GLC All Different: All Equal
Together, Improving Upon Our Best

GLC MATHS HANDBOOK 2025-2026

CONTENTS

GLC Maths Policy [Primary]

This policy was published for consultation on:	Summer 2024
This Policy was ratified by the Board of Directors on :	Summer 2024
This Policy will be reviewed by the GLC Board on :	Summer 2025

GLC Mission Statement

The GLC's mission is to develop active and thriving citizens within a diverse, truly fair and equal community. This will be achieved through:

- High quality teaching that deliberately develops the competencies of curiosity, creativity, communication and critical-thinking;
- An inspiring and meaningful curriculum;
- The development of productive relationships by instilling the values of compassion, resilience, responsibility and aspiration to prepare our young people for learning and life;
- A commitment to the wellbeing of our staff;
- A culture of professional generosity, collaboration, challenge and support throughout the GLC;
- The development of effective external partnerships for the benefit and wellbeing of our community.

The Gateway Learning Community Trust comprises the Gateway Academy, Herringham Primary Academy, Lansdowne Primary Academy, the Gateway Primary Free School and Tilbury Pioneer Academy. For the purposes of this document each will be referred to as an 'Academy'.

Equalities Statement

The GLC is committed to ensuring equality of provision for all. Equality is enshrined in our mission statement. Additionally, our wider vision for community equality is outlined in the GLC Community Vision Statement:

The GLC: all different and all equal

Imagine the GLC ... A thriving and prosperous place where all are equal and where every one of all ages matter. It is expected in each GLC academy, that all people are treated fairly, equality of opportunity and good relations are expected and individual different characteristics including age, ethnicity, academic ability, disability, gender, religious beliefs, sexual orientation are not discriminated against in any way. We will create environments where people are not fearful of others, and where individual differences or family circumstances don't act as a barrier to success.

THE GLC MATHEMATICS POLICY

Introduction

1. The GLC's mission is to develop all pupils as high achieving, resilient, healthy, aspirational, caring and fulfilled members of society.
   We expect that through the strict adherence to this Policy:

   - The quality of the teaching of mathematics will enable each GLC academy to achieve its annual pupil outcome targets [see current GLC Development Plan];
   - The achievement gaps for particular groups of pupils [particularly disadvantaged and SEND] will reduce and eventually close;
   - The GLC will achieve year-on-year improvement in attainment for all pupils.

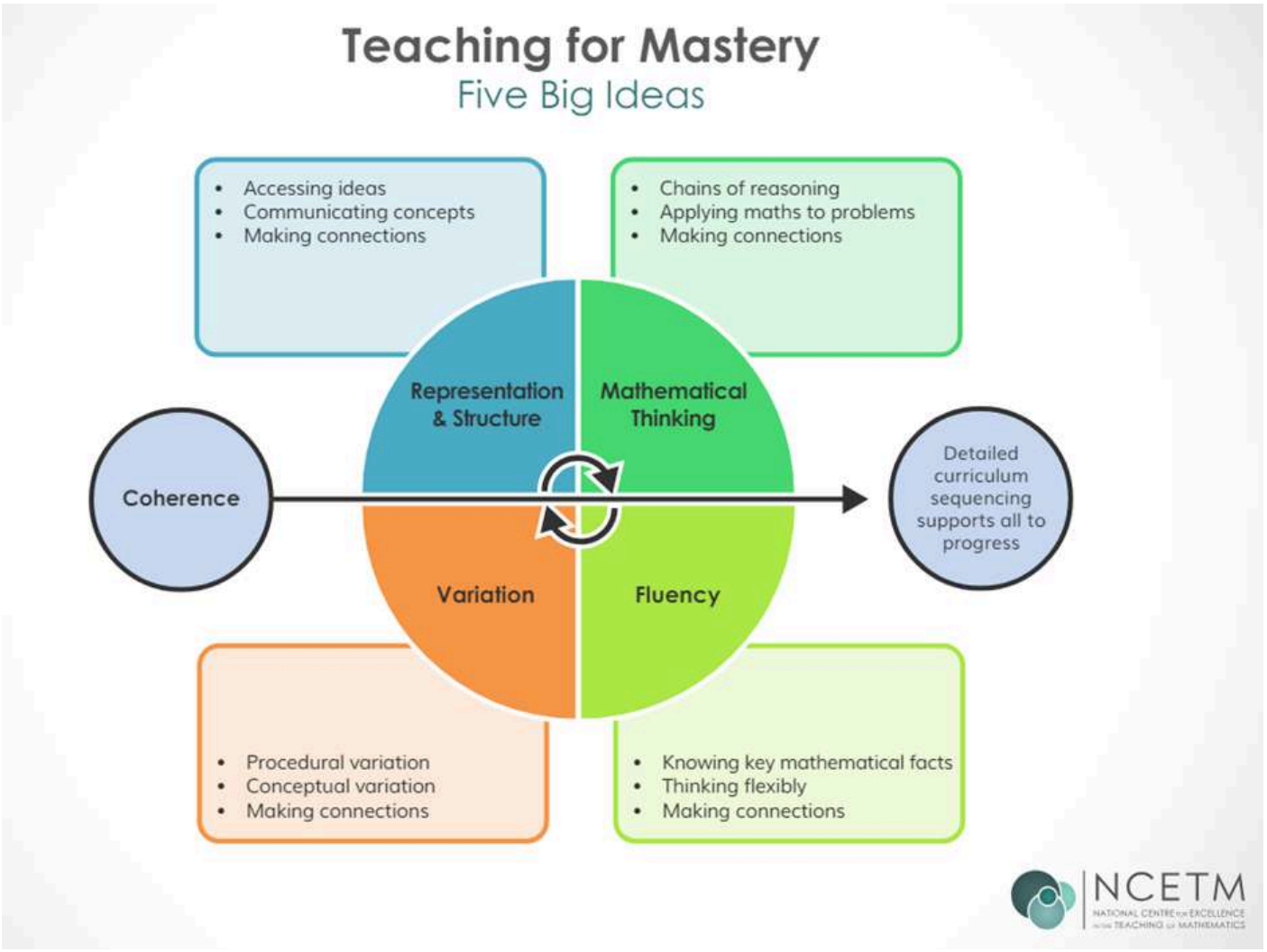
2. The GLC Mathematics Policy:
   - Identifies how mathematics will be assessed.
   - Recognises the role of all adults in modelling positive attitudes towards mathematics.
   - Recognises the importance of the support of parents and carers.

