Hunsley Primary Maths Calculation Policy[1]

This policy is applicable to Hunsley Primary

Version i

Important: This document can only be considered valid when viewed on the school website. If this document has been printed or saved to another location, you must check that the version number on your copy matches that of the document online.	
Name of Responsible Committee/Individual:	Hunsley Primary Local Governing Body
Implementation Date:	March 2019
Review Date:	September 2021
Target Audience:	All Staff, Parents, Pupils, Community Users, Key Stakeholders

[1] *Adapted from NCETM, STEM and White Rose Maths Hub policy resources*

Calculation Policy

Policy Contents

Policy Statement

Policy Statement

This policy outlines the principles, values and methods underpinning the expectations of Hunsley Primary regarding the teaching of calculation in maths lessons and across the curriculum.

Purpose and Scope

The purpose of the policy is to ensure all methodology for the teaching of calculation is consistent across the school. The language used by all staff and pupils to define and explain calculation methods must also be used with consistency and with understanding. The structures for teaching mathematics should also allow for progression within an agreed framework, in line with how pupils are identified by school to learn best. Thus will children be given their best opportunity to master the mathematical skills, knowledge and understanding for learning at depth and for learning which lasts over time.

Roles and Responsibilities

Head of Hunsley Primary and the School Leadership Team
It is the responsibility of the Head of Hunsley Primary and the School Leadership Team

- To ensure this policy is fully and consistently followed by Hunsley Primary staff
- To enable staff to deliver the expectations of the policy through induction and training processes
- To set, monitor and model the whole school standards for calculation and mathematics teaching

Staff
It is the responsibility of teaching staff

- To plan, deliver and assess a programme of maths teaching in line with the Calculation Policy methodology, appropriate to the specific needs of all children within the long-term curriculum plan

Equality and Diversity

The Education Alliance is committed to:

- Eliminating discrimination and promoting equality and diversity in its policies, procedures and guidelines
- Delivering high quality teaching and services that meet the diverse needs of its pupil population and its workforce, ensuring that no individual or group is disadvantaged

Vision, Values and Ethos

Vision: Our Commitment

Hunsley Primary is committed to being an innovative, stimulating, forward-thinking free school that makes the most of its freedoms to impact positively on pupils' lives in the community and provide opportunities for all its children to make outstanding progress. Hunsley Primary children are capable, confident and creative thinkers and motivated, resilient, problem-solving learners. In particular, the school is committed to developing pupils as mathematicians and scientists.

Values: Our Children

At Hunsley Primary, we believe that every child is an individual, ready, able and eager to learn, and as such a member of the team. We are a fully inclusive school and we view every child as unique; we believe that all learning activities should be personalised and challenging to meet all pupils' needs and that every child should receive the care, guidance, nurture and robust support they need to overcome disadvantage or barriers to learning. It is our prime aim that all children make their best progress in an enabling learning environment, in the presence of their peers and the security of positive relationships with those around them. Our highly-trained expert classroom practitioners, from teachers, TAs, volunteers to associate Trust staff, ensure that all children have the chance to work, discuss and learn with professionals who are passionate about education.

By ensuring our children become responsible for directing, sustaining and reviewing their own learning, taking responsibility for critiquing their own and each other's work and for setting ambitious challenges, we aim to embed an understanding of the importance of refining work to its best point so that children feel a sense of high achievement as a result of the feedback they receive.

By maximising the benefits of our close relationship with South Hunsley School and Sixth Form College and its subject specialists, we aim to secure a continuum of learning and a depth of conceptual understanding necessary for excellent progress in all curriculum areas, leading to the highest achievement at Key Stage 2, GCSE and A Level and, in due course, access to the most aspirational HE institutions, courses and professions for all children.

Ethos: Our Teaching and Learning Rationale

Engagement, Enjoyment, Discovery, Reflection, Achievement

Our aim is to deliver teaching and learning which meets the needs of every single pupil in school, basing our planning on rigorous assessment and observation, mapping out challenging, supportive next steps. We plan our curriculum activities and our personalised teaching and learning approach to match the following rationale:

- Flexible, personalised timeframes for learning, based on excellent pupil-centred teaching – teachers highly conversant in the complexities and specialisms of their practice
- Real learning themes and deep-thinking investigations, which prepare our pupils for 21st Century living and engage them in learning with enjoyment and passion
- Inspirational and challenging learning activities, which have the principles of scientific enquiry and investigation ('working scientifically') at their core, generating a lifelong love of learning, enquiry and discovery and a systematic means of approaching challenging and new tasks

- A union of partnerships with cross-phase, multi-agency and multi-disciplinary expertise for planning, delivery, monitoring and review, to ensure each child has every opportunity to build successfully on their learning from 4 to 19, removing barriers to engagement and development
- Pupil resilience, independence, confidence and readiness to meet the rigours of education, through to university and beyond, and the demands of living and working in a rapidly-changing technological world
- Innovative, immersive and inclusive learning resources, combining the best of expert input, outdoor, hands-on, experiential learning and digital interfaces, to give pupils every opportunity to aspire to their full potential.

