too

$19 \times 3 = 57$

$30 + 27 = 57$

I can see eight groups of seven!

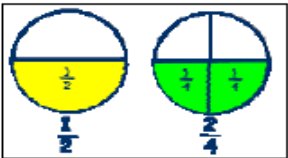
I can see seven, eight times!

And seven groups of eight!

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

I'm only 1 metre tall.

Three times as many

Fractions	• Recognise and show, using diagrams, equivalent fractions with small denominators <table><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr><tr><td>2</td><td>4</td><td>6</td><td>8</td><td>10</td><td>12</td><td>14</td><td>16</td><td>18</td><td>20</td></tr><tr><td>3</td><td>6</td><td>9</td><td>12</td><td>15</td><td>18</td><td>21</td><td>24</td><td>27</td><td>30</td></tr><tr><td>4</td><td>8</td><td>12</td><td>16</td><td>20</td><td>24</td><td>28</td><td>32</td><td>36</td><td>40</td></tr><tr><td>5</td><td>10</td><td>15</td><td>20</td><td>25</td><td>30</td><td>35</td><td>40</td><td>45</td><td>50</td></tr></table> 	1	2	3	4	5	6	7	8	9	10	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
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Links from other strands.	• Solve problems, including missing number problems, involving multiplication, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects. • The comparison of measures includes simple scaling by integers (for example, a given quantity or measure is twice as long or five times as high) • Pupils now use multiples of 2, 3, 4, 5, 8, 10, 50 and 100. • Pupils understand and use simple scales (for example 2, 5, 10 units per cm) in pictograms and bar charts with increasing accuracy.																																																		

St Thomas More's Catholic Primary School Calculation Policy for multiplication: Year 4

Division and multiplication concepts must be linked continuously.

Informal methods to support mental Calculation

- 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 $600 \div 3 = 200$ can be derived from $2 \times 3 = 6$)

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

Using facts and rules:
 $2 \times 6 \times 5 = 10 \times 6 = 60$

Written Calculation

- 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

$$\begin{array}{r} 54 \\ \times 4 \\ \hline 216 \\ 200 \quad (50 \times 4) \\ \hline 216 \end{array}$$

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 $70 \times 40 = 2800$ and use this information to check whether their answer appears sensible

Revert to expanded methods if children find formal calculation method difficult

Representations to support mental and written calculations

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

Moving digits ITP

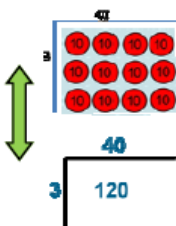


This digit is worth 200

$$\begin{array}{r} 245 \\ \times 6 \\ \hline 1470 \end{array}$$

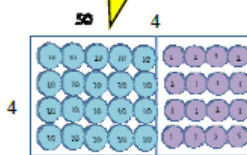
This digit is worth 30

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



Children need to understand and apply the language of multiples and factors and use it in solving multiplication and division problems, 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.'

I can use place value counters to model the grid method

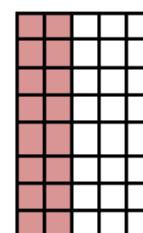


Fractions

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

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

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



Links from other strands.	• Solve problems involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects. • Convert between different units of measure (e.g. km to m) – use multiplication to convert from larger to smaller units • Understand the relation between non-unit fractions and multiplication/division of quantities. With particular emphasis on tenths and hundredths • Relate area to arrays and multiplication • Problem solving work can involve finding all possibilities and combinations drawing on knowledge of multiplication tables facts • Pupils understand and use a greater range of scales in their representations (statistics)
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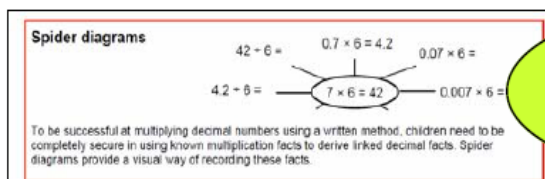
St Thomas More's Catholic Primary School Calculation Policy for multiplication: Year 5

Division and multiplication concepts must be linked continuously.