3. The GLC expects that the planning for individual lessons and wider units of work adheres to the agreed mathematics curriculum [to achieve the same learning across each of the GLC primary academies]. Teachers are welcome to use and adapt existing lesson plans that have been saved on the Google Drive **but teachers are encouraged to use their own experiences and creativity to create new plans to meet the needs of their pupils.** Teachers are supported by a Mathematics Leader in their own school and the GLC Mathematics Lead.

4. **Equal opportunities**
   All pupils have equal access to all aspects of the mathematics curriculum. This is monitored by analysing pupil performance throughout the school to ensure that there is no disparity between groups. Appropriate support is provided as necessary to ensure that all pupils can access the curriculum. Pupils with SEN related to mathematical development will be supported by the classroom teacher, SENDCo and subject leader. The GLC mathematics provision map outlines appropriate intervention programmes and materials to closely match additional provision to pupils' needs. Additional provision ensures that pupils on SEN support achieve their short-term goals and long-term objectives; through planning manageable steps to meet them. Effective use is made of pre-teaching of vocabulary, skills and strategies to enable pupils with EAL and SEN to feel successful.

Our philosophy is that all pupils can achieve highly and succeed in mathematics

"The 2014 National Curriculum for Mathematics has been designed to raise standards in mathematics with the aim that the large majority of pupils will achieve mastery of this subject."


Teaching for Mastery
Five Big Ideas
Accessing ideas
Communicating concepts
Making connections
Chains of reasoning
Applying maths to problems
Making connections
Representation & Structure
Mathematical Thinking
Coherence
Detailed curriculum sequencing supports all to progress
Variation
Fluency
Procedural variation
Conceptual variation
Making connections
Knowing key mathematical facts
Thinking flexibly
Making connections
NCETM

Purpose of study as detailed in the National Curriculum:

Mathematics is a creative and highly interconnected discipline that has been developed over centuries providing the solution to some of history's most intriguing problems. It is essential to everyday life, critical to science, technology and engineering, and necessary for financial literacy and most forms of employment. A high-quality mathematics education therefore provides a foundation for understanding the world, the ability to reason mathematically, an appreciation of the beauty and power of mathematics, and a sense of enjoyment and curiosity about the subject.

Aims as detailed in the National Curriculum:

- Pupils 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.
- Pupils **reason mathematically** by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language.
- Pupils 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.

INTENT

Mathematics is an essential life skill which provides students with a foundation for understanding number, reasoning, logical thinking and allows them to apply these skills to problem-solving creating a sense of curiosity about the subject both within and beyond the classroom.

With the overarching National Curriculum aims at the core of our practice, the intent of mathematics teaching at The GLC is for pupils to:

- Have access to a high-quality maths provision that excites, challenges and requires deep thinking through contextual variation of task.
- Have a positive attitude to maths and the confidence and resilience to take risks and persist.
- Make rich connections across the areas of maths and use their knowledge across other subjects in the curriculum.
- Have a secure sense of number and where it fits into the number system.
- Know by heart number facts such as number bonds, multiplication and division facts relative to age-related expectations.
- Use what they know by heart, to derive new facts and apply them to calculations.
- Use what they know to make reasonable estimations refining answers accordingly.
- Calculate accurately with efficiency, knowing when a mental strategy, jottings or a formal written method is appropriate.
- Have a secure understanding and be able to apply a wide range of mental calculation strategies for the four operations relative to their developmental stage and age-related expectations.
- Have a secure understanding and be able to apply efficient formal written methods relative to their developmental stage and age-related expectations.
- Discuss and reason in maths applying logical and critical thinking to a range of mathematical concepts.
- Efficiently and effectively apply their knowledge to a range of single and multiple-concept problems.
- Communicate mathematically using the correct vocabulary and pictures and diagrams to explain their thinking where appropriate.
- Suggest suitable units of measuring and make sensible estimates in measurements.
- Explain and make predictions from the numbers in graphs, diagrams, charts and table.
- Develop spatial awareness and an understanding of the properties of 2D and 3D shapes.