Systems and Procedures

'Research by the Department for Education demonstrates that a key feature of high performing jurisdictions is that the development of quick recall, accuracy and fluency in parallel with the development of understanding and reasoning are all required to promote sound mathematical development (DfE 2012 p70). Procedural fluency and conceptual understanding are not mutually exclusive. The Ofsted Survey of Good Practice in Primary Mathematics (Ofsted 2011) found that many of the successful schools sampled teach fluency in mental and written methods of calculation, alongside understanding of the underlying mathematical concepts.'[2] **It is essential that the following strands permeate the day-to-day teaching and learning of mathematics at Hunsley Primary.** Pupils from EYFS to Y6 must:

- become **fluent** in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately.
- **reason mathematically** by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language
- can **solve problems** by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions.'[3]

There are six key areas identified as essential prerequisites within the Framework's Year 1 to 3 teaching programmes for future learning in mathematics. The six key areas are: ordering numbers; counting on and back; partitioning and recombining; addition/subtraction facts within 20; understanding the four operations; and problem solving strategies. *'The expectation is that the majority of pupils will move through the programmes of study at broadly the same pace. However, decisions about when to progress should always be based on the security of pupils' understanding and their readiness to progress to the next stage. Pupils who grasp concepts rapidly should be challenged through being offered rich and sophisticated problems before any acceleration through new content. Those who are not sufficiently*

[2] *https://www.ncetm.org.uk/resources/44577*
[3] *National curriculum in England: mathematics programmes of study*

fluent with earlier material should consolidate their understanding, including through additional practice, before moving on.'[4]

Our key principles with regard to language, presentation and terminology in maths teaching and learning are as follows:

1) all staff use consistent terms to define and express mathematical concepts – see Appendix
2) all staff use the agreed font for written representation of number and mathematical symbols – see Appendix
3) key language will be displayed in each classroom with examples to exemplify the language
4) staff will correct pupils' inaccurate use of terminology and support others to do the same
5) praise is given for process and application, as much as for outcome
6) maths teaching is supported by resources from a range of source material, including NRICH, NCETM, White Rose and Rising Stars
7) all teaching will follow the 'Concrete; Pictorial; Abstract' model
8) staff planning is responsive to immediate learning needs as well as medium term learning progress and end goals
9) pre-learning and intervention activities are planned across the teaching team with the aim of consistency through collaboration
10) Home Learning in maths is supported by ParentLearn sessions delivered to upskill and inform parents about the curriculum and its delivery

Monitoring of compliance with and effectiveness of the policy

The **Local Board of Governors** is responsible for the final approval of this policy and procedure and for ensuring that this policy and procedure is implemented fairly, consistently and objectively.

The **Head of Hunsley Primary** is responsible for overseeing the introduction, implementation, monitoring and review of this policy:

Review

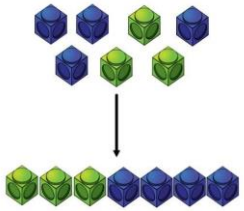
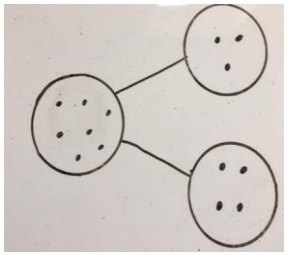
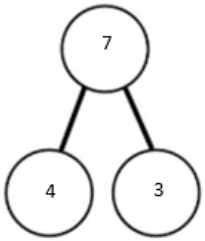
The Calculation Policy will be reviewed at regular intervals and may be adjusted as a result of that review process.

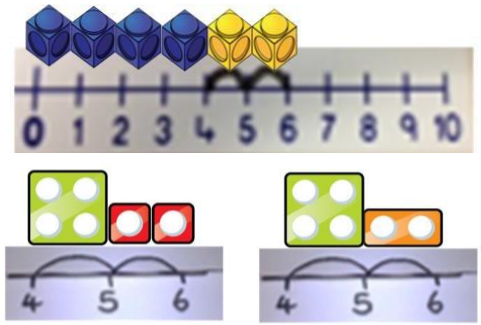
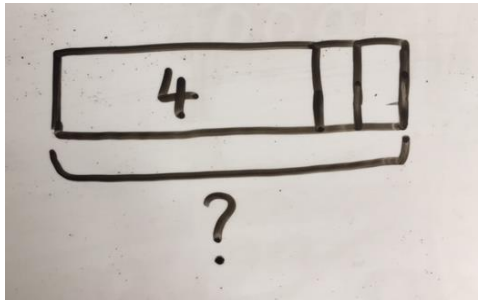
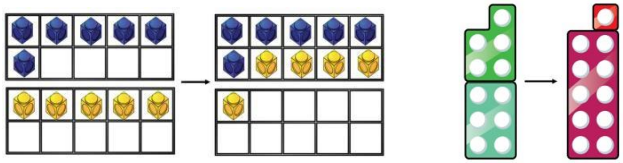
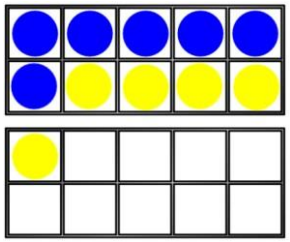
[4] *National curriculum in England: mathematics programmes of study*

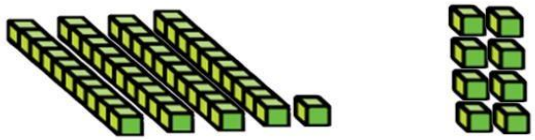
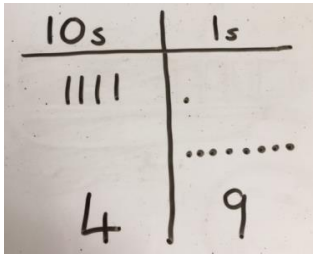
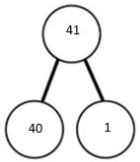
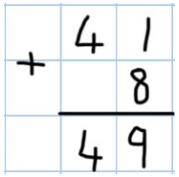
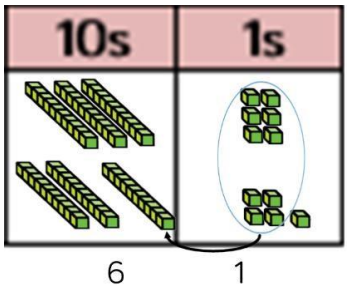
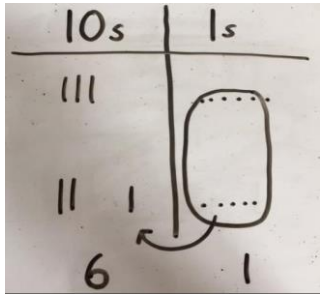
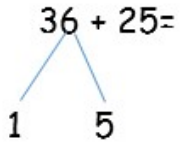
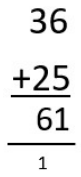
Appendix

The following examples are taken from the White Rose approach to Calculation.