Informal methods to support mental Calculation

- 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)

$$24 \times 15 = ?$$



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

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

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

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

Written Calculation

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

24×16 becomes $\begin{array}{r} 24 \\ \times 16 \\ \hline 144 \\ 240 \\ \hline 384 \end{array}$	124×26 becomes $\begin{array}{r} 124 \\ \times 26 \\ \hline 744 \\ 2480 \\ \hline 3224 \end{array}$	124×26 becomes $\begin{array}{r} 124 \\ \times 26 \\ \hline 744 \\ 2480 \\ \hline 3224 \end{array}$	2741×6 becomes $\begin{array}{r} 2741 \\ \times 6 \\ \hline 16446 \end{array}$
Answer: 384	Answer: 3224	Answer: 3224	Answer: 16 446

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

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
					85608

Total 85608

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

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

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

326	3.26
$\times 8$	$\times 8$
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 .

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

Scaling by $\frac{1}{2}$
 "finding a half of a quarter"

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

" $\frac{1}{4}$ of a $\frac{1}{2}$ ": find a $\frac{1}{2}$, 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.	• 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 measure questions such as these can be expressed algebraically, for example $4 + 2b = 20$ for a rectangle of sides 2cm and b cm and perimeter of 20cm. Pupils calculate the area from scale drawings using given measurements.
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St Thomas More's Catholic Primary School Calculation Policy for multiplication : Year 6

Division and multiplication concepts must be linked continuously.

Informal methods to support mental Calculation	- 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. Children should know the square numbers up to 12×12 & derive the corresponding squares of multiples of 10 e.g. $80 \times 80 = 6400$ Use mental strategies to solve problems e.g. - x4 by doubling and doubling again - x5 by x10 and halving - x20 by x10 and doubling - x9 by multiplying by 10 and adjusting - x6 by multiplying by 3 and doubling How many different x/+ facts can you make using 72? 7.2? 0.72? What is the best approximation for 4.4×18.6?								
Written Calculation	- 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. $\begin{array}{r} \text{£} \quad 6.23 \\ \times \quad 27 \\ \hline 43.61 \\ + \quad 124.60 \\ \hline \text{£} \quad 168.21 \end{array}$								
Representations to support mental and written calculations	Look at long-multiplication calculations containing errors, identify the errors and determine how they should be corrected <table><tr><td>x</td><td>8</td><td>0.4</td><td>0.06</td></tr><tr><td>11</td><td>88</td><td>4.4</td><td>0.66</td></tr></table>$= 93.06$ $\begin{array}{r} 8.46 \\ \times 11 \\ \hline 93.06 \end{array}$ What's the same? What's different? $a \xrightarrow{\Delta} \times 3 \xrightarrow{\Delta} b \xrightarrow{\Delta} + 7 \xrightarrow{\Delta} 14.5$	x	8	0.4	0.06	11	88	4.4	0.66
x	8	0.4	0.06						
11	88	4.4	0.66						
Fractions	- multiply simple pairs of proper fractions, writing the answer in its simplest form e.g. $\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$ Three key applications of understanding: - Recognise that $\frac{1}{4}$ of 12, $\frac{1}{4} \times 12$ and 12 divided by 4 are equivalent - Use cancellation to simplify the product of a fraction and an integer e.g. $\frac{1}{2} \times 15 = 3$, $\frac{3}{2} \times 15 = 2 \times \frac{1}{2} \times 15 = 2 \times 3 = 6$ - Work out how many $\frac{1}{2}$s in 15, how many $\frac{1}{3}$s in 15, how many $\frac{2}{5}$s in 1 etc. $\frac{1}{2}$ $\frac{1}{4}$ To calculate $\frac{1}{4} \times \frac{1}{2}$, find $\frac{1}{2}$ of a rectangle/array, then divide that $\frac{1}{2}$ into $\frac{1}{4}$s. So $\frac{1}{4}$ of $\frac{1}{2}$ is $\frac{1}{8}$ Pupils should use a variety of images to support their understanding of multiplication with fractions. This follows earlier work about fractions as operators (fractions of), as numbers, and as equal parts of objects, e.g. as parts of a rectangle.								

Links from other strands.	• Identify common factors, common multiples and prime numbers • Use their knowledge of the order of operations to carry out calculations involving the four operations • Solve problems involving addition, subtraction, multiplication and division • Explore the order of operations using brackets; for example, $2 + 1 \times 3 = 5$ and $(2+1) \times 3 = 9$ • 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 and volume • Statistics including pie charts, line charts and calculating the mean.
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St Thomas More's Catholic Primary School Calculation Policy for division: Year 1

Division and multiplication concepts must be linked continuously.