- Write numerals and mathematical symbols accurately and present work in line with the maths presentation policy.
- Be well supported to close gaps in learning where they exist during whole class and targeted intervention.
- Be well-supported by parents who have the ability to do so.

IMPLEMENTATION

The Long-Term Plan [LTP] for mathematics is designed to support a Teaching for Mastery [TfM] approach to teaching and learning to achieve the aims and objectives of the National Curriculum and The GLC's intent.

Our approach:
White Rose and Power Maths are our core schemes of work for EYFS to Year 6. Based on a proven concrete pictorial-abstract approach, it encourages pupils to explore mathematics using pictorial representations and manipulatives in order to understand and explain mathematical concepts.

Key questions informing our approach to mathematics. How do we strategically lead and evaluate the impact of mathematics in The GLC?

- Each academy has a designated mathematics leader responsible for the quality of education and full implementations of the mathematics Policy.
- Leaders maintain an accurate understanding of the effectiveness of mathematics teaching through rigorous monitoring and evaluation of teaching and pupil outcomes.
- Leaders use information gathered through monitoring and evaluation to inform universal and targeted professional development and teaching and learning support.
- Leaders are required to write a ½ termly evaluation of their impact informing the academy's self-evaluation and to present this to the Trust leadership team and governors as part of progress boards.
- Leaders work collaboratively across the Trust to develop policy, debate key approaches informed by research and moderate pupil outcomes.

What is mastery and how do we implement this approach?

- In our mastery curriculum, a significant majority of pupils progress through units of work at the same pace, with progress based on pupil's understanding and readiness to move on to the next stage.
- Pupils who grasp concepts quickly are challenged through carefully planned activities which add depth to learning.
- Pupils who are not fluent in concepts consolidate their understanding through targeted interventions.

Venn Essex Maths Hub

The aim of the Maths hub is to ensure that all pupils, teachers and leaders have access to support, training, and innovation that will improve the enjoyment and achievement of mathematics, from **Early Years through to the post 16 sector.**

The Maths Hubs programme is funded by the Department for Education (DFE) and led by the **NCETM (National Centre for Excellence in the Teaching of Mathematics)**.

The Maths Hub Programme brings together mathematics education professionals in a collaborative national network of 40 hubs, each locally led by an outstanding school or college, to develop and spread excellent practice, for the benefit of all pupils and students. Our Local Hub is the Venn Essex Maths Hub and is located at St Thomas More's Primary School, Priory street, Colchester CO1, 2QB.

What is a Maths Hub?
Each Maths Hub is made up of a partnership of schools, colleges and other organisations working together to provide support for maths teaching in a particular region of England.

A hub's work takes many forms and includes face-to-face CPD and online support. Every hub runs several projects each year which enable teachers and teaching assistants to work collaboratively with the support of Local Leaders of Maths Education (LLMEs).

What opportunities does a Maths Hub provide?

All hubs encourage schools in the areas they serve to get in touch to find out more about the CPD and other activities they offer. Each year, there are projects that are available nationwide through Work Groups in every hub. Some Work Groups are unique to particular hubs. Hubs also run conferences, exchanges, network meetings and other opportunities for professional collaboration.

How do we enable pupils to develop efficient and effective mental and written calculation strategies?

will be taught for 20 minutes daily with a focus on:

- Developing number sense and fluency (Number Bond and Times Table focus).
- Securing mental strategies
- Revisiting prior knowledge (Maintenance Keeping it on the Boil).
- Explicitly teaching mental and written calculation strategies linked to gaps in learning identified from QLA analysis (Targeted Objective).
- Maintaining previously taught skills and knowledge with speed and accuracy (Fluent in 5).

How do we enable pupils to secure age-related expectations for number bonds and times tables?

At the GLC schools we believe that rapid recall of number facts is the key to a confident mathematician. Recall of number facts is the foundation for virtually every other aspect of primary mathematics. We need to get number facts 'right' if we are going to be successful in raising standards in mathematics. The National Curriculum specifies that pupils should be taught to recall the multiplication tables up to and including 12 × 12 by the end of year 4.

The Number fact Challenge is a whole school approach aimed at learning number facts. Pupils who learn all of the number facts unlock the right to train to become '**Maths Ninjas',** a further challenge involving fractions, decimals, percentages and time.

The idea is to develop the sense of competition (and excitement!) in learning basic mathematical skills. At the same time the pupils will be learning their addition, multiplication and division facts quickly and efficiently.