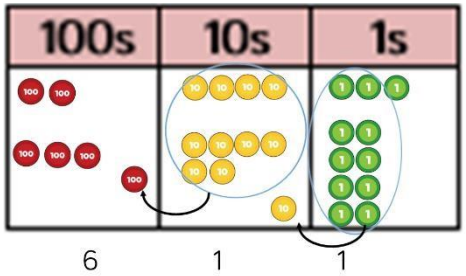
Addition

Concrete	Pictorial	Abstract
Combining two parts to make a whole (use other resources too e.g. eggs, shells, teddy bears, cars) 	*Children to represent the cubes using dots or crosses. They could put each part on a part whole model too.* 	*4 + 3 = 7* *Four is a part, 3 is a part and the whole is seven.* 

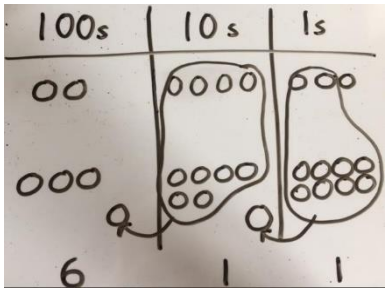
Counting on using number lines using cubes or Numicon. 	*A bar model which encourages the children to count on, rather than count all.* 	*The abstract number line:* *What is 2 more than 4?* *What is the sum of 2 and 4?* *What is the total of 4 and 2?* *4 + 2 = ?* 
Regrouping to make 10: using ten frames and counters/cubes or using Numicon. 6 + 5 = ? 	Children to draw the ten frame and add counters/cubes: 	Children to develop an understanding of **equality**; e.g. 6 + □ = 11 6 + 5 = 5 + □ 6 + 5 = □ + 4

TO + O using base 10. Continue to develop understanding of partitioning and place value. 41 + 8 	Children to represent the base 10; e.g. lines for tens and dot/crosses for ones. 	41 + 8 = ?  
TO + TO using base 10. Continue to develop understanding of partitioning and place value. 36 + 25 =? 	Children to represent the base 10 in a place value chart. 	Looking for ways to make 10.  

Use of place value counters to add HTO + TO, HTO + HTO etc. When there are 10 ones in the 1s column- we exchange for 1 ten, when there are 10 tens in the 10s column- we exchange for 1 hundred.



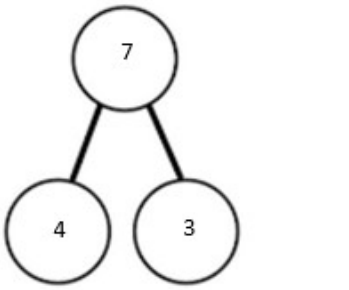
Children to represent the counters in a place value chart, circling when they make an exchange.



Column addition HTO:

$$\begin{array}{r} 243 \\ +368 \\ \hline 611 \\ \hline 1\ 1 \end{array}$$

Conceptual variation: different ways to ask children to solve 21 + 34



?	
21	34

Word problems:
In Year 3, there are 21 children and in Year 4, there are 34 children.
How many children in total?

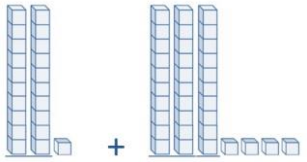
21 + 34 = 55. Prove it.

$$\begin{array}{r} 21 \\ +34 \\ \hline \\ \hline \end{array}$$

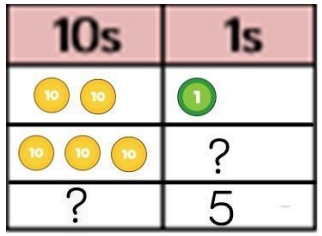
21 + 34 = $\square$

$\square$ = 21 + 34

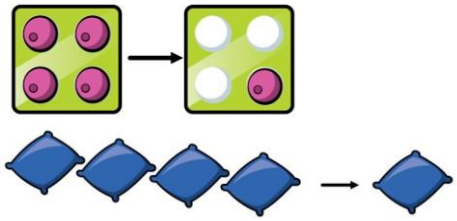
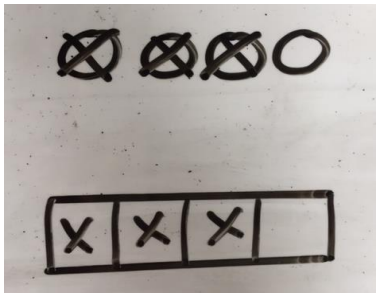
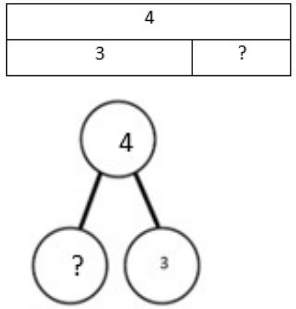
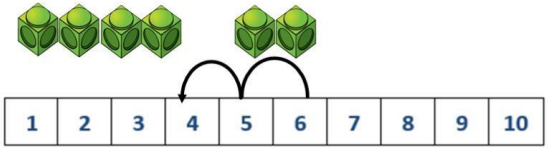
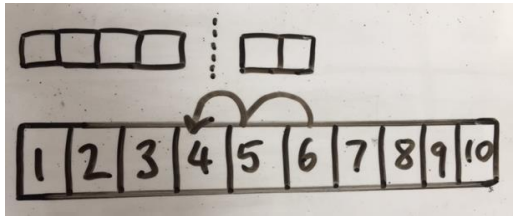
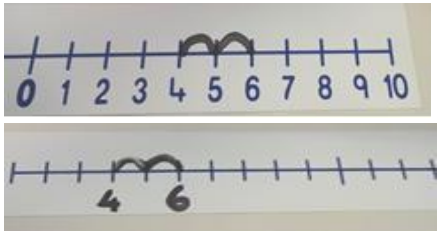
Calculate the sum of twenty-one and thirty-four.