Mental Calculation	Solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher. Pupils make connections between arrays, number patterns, and counting in twos, fives and tens. Count on or back in 2s, 5s and 10s and look for patterns. Songs are useful for counting in steps.
Written Calculation	Pictorial jottings to support the calculation of $8 \div 4$ half of 8 is 4 $8 \div 2 = 4$ double 4 is 8 $4 \times 2 = 8$ 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. multiplication. "How can we share 6 cakes between 2 people?" Here, the cakes are placed in an array formation. Moving from concrete to pictorial, counters represent the relationship between multiplication and division. How many 2 tiles can we fit on the 6 tile? - Manipulatives, and real-life objects to support children's own recording; and understanding of <i>grouping</i> and the link with multiplication. Coat hangers and socks support calculation of $8 \div 2$ Bead strings $15 \div 2$ using grouping model "Double 3 is 6. Half of 6 is 3." - Dominoes and dice to reinforce concepts of doubling and halving.
Fractions	Recognise, find and name a half as one of two equal parts of an object, shape or quantity. Recognise, find and name a quarter as one of four equal parts of an object, shape or quantity. (See representations above.)
Links from other strands.	They practise counting as reciting numbers and counting as enumerating objects, and counting in twos, fives and tens from different multiples to develop their recognition of patterns in the number system (for example, odd and even numbers). (PLACE VALUE). Pupils are taught half and quarter as 'fractions of' by solving problems using shapes, objects and quantites. (FRACTIONS)

St Thomas More's Catholic Primary School Calculation Policy for division: Year 2

Division and multiplication concepts must be linked continuously.

Mental Calculation	- Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers. - Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (x), division (÷) and equals (=) signs. "5, one time", "5, two times" and so on.
Written Calculation	- 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.) $\frac{1}{2}$ of 26 = 13 $26 \div 2 = 13$ 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 $7 \times 2 = 14$ $14 \div 2 = 7$ - Number lines to support grouping $10p + 10p + 10p + 10p + 10p = 50p$ $10p \times 5 = 50p$ 5 hops of 10 - Representations to support multiplicative reasoning: Using Dienes: "If $40 \div 10 = 4$ and $30 \div 10 = 3$, what do you think $70 \div 10$ would be? Why?" Is 14 an odd number? How do you know? Grouping ITP "How many groups of 5 minutes have passed when the minute hand reaches twenty past?"
Fractions	Recognise, find, name and write fractions $\frac{1}{3}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{2}{4}$ of a length, shape, set of objects or quantity. Write simple fractions for example, $\frac{1}{2}$ of 6 = 3 and recognise the equivalence of $\frac{1}{2}$ and $\frac{2}{4}$.
Links from other strands.	- Count in steps of 2, 3, and 5 from 0, and in tens from any number, forward and backward. - Recognise the place value of each digit in a two-digit number (tens, ones) (PLACE VALUE). - Tell and write the time to five minutes, including quarter past/to the hour and draw the hands on a clock face to show these times, (MEASURES).

St Thomas More's Catholic Primary School Calculation Policy for division: Year 3

Division and multiplication concepts must be linked continuously.

Mental Calculation

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

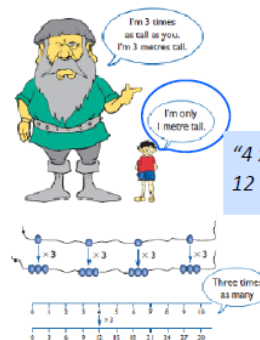
Pupils continue to practise their mental recall of multiplication tables... in order to improve fluency.