<u>Year group expectations for number bonds and times tables</u>

Every Child Who Can [90%]

Year	Bonds and tables	**Levels of progress**	**Aut 1**	**Aut 2**	**Spr 1**	**Spr 2**	**Sum 1**	**Sum 2**
Reception	Number bonds to 10	Expected	ELG: Number Level 1: Recognise quantities without counting up to 5.	ELG: Numerical Patterns Level 2: Compare quantities up to 10 in different contexts.	ELG: Numerical Patterns Level 3- Verbally count beyond 20, Recognising the pattern of the counting system.	ELG: Numerical Patterns Level 4: Auto-matically recall number bonds up to 5 and some number bonds to 10.	ELG: Number Level 5: Have a deep under-standing of numbers to 10 including The compositio n of each Number.	ELG: Number Level 6: Explore and represent patterns within numbers up to 10, including evens and odds, double facts and how quantities can be distributed equally.

			Shape, Space and Measures SSM to be weaved into the curriculum throughout the year. • I can talk about 2D and 3D shapes using informal and maths language: 'slides, corners, straight, flat, round'. • I understand position through words alone- for example "The bag is under the table" with no pointing. • I can describe a familiar route. • I can discuss routes and locations, using words like 'in front of and 'behind'. • I can compare objects relating to size, length, weight and capacity. • I can select shapes appropriately: flat surfaces for building, a triangular prism for a roof etc. I can combine shapes to make new ones- an arch, a bigger triangle etc. • I can begin to describe a sequence of events, real or fictional, using words such as 'first', 'then'. • Continue, copy and create repeating patterns.

Year	**Bonds and tables**	**Levels of progress**	**Aut 1**	**Aut 2**	**Spr 1**	**Spr 2**	**Sum 1**	**Sum 2**
Year 1	6 - 20	Expected	3,4,5	6,7,8	9,10,11	12,13,14	15,16,17	18,19,20
Year 2	2, 5, 10	Expected	15, 16, 17	18, 19, 20	10	5	2	Bronze
Year 3	+ 3, 4, 6, 8	Expected	3	6	4	8	8	Silver
Year 4	+ 7, 9, 11, 12	Expected	11	9	7	12	12	Gold
Year 5	All to 12 [Mixed]	Expected	All mixed to 12	All mixed to 12	Gold	Platinum	White	Yellow
Year 6	All to 12 [Mixed]	Accelerated					Red	Black
		Expected	Yellow	Orange	Green	Green	Blue	Blue

How does it work?

Pupils should be learning times tables and number bonds on a daily basis and teachers should take every spare minute in the day to reinforce this. From Year 1 upwards, the pupils will have a timed test each week and weekly homework.

The Early Years Number Challenge

Pupils start at level 1 and are tested fortnightly. If they do not achieve a level they will retest that same level the following week. If they do achieve a level, they will be awarded a sticker to put on the number challenge poster. This is also celebrated on Dojo with a photo of the pupils that achieved a level so all families can see. Then the following week they are tested on the next level. A certificate will be awarded to the pupil once they have achieved all the levels as they become our "Reception Number Ninja".

Level 1: Recognise quantities without counting up to 5.

Level 2: Compare quantities up to 10 in different contexts.

Level 3: Verbally count beyond 20, recognising the pattern of the counting system.

Level 4: Automatically recall number bonds up to 5 and some number bonds to 10.

Level 5: Have a deep understanding of numbers to 10 including the composition of each number.

Level 6: Explore and represent patterns within numbers up to 10, including evens and odds, double facts and how quantities can be distributed equally.

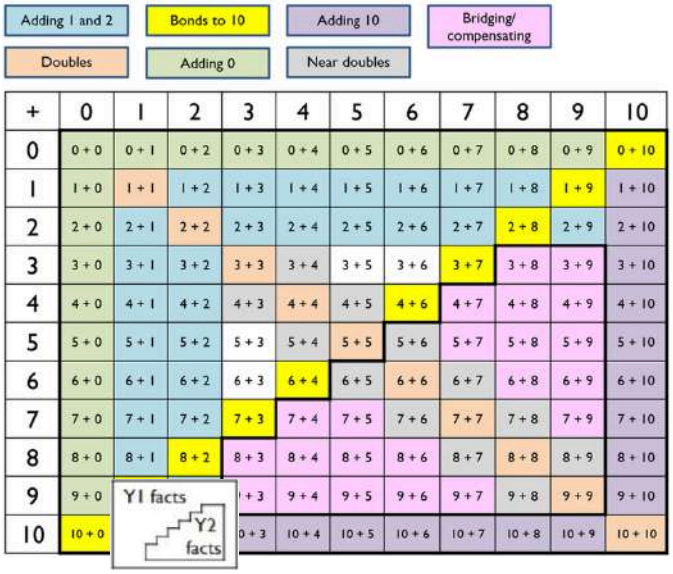
Number Bonds, Times Tables and Ninja Tests