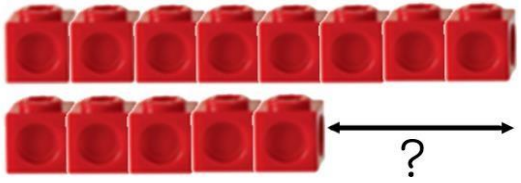
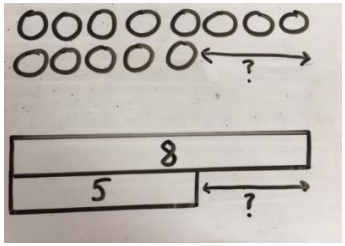
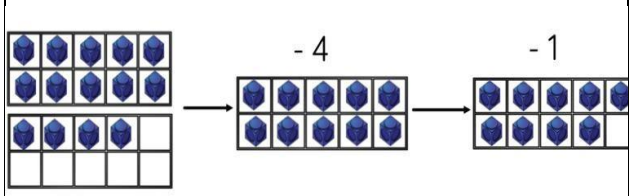
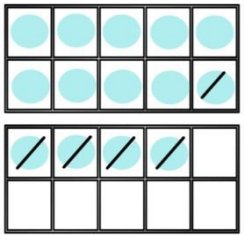


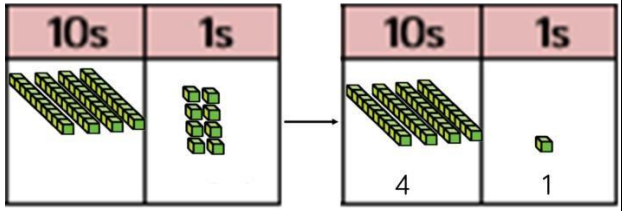
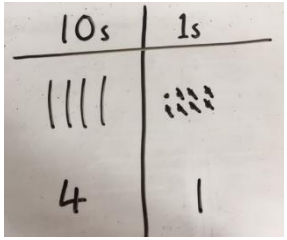
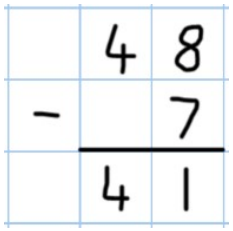
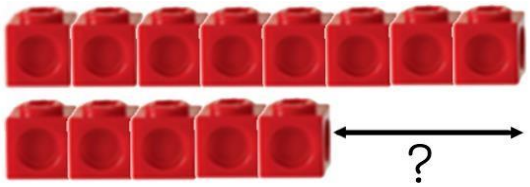
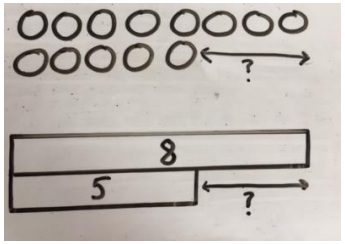
Missing digit problems:

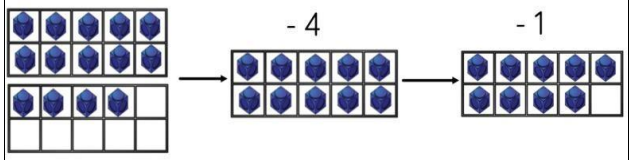
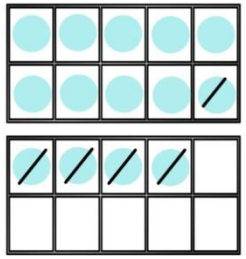
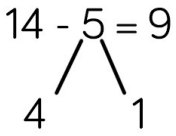
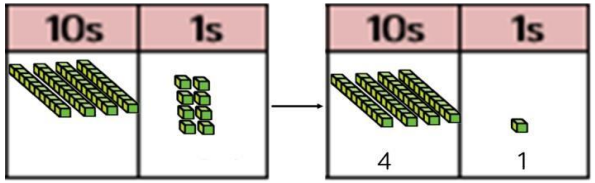
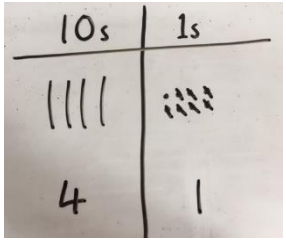
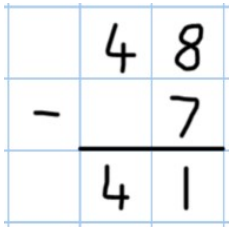
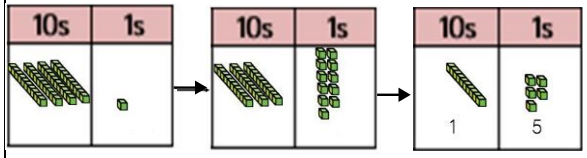
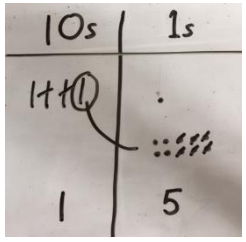
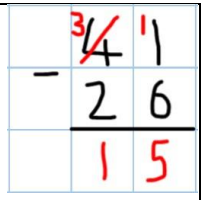


Subtraction

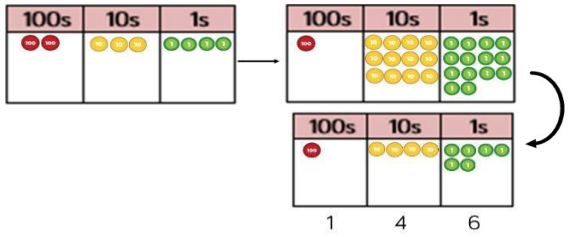
Concrete	Pictorial	Abstract
Physically taking away and removing objects from a whole (ten frames, Numicon, cubes and other items such as beanbags could be used). 4 – 3 = 1 	Children to draw the concrete resources they are using and cross out the correct amount. The bar model can also be used. 	4- 3 = ? 
Counting back (using number lines or number tracks) children start with 6 and count back 2. 6 – 2 = 4 	Children to represent what they see pictorially e.g. 	Children to represent the calculation on a number line or number track and show their jumps. Encourage children to use an empty number line. 