Pupils develop efficient mental methods, for example, using commutativity and associativity (e.g., $4 \times 12 \times 5 = 4 \times 5 \times 12 = 20 \times 12 = 240$) and multiplication and division facts to derive related facts.

$$36 \div 3 = 12$$

$$30 \quad 6$$

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



Written Calculation

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

$$120 \div 3$$

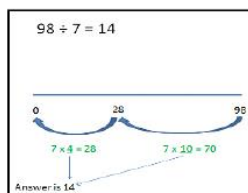


$$\begin{array}{r} 40 \\ 3 \overline{) 120} \end{array}$$

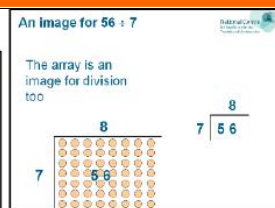
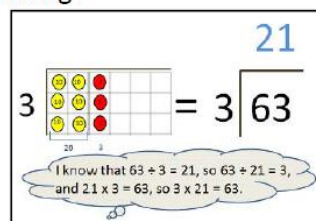
New written methods can be modelled alongside mental or informal methods to ensure understanding.

Representations to support mental and written calculations

Use a range of concrete and pictorial resources, including:

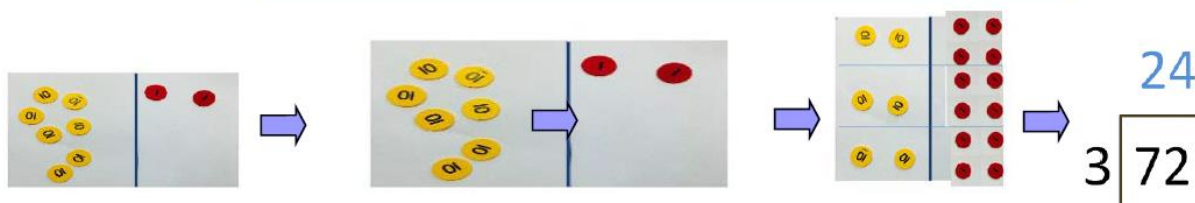


63 ÷ 3 equals three groups of 2 tens and a one.



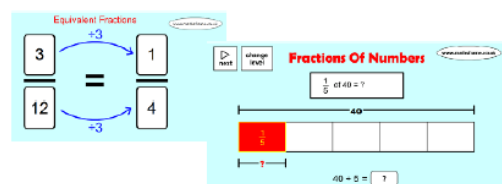
How could I calculate $72 \div 3$?

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

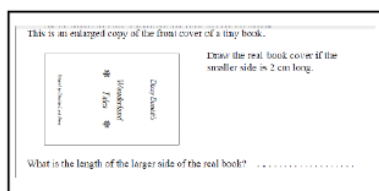


Fractions

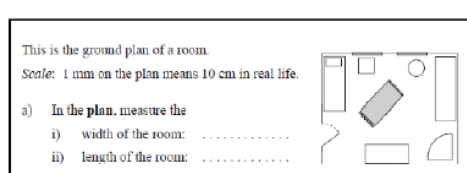
- Recognise that tenths arise from dividing an object into 10 equal parts and in dividing one-digit numbers or quantities by 10.
- Recognise and show, using diagrams, equivalent fractions with small denominators.
- Recognise, find and write fractions of a discrete set of objects: unit fractions and non-unit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



Links from other strands.



Pupils solve simple problems in contexts, including measuring and scaling contexts, (e.g., four times as high etc.) and correspondence problems.



St Thomas More's Catholic Primary School Calculation Policy for division: Year 4

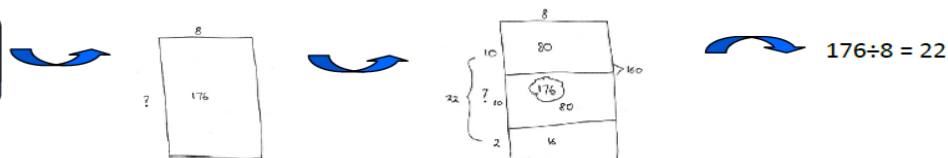
Division and multiplication concepts must be linked continuously.

Mental Calculation

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.

Using known facts and blank arrays to calculate $176 \div 8$.



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

Written Calculation

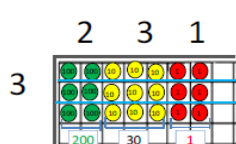
Pupils should be taught to:

- Multiply two-digit and three-digit numbers by a one-digit number using formal written layout
- Solve problems involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects.