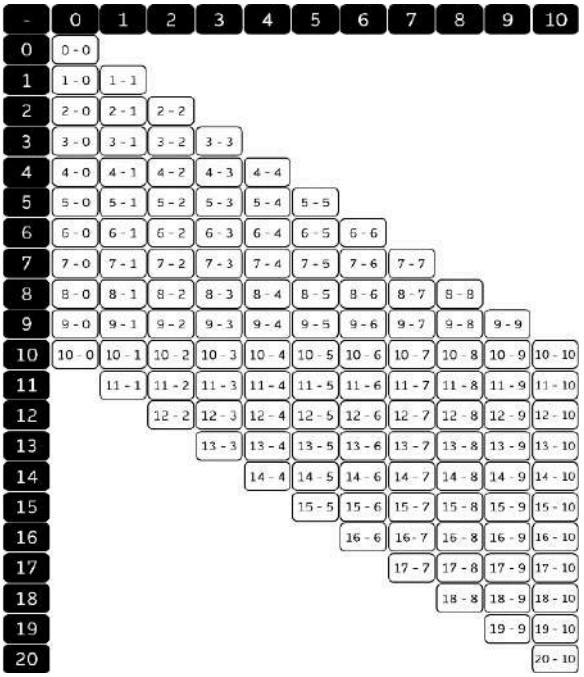
Number Bonds

A defined set of addition and subtraction facts builds the basis of all additive calculation, just as times tables are the building blocks for all multiplicative calculation. Fluency in basic facts allows children to tackle more complex maths more effectively, as children use less working memory and can focus on solving the actual problem. Children must be taught strategies to solve these facts. Most children aren't fluent in facts but fluent in strategy, particularly those that bridge ten. If they aren't explicitly taught to these strategies, then many children will get stuck on inefficient counting based approaches.

The full set of addition facts:

Corresponding subtraction facts:





- Teaching progression has been mapped to identify when every individual fact was being taught. Year 1 should teach strategies for facts within 10 (steps 1 – 7) and in year 2, the bridging ten facts (steps 8 – 11)

1. Adding 1 (e.g. 7 + 1 and 1 + 7)
2. Doubles and near double of numbers to 5 (e.g. 3 + 3, 4 + 5, 5 + 4)
3. Adding 2 (e.g. 4 + 2 and 2 + 4)
4. Number bonds to 10 (e.g. 8 + 2 and 2 + 8)
5. Adding 0 to a number (e.g. 3 + 0 and 0 + 3)
6. Adding 10 to a number (e.g. 5 + 10 and 10 + 5)
7. The ones without a family 5 + 3, 3 + 5, 6 + 3, 3 + 6 (these pairs of facts are the only ones which don't fit in any of the other families, though the last two can be related to counting in 3s)
8. Doubles of numbers to 10 (e.g. 7 + 7)
9. Near doubles (e.g. 5 + 6 and 6 + 5)
10. Bridging (e.g. 8 + 4 and 4 + 8)
11. Compensating

Note that these 3 strategies can often be used interchangeably, e.g. for 8 + 9, some people will use near doubles (e.g. 8 + 8 + 1), some will use bridging (e.g. 8 + 2 + 7) and some will use compensating (8 + 10 – 1)

Year 1

- Number Bonds 6 – 20 - each test consists of 20 questions

Year 2

- X2, X5, and X10 tables – each test consists of 25 questions
- Bronze award consists of 30 questions.

Year 3

- X3, X4, X6, X8 tables – each test consists of 25 questions
- Silver Award consists of 30 questions

Year 4

- X7, X9, X11, X12 – each test consists of 25 questions
- Gold Award consists of 30 questions

Year 5

- All mixed multiplication and division questions – each test consists of 50 questions covering all multiplication and division facts
- Gold award consists of 50 questions
- Platinum award consists of 50 questions
- White belt ninjas consist of 68 questions
- Yellow belt ninjas consist of 72 questions

Once pupils have shown, through testing, that they are fluent in all times tables (which should be by the end of year 4 at the latest), they move on to mixed multiplication and division tests. Once pupils have shown, through testing, that they are fluent in the mixed tests they move on to the Ninja challenges. Ninja belt tests have different amounts of questions. All tests to be administered in 3 minutes unless it is a Ninja test (or Beyond Ninjas) where children should have 6 minutes to complete. Pupils must achieve full marks in order to move on to the next test.