Finding the difference (using cubes, Numicon or Cuisenaire rods, other objects can also be used). Calculate the difference between 8 and 5. 	Children to draw the cubes / other concrete objects which they have used or use the bar model to illustrate what they need to calculate. 	Find the difference between 8 and 5. 8– 5: the difference is ☐ Children to explore why 8 – 5 = 7 – 4 Why have they the same difference?
Making 10 using ten frames. 14 – 5 = ? 	Children to present the ten frame pictorially and discuss what they did to make 10. 	Children to show how they can make 10 by partitioning the subtrahend. 14 - 5 = 9 4 1 14 – 4 = 10 10 – 1 = 9

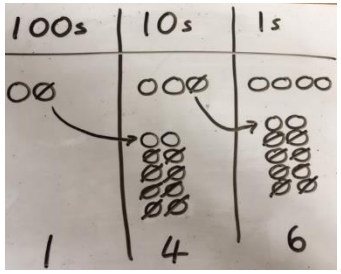
Column method using base 10. 48-7 =? 	Children to represent the base 10 pictorially. 	Column method or children could count back 7. 
Finding the difference (using cubes, Numicon or Cuisenaire rods, other objects can also be used). Calculate the difference between 8 and 5. 	Children to draw the cubes/other concrete objects which they have used or use the bar model to illustrate what they need to calculate. 	Find the difference between 8 and 5. 8– 5, the difference is ☐ Children to explore why 9 - 6 = 8 – 5 = 7 – 4 Why have they the same difference?

Making 10 using ten frames. 14 – 5 	Children to present the ten frame pictorially and discuss what they did to make 10. 	Children to show how they can make 10 by partitioning the subtrahend.  14 – 4 = 10 10 – 1 = 9
Column method using base 10. 48-7 	Children to represent the base 10 pictorially. 	Column method or children could count back 7. 
Column method using base 10 and having to exchange. 41 – 26 	*Represent the base 10 pictorially, remembering to show the exchange.* 	*Formal column method. Children must understand that when they have exchanged the 10 they still have 41 because 41 = 30 + 11.* 

Column method using place value counters. 234 – 88



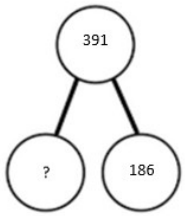
Represent the place value counters pictorially; remembering to show what has been exchanged.



Formal column method. Children must understand what has happened when they have crossed out digits.

$$\begin{array}{r} {}^{2}\not{2}\,{}^{1}\not{3}4 \\ -\ 88 \\ \hline 6 \end{array}$$

Conceptual variation; different ways to ask children to solve 391 - 186



391	
186	?

Raj spent £391 and Timmy spent £186. How much more did Raj spend?

Calculate the difference between 391 and 186.

391
-186
———

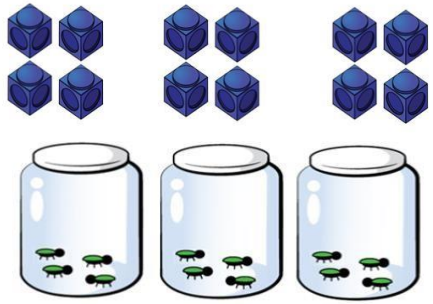
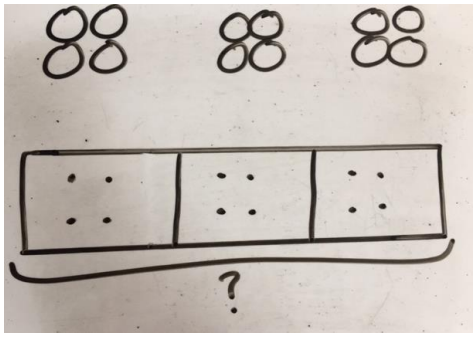
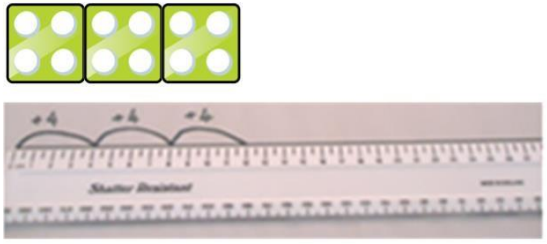
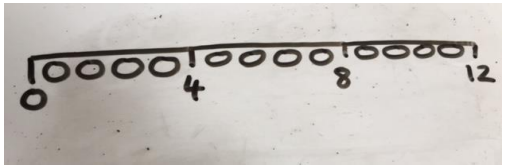
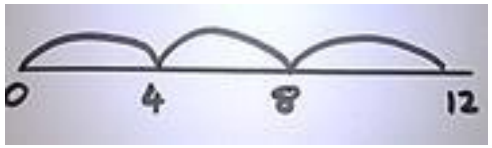
= 391 – 186