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

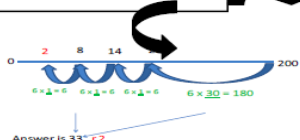
Representations to support mental and written calculations

$$693 \div 3$$



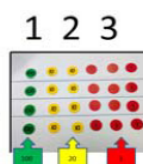
Children can work in pairs: child A constructs the array (dividing manipulatives into 3 rows), child B checks it and records this in a formal, short division format.

$$200 \div 6 = 33 \text{ r.} 2$$

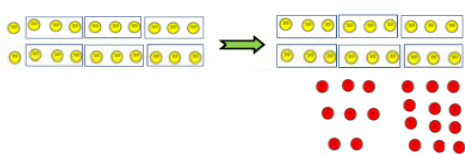


By working through larger number calculations with manipulatives, children gain experience of exchange (re-partitioning) within division algorithms.

$$492 \div 4$$



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. $13 \div 4$; and then progress to larger numbers. (See below).

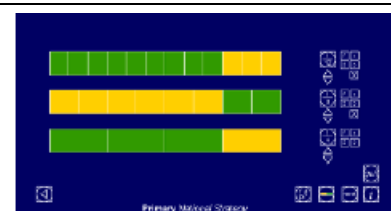


Money can be used instead of place value counters.

Fractions

Pupils should be taught to:

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



Links from other strands.

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

St Thomas More's Catholic Primary School Calculation Policy for division: Year 5

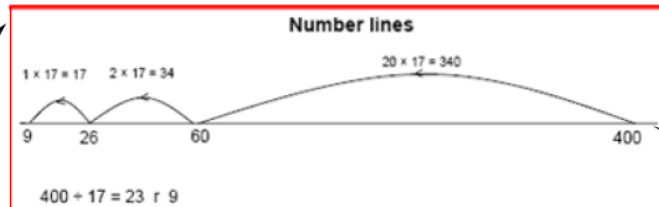
Division and multiplication concepts must be linked continuously.

Informal methods to support mental Calculation

Pupils should be taught to:

- Multiply and divide whole numbers and those involving decimals by 10, 100 and 1000
- Multiply and divide numbers mentally drawing upon known facts
- Identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers.

If $42 \div 6 = 7$
 $\div 10$ $\div 10$
 Then $4.2 \div 6 = 0.7$



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

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

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

Written Calculation

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 short division and context.

$98 \div 7$ becomes

Answer: 14

$432 \div 5$ becomes

Answer: 86 remainder 2

$496 \div 11$ becomes

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

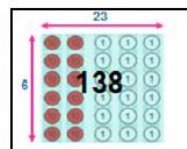
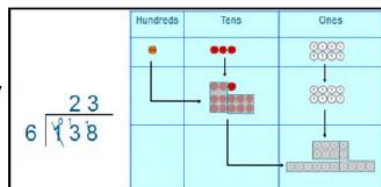
of

- 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.)

Representations to support mental and written calculations

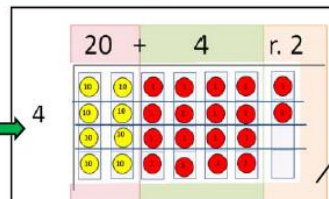
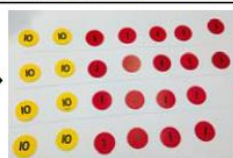
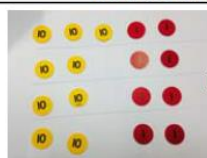
Can we divide this token into 6 equal groups?, then we must exchange it for ten tokens. Can we divide into 6 groups now?

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 = $\frac{2}{4} = \frac{1}{2} = 0.5$

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

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

Fractions

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

Links from other strands.	• Pupils use all four operations in problems involving time and money, including conversions.....using decimal notation, including scaling. • Calculate and compare the area of rectangles (including squares). (MEASURES) • establish whether a number up to 100 is prime and recall prime numbers up to 19 • recognise and use square numbers and cube numbers, and the notation for squared (2) and cubed (3) • solve problems involving multiplication and division including using their knowledge of factors and multiples, squares and cubes and including scaling by simple fractions and problems involving simple rates. • solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign. (NUMBER—MULTIPLICATION AND DIVISION)
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St Thomas More's Catholic Primary School Calculation Policy for division: Year 6

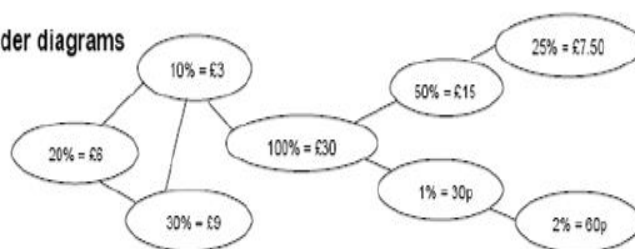
Division and multiplication concepts must be linked continuously.