Year 6

<table>
<tr><td>Ninja Belts</td><td colspan="4">White belt — mixed x12 multiplication and division questions
Yellow belt — using and applying known facts (place value, decimals) e.g. 10 x 4 = 40 so 10 x 40
Orange belt — mixed tables multiplying and dividing by 10 100 & 1000 including decimals
Green belt — unit fractions of an amount, key percentages, decimal fractions of an amount
Blue belt — non-unit fractions of an amount, percentage and decimal fractions of an amount
Red belt — as above
Black belt — mixed worded problems</td></tr>
<tr><td colspan="5">Beyond Ninjas</td></tr>
<tr><td rowspan="4">Jewel Collector Challenge</td><td>x25</td><td>x15</td><td colspan="2">Emerald — mixed x25 and x15 multiplication and division questions</td></tr>
<tr><td>x16</td><td>x14</td><td>x18</td><td>Sapphire — mixed x16, x14 and x18 multiplication and division questions</td></tr>
<tr><td>x19</td><td>x13</td><td>x17</td><td>Ruby — mixed x19, x13 and x17 multiplication and division questions</td></tr>
<tr><td colspan="4">Diamond — mixed multiplication and division questions up to x19 and including x25</td></tr>
</table>

Out of this World Challenge	Mercury —multiplying by partitioning up to 12 x 12 Venus —multiplying by partitioning beyond Earth —multiplying by factorising up to 12 x 12 Mars —multiplying by factorising beyond Jupiter — multiplying by factorising up to 12 x 12 Saturn —multiplying by factorising beyond Uranus —multiplying using known facts up to 12 x 12 Neptune—multiplying using known facts beyond

All results to be recorded by the end of each half term on the relevant mark sheet on SIMs.

Tables Stick

In line with EEF (education Endowment Foundation) guidance for improving the teaching of maths, Table Sticks provides a strategy-based approach for the teaching of times tables, supported by Tables Stick practical resources to deepen understanding and scaffold learning so the facts make sense for all children.

This mastery approach, grounded in number sense, builds on what children already know and emphasises the rich patterns and connections between mathematical facts, locking them into long-term memory for fluent recall and application.

Table Sticks supports the teaching and learning of times tables up to 12x12, using a CPA strategy-based approach, which focuses on deep learning to ensure that table facts in the long term memory for fluent and rapid recall. Teachers will use key proven strategies and other concrete resources including ten frames, arrays and Numicon alongside the Tables Stick to ensure table facts are locked into the long term memory.

Fundamentals of programme:

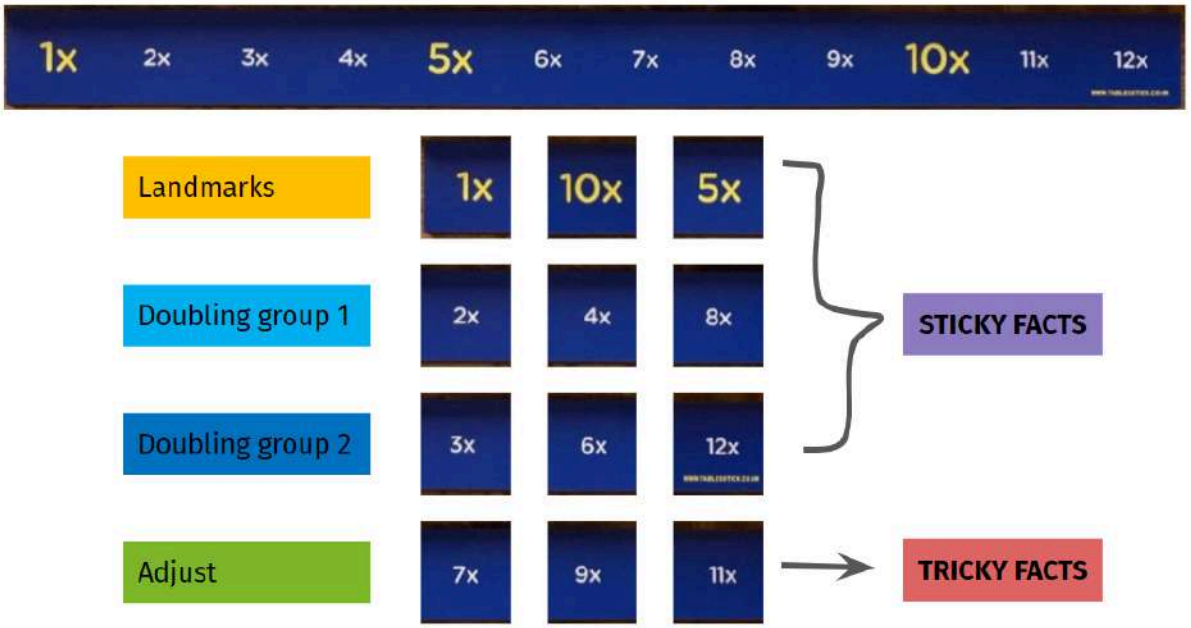
- The counting stick (and a colour-coded card set of each times table from 2 – 12) is a core resource and should be on hand at the front of the class at all times
- Explore the rich patterns of multiplication
- Develop reasoning alongside fluency
- Children need to build on what they know

Times table	Connection/strategy	Additional representations
2x	Doubles Commutativity	Arrays
10x	1x	Place value board Numicon
5x	10x Odd/even Double/half	Numicon Ten frames
3x, 4x,6x,7x,8x	Doubles Landmarks (5x and 10x)	Arrays Ten frames
9x 11x	10x (and adjust)	Numicon
12x	Landmark – 10x	Ten frames Numicon

Overview of our approach:

- Tables stick should be part of daily practice, during times tables in
- Not all steps must be covered each day
- Repeat steps until children are rapid
- Steps can take as long as children need until they are secure
- Focus on rapid recall as well as quick articulation of strategy (no finger counting!)