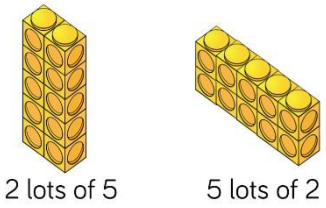
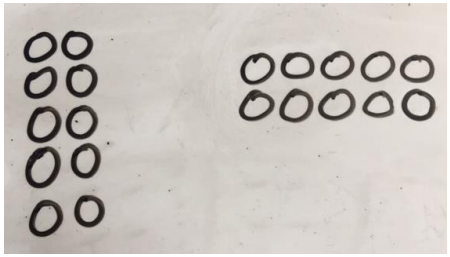
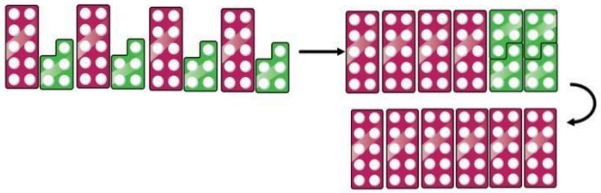
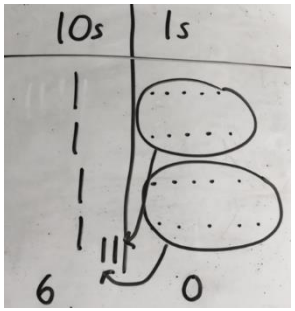
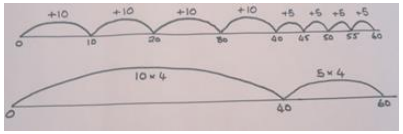
What is 186 less than

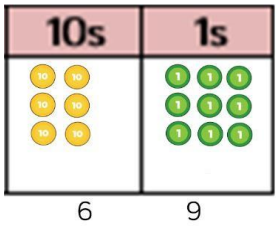
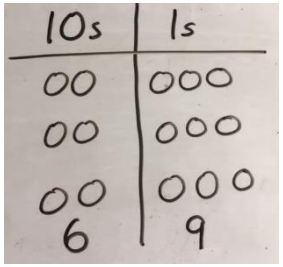
Missing digit calculations

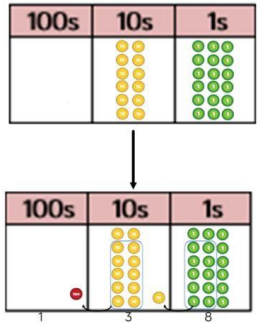
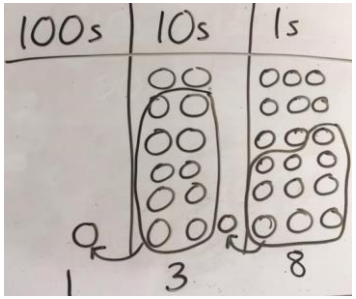
$$\begin{array}{r} 3\ 9\ \square \\ -\ \square\ \square\ 6 \\ \hline \square\ 0\ 5 \end{array}$$

Multiplication

Concrete	Pictorial	Abstract
Repeated grouping/repeated addition 3 × 4 = 4 + 4 + 4 = There are 3 equal groups, with 4 in each group. 	Children to represent the practical resources in a picture and use a bar model. 	3 × 4 = 12 4 + 4 + 4 = 12
Number lines to show repeated groups- 3 × 4  Cuisenaire rods can be used too.	Represent this pictorially alongside a number line e.g.: 	Abstract number line showing three jumps of four. 3 × 4 = 12 

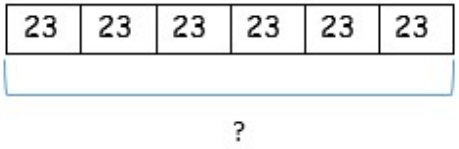
Use arrays to illustrate commutativity counters and other objects can also be used. 2 × 5 = 5 × 2  	Children to represent the arrays pictorially. 	Children to be able to use an array to write a range of calculations e.g. 10 = 2 × 5 5 × 2 = 10 2 + 2 + 2 + 2 + 2 = 10 10 = 5 + 5
Partition to multiply using Numicon, base 10 or Cuisenaire rods. 4 × 15 	Children to represent the concrete manipulatives pictorially.  	Children to be encouraged to show the steps they have taken. 4 x 15 10 5 10 x 4 = 40 5 x 4 = 20 40 + 20 = 60  A number line can also be used

Formal column method with place value counters (base 10 can also be used) 3 × 23  	Children to represent the counters pictorially.  	Children to record what it is they are doing to show understanding. 3 × 23 3 × 20 = 60 3 × 3 = 9 20 3 60 + 9 = 69 23 × 3 69

Formal column method with place value counters. 6 x 23  	*Children to represent the counters/base 10, pictorially e.g. the image below.*  	*Formal written method* 6 x 23 = 23 × 6 138 1 1

When children start to multiply 3d × 3d and 4d × 2d etc., they should be confident with the abstract: To get 744 children have solved 6 × 124. To get 2480 they have solved 20 × 124.	1 2 4 × 2 6 7 4 4 1 2 2 4 8 0 3 2 2 4 1 1 Answer: 3224

Conceptual variation: different ways to ask children to solve 6 × 23



Mai had to swim 23 lengths, 6 times a week.
How many lengths did she swim in one week?