Informal methods to support mental Calculation

Pupils should be taught to:

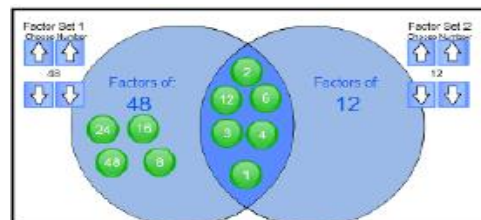
- Perform mental calculations, including with mixed operations and large numbers.
- Use their knowledge of the order of operations to carry out calculations involving the four operations.
- Identify common factors, common multiples and prime numbers.

Spider diagrams



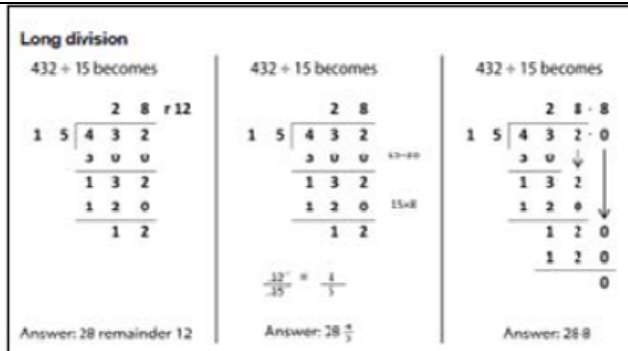
I know that 366 will divide by 6 because it has 2 and 3 as factors

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

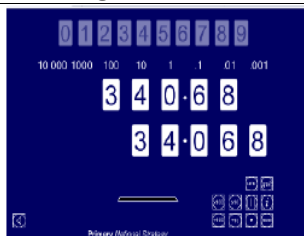


Written Calculation

- 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.
- Pupil's practise division for larger numbers, using the formal written methods of short and long division.



Representations to support mental and written calculations



$$£1362.72 \div 40 = ?$$

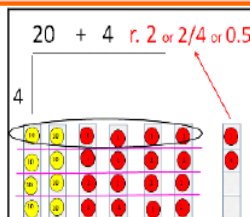
$$£1362.72 \div 4 = £340.68$$

[½ and ½ again.]

$$£340.68 \div 10 = £34.068$$

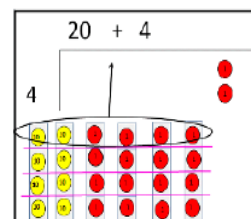
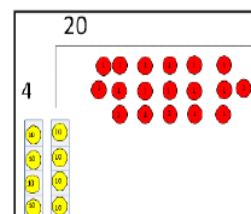
which rounds to £34.07.

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



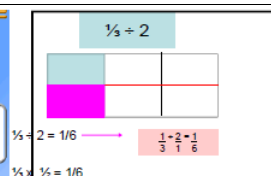
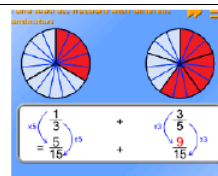
$$\begin{array}{r} 24 \text{ r.2} \\ 4 \overline{) 98} \\ \underline{- 80} \quad (4 \times 20) \\ 18 \\ \underline{- 16} \quad (4 \times 4) \\ 2 \end{array}$$

What's the same? What's different?

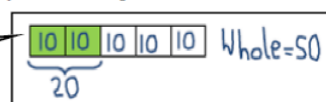


Fractions

- use common factors to simplify fractions,
- compare and order fractions, including fractions > 1
- add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions
- divide proper fractions by whole numbers [for example, $1/3 \div 2 = 1/6$.]
- associate a fraction with division and calculate decimal fraction equivalents [for example, 0.375.]
- Pupils use their understanding of the relationship between unit fractions and division to work backwards. use written division methods in cases where the answer has up to 2 dp.



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



Links from other strands.

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

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