The resource:



Breakdown of strategies:

LANDMARKS

1x — What times table are we focussing on?

10x — 10 times larger than 1x

5x — Half of 10x

Can swap these around

Identify the connection - odd/even

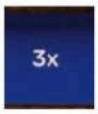
DOUBLING

2x — Double 1x

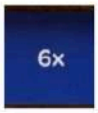
4x — Double 2x OR 1 group less than 5x (5x - 1x)

8x — Double 4x OR 2 groups less than 10x (10x - 8x)

DOUBLING



Add 1x and 2x OR 1 group less than 4x (4x - 1x)



Double 3x OR 1 group more than 5x (5x + 1x)

Double 6x OR 2 groups more than 10x (10x + 2x)

Multiplication Test Check

Overview:

- It is an on-screen check consisting of 25 times table questions.
- Children will be able to answer 3 practice questions before taking the actual check.
- They will then have 6 seconds to answer each question.
- On average, the check should take no longer than 5 minutes to complete.
- Questions about the 6, 7, 8, 9, and 12 times table come up more often.

What if a child cannot access the check?

- There are several access arrangements available for the check, these can be used to support pupils with specific needs.
- The check has been designed so that it is inclusive and accessible to as many children as possible, including those with special educational needs or disability (SEND) or English as an additional language (EAL). However, there may be some circumstances in which it will not be appropriate for a pupil to take the check, even when using suitable access arrangements. If you have any concerns about a child accessing the check, you should discuss this with your headteacher.

The data from the times tables checks is:

- Used by schools to provide additional support to pupils who require it.
- Available to Ofsted via the Analyse School Performance (ASP) data system.
- Reported on by the Department for Education (DfE) to track standards over time.
- Used by the DfE to provide schools with the ability to benchmark the performance of their pupils.

There is no official 'pass mark' for the Multiplication Times Table Check but each school has their own personalised target which is important to aim for as school level results are available to selected users including Ofsted for standards benchmarking. Results are also published at national and local authority level which all means that school's results need to be in line with (or better than) local and national averages.

MTC Boundary

Threshold Scores

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
% of pupils achieved threshold	10	15	20	23	25	Actual MTC 25

Current Practice

- The SIMs Marksheet should be completed at the end of every half term.
- Data should be compared against the boundary document [as above] then all schools to identify pupils who didn't meet the boundary. Interventions and ALPS should be put in place for these pupils.
- The CEO report should be completed at the end of every half term to indicate current data.
- Pupils to be made aware of their target and current attainment.
- A thorough plan should be put in place as to which pupils will be completing the tests and when and how this will be facilitated. Ensuring that the entire assessment window is used and persistently absent children are targeted at the beginning of the assessment window.
- Pupils are to practice the MTCs using UrBrainy practice every week. This should be NO ENTER practice. Children do not hit enter instead they check their answer during the 6 second window.
- Phase leads should send out the DFE document 'Multiplication Test Check Information' for Parents in Autumn 1 and parental engagement should be sustained across the year, including having regular conversations with parents for targeted and key marginals children. Then targets, current attainment and boundaries should be reinforced during parents evening.
  https://www.gov.uk/government/publications/multiplication-tables-check-information-for-parents
- Half- termly report which includes times tables data should be sent to parents when available.
- Pupil successes should be celebrated every week using the times table stickers.

Mental Strategies

Understanding mental math strategies is an essential skill in mathematics. By explicitly teaching these strategies, pupils can quickly solve problems mentally without relying on written calculations. This helps build confidence in their mathematical abilities and enhances their overall problem-solving skills. Teachers will introduce various mental strategies such as compensation, rounding and adjusting, bridging through 10 etc to make computations easier and faster. Encouraging the usage of mental strategies should lead to improved fluency and efficiency in solving math problems.

Mental strategies are taught explicitly everyday during the session, the mental strategy in focus taught each week is informed by the long term map and supported by the progression document and Mental strategy posters. The mental strategy in focus is added to the Maths on a Page.

The Monday session is used to explicitly teach the mental strategy in focus which follows an I do, you do, we do approach. The mental strategy is then revisited during the session on a Tuesday, Wednesday, Thursday and Friday.

As part of the 3.0 Whiterose planning process the planning for mental strategies will be incorporated into the main Maths lesson where the strategy best fits. This will be added to the MTP.

How is mathematics lessons planned for?

The long-term map:

- Has number at their heart. A large proportion of time is spent reinforcing number to build competency.
- Ensures teachers secure the year group objectives and support the ideal of depth by variation of task before breadth.
- Ensures students have the opportunity to stay together as they work through the schemes as a whole group.
- Provides regular opportunities to build reasoning and problem-solving elements into the curriculum.