With the counters, prove that 6 x 23
= 138

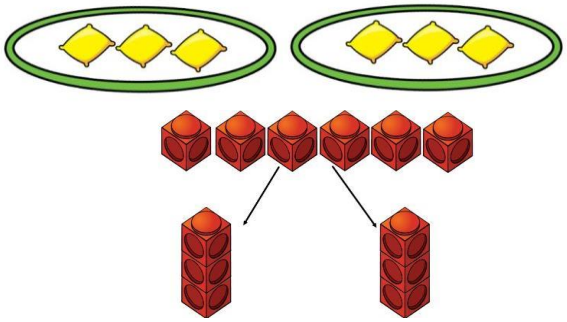
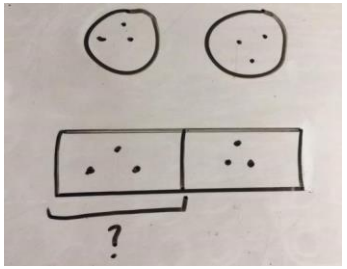
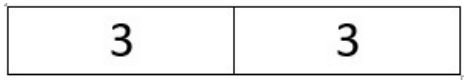
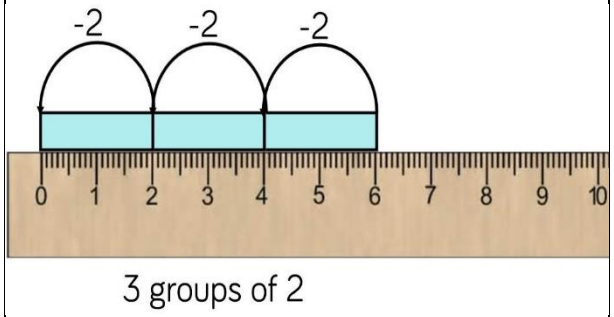
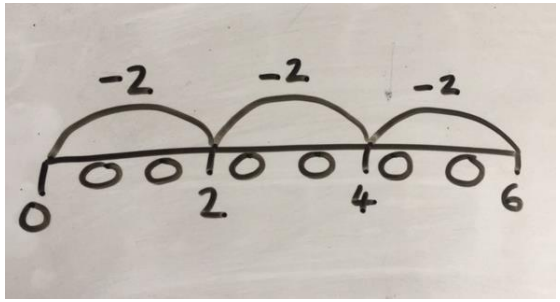
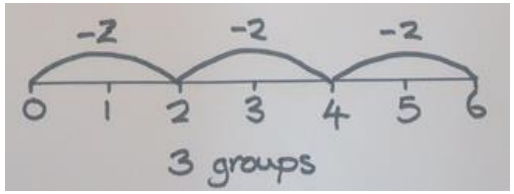
Find the product of 6 and 23

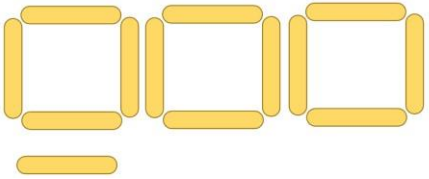
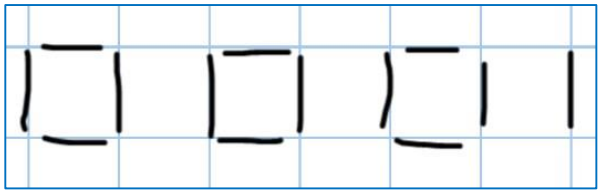
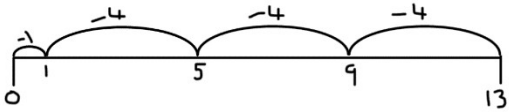
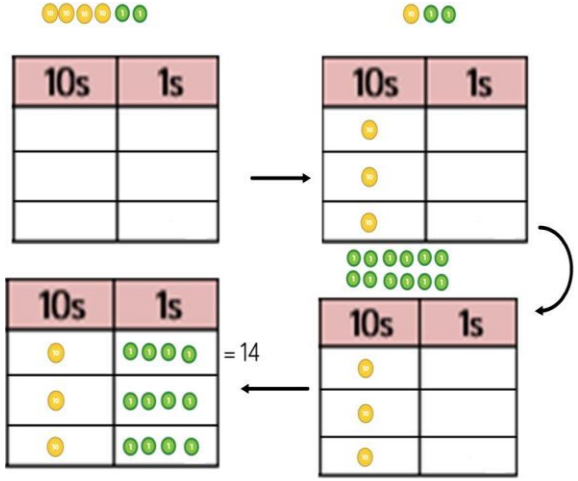
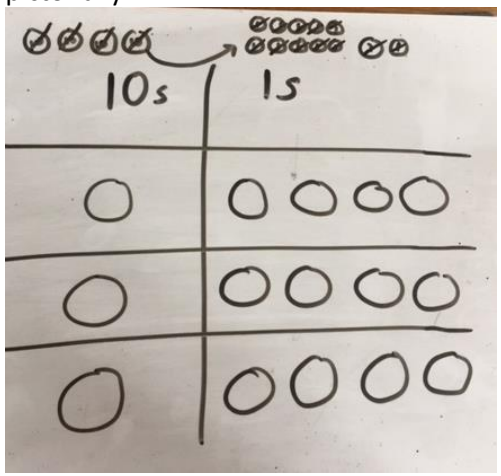
$\square$

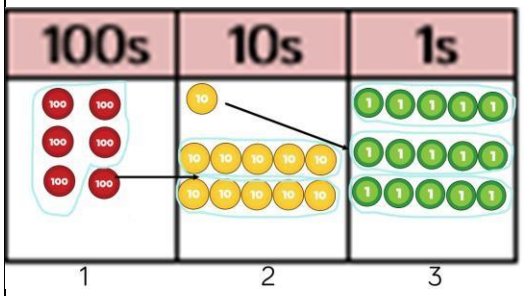
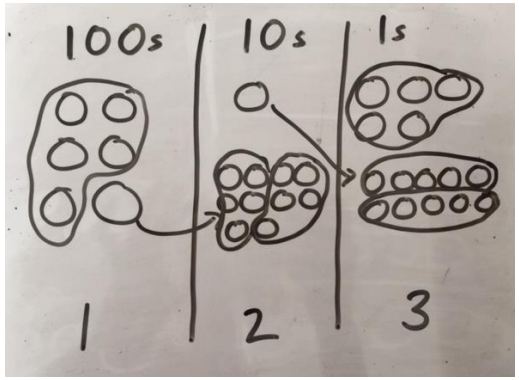
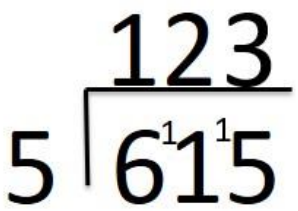
$$\begin{array}{rr} 6 & 23 \\ \times\ \underline{23} & \times\ \underline{6} \\ \_\_\_\_ & \_\_\_\_ \end{array}$$

What is the calculation? What is the product?

Division

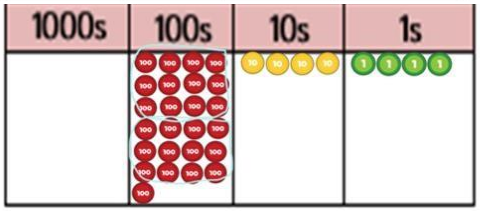
Concrete	Pictorial	Abstract
Sharing using a range of objects. 6 ÷ 2 	Represent the sharing pictorially. 	6 ÷ 2 = 3  Children should also be encouraged to use their 2 times-tables facts.
Repeated subtraction using Cuisenaire rods above a ruler. 6 ÷ 2 	Children to represent repeated subtraction pictorially. 	Abstract number line to represent the equal groups that have been subtracted. 

2d ÷ 1d with remainders using lollipop sticks. Cuisenaire rods, above a ruler can also be used. 13 ÷ 4 Use of lollipop sticks to form wholes- squares are made because we are dividing by 4.  There are 3 whole squares, with 1 left over.	Children to represent the lollipop sticks pictorially.  There are 3 whole squares, with 1 left over.	13 ÷ 4 – 3 remainder 1 Children should be encouraged to use their times table facts; they could also represent repeated addition on a number line. '3 groups of 4, with 1 left over' 
Sharing using place value counters. 42 ÷ 3 = 14 	Children to represent the place value counters pictorially. 	Children to be able to make sense of the place value counters and write calculations to show the process. 42 ÷ 3 42 = 30 + 12 30 ÷ 3 = 10 12 ÷ 3 = 4 10 + 4 = 14

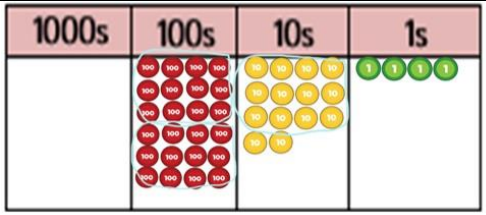
Short division using place value counters to group. 615 ÷ 5  1. Make 615 with place value counters. 2. How many groups of 5 hundreds can you make with 6 hundred counters? 3. Exchange 1 hundred for 10 tens. 4. How many groups of 5 tens can you make with 11 ten counters? 5. Exchange 1 ten for 10 ones. 6. How many groups of 5 ones can you make with 15 ones?	Represent the place value counters pictorially.  	Children to the calculation using the short division scaffold. 

Long division using place value counters: 2544 ÷ 12

We can't group 2 thousands into groups of 12 so will exchange ther

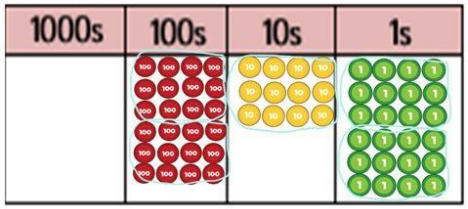


We can group 24 hundreds into groups of 12 which leaves with 1 hundred.



After exchanging the hundred, we have 14 tens. We can group 12 tens into a group of 12, which leaves 2 tens.

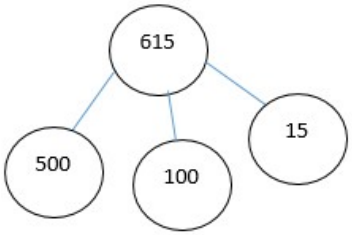
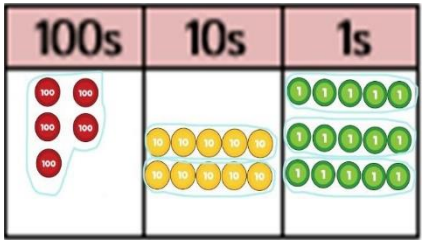
$$\begin{array}{r} 021 \\ 12\overline{)2544} \\ 24 \\ \hline 14 \\ 12 \\ \hline 2 \end{array}$$



After exchanging the 2 tens, we have 24 ones. We can group 24 ones into 2 group of 12, which leaves no remainder.

$$\begin{array}{r} 0212 \\ 12\overline{)2544} \\ 24 \\ \hline 14 \\ 12 \\ \hline 24 \\ 24 \\ \hline 0 \end{array}$$

Conceptual variation: different ways to ask children to solve 615 ÷ 5

Using the part whole model below, how can you divide 615 by 5 without using short division?  	I have £615 and share it equally between 5 bank accounts. How much will be in each account? 615 pupils need to be put into 5 groups. How many will be in each group?	$5 \overline{)615}$	What is the calculation? What is the answer? 

Key Terminology

Addition	sum	Add, addition
	total	altogether
	parts	more
	wholes	is equal to
	plus	is the same as
	double near double	difference
	inverse	equals
	ones, tens, hundreds boundaries	
Subtraction	take away	fewer
	less than	minus
	the difference	subtract, subtraction
	how many left over	decrease
	how many more than / fewer than	leave
	how much more than / less than	same as
		equals
		ones, tens, hundred boundary
Multiplication	double	the product of
	times	groups of
	multiplied by	lots of
	equal groups	doubling
	counting	scaling

	steps	times
	each	twice as big
Division	share	divided by
	share equally	half
	group	halve
	divide, division, divided by	one each
	left, left over	remainder
	exchange	quotient
	repartition	divisible by
	divisor	inverse
	scaling	array
	equal groups of	row
		column

Other

Minuend

The first number in a subtraction.

The number from which another number (the Subtrahend) is to be subtracted:

minuend − subtrahend = difference.

Example: in 8 − 3 = 5, 8 is the minuend and 5 is the subtrahend