The units which are set out in the long-term map are progressive. Teachers use these to plan a unit of work. They use the White Rose and Power Maths resources to secure an understanding of the unit and to select activities that will enable pupils to secure the objectives and skills identified. They will also use gap analysis effectively to identify gaps in learning for individuals, groups and classes.

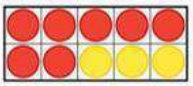
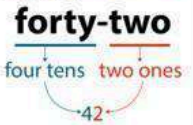
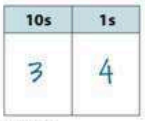
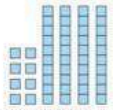
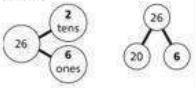
Teachers are responsible for planning the units they will cover each half term. Each unit will follow the GLC approach to teaching mathematics.
The unit plan will include:

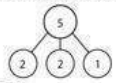
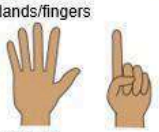
- The unit in focus
- Learning objectives (Small steps)
- National Curriculum objectives
- White Rose, Power Maths and NCETM resources
- Representations and structures
- Key vocabulary
- Assessment and probing questions
- Stem sentences
- Generalisations

At each stage of the lesson clear timescales and the amount of work to be completed must be given to ensure pupils are able to work quickly and efficiently and develop resilience.

Exemplification materials will be used to ensure appropriate pitch and challenge.

Half termly overview example:

PLACE VALUE - WEEK 1					
National Curriculum	**Small steps**	**White Rose Power Maths Other**	**Representations and structures**	**Vocabulary**	**Assessment and Probing Questions**
Pupils should be taught to: • Recognise the place value of each digit in a two-digit number (tens, ones) • Identify, represent and estimate numbers using different representations, including the number line • Read and write numbers to at least 100 in numerals and in words • Use place value and number facts to solve	• PRE BLOCK ASSESSMENT • Lesson 1: Counting forwards and backwards within 20 • Lesson 2: Tens and ones within 20 • Lesson 3: Counting forwards and backwards within 50 • Lesson 4: Tens and ones within 50 • Lesson 5: Compare numbers within 50	**White Rose** Small steps p10-19 Premium Resources **Power Maths** Textbook 1A, Unit 6 Numbers to 20 Teacher Guide Textbook 1B, Unit 9 Numbers to 50 Teacher Guide **NCETM** Making group of 10s and 1s, 20-99 - teaching point 2 and 5	Cardinal counting sequence Tens Frames  Number lines Number tracks  Bundle Sticks  10s and 1s  Teen numbers	Number names and numerals 11-50 Digit, one-digit, two-digit Count, forwards, backwards Place value Tens, ones More, less Less than (<), greater than (>) Greatest, smallest, fewer, fewest, most, least Order, compare Equal to, more than, less than Pattern, compare Sequence Equals (=), equivalent	What do you notice about the sounds of the numbers? Do you notice a pattern with the numbers? What do you notice about the ends of most of these numbers? What does 'teen' tell us about a number? Will I say the number ___? What does the number _____ look like?
problems.			 Place value chart  Dienes  Dienes variation  Part-part-whole cherry model  	Partition, part, whole, part-part-whole Represent Check	Which is greater 1 ten or 1 one? How do you know? Can you swap tens for ones? Will it change the amount? Explain. Can you describe the number _____ using tens and ones? How can we count a larger number of objects more easily? What happens when we get to 10? 20? 30? Do we need to count the 10 individually? Do we need to start counting from 0 every time?

			Part-part-part-whole  Multilink Cubes  Bead strings  Hands/fingers  Numicon  Gattengo chart  100 grids/square		How many groups of 10 can we see in the number ___? Which practical equipment is best for showing groups of 10? How many tens are there? How many ones are there? What number does that make? How have the beads been grouped? How does this help you count?

					
	Stem sentences			**Generalisation Statements:**	
	• This is the number _. We write the _ then the _. • ___ ones make ___ ten. • The _ shows that we have _ groups of ten. • The _shows that we have _ extra ones. • We have _ groups of ten and _ extra ones. • _has _tens and _ones. • There are _ tens; it has the value of _. • There are _ tens which is _, and _ one(s), which is _. This makes _ altogether. The _ represents _ tens; it has a value of _. The _ represents _ one(s); it has a value of _. • The number after _ is _. The number before _ is _. • E.g. forty-five is made up of forty and five more. Forty-five is made up of four tens and five ones. Forty-five is made up of forty-five ones.			This is ten ones. It is also one ten. One ten is equivalent to ten ones. All two-digit numbers are made up of tens and ones. We know that objects can be counted efficiently by making groups of ten. When I read a 'teen' number, I cannot hear the single digit in the name like others e.g. sixteen – six ones and a ten. I know a 'teen' number always starts with a 1 and has 1 ten. Each number from 11 to 19 has 1 ten and extra ones. We can work out how many there are by counting in ones or by counting the groups of ten and the extra ones. I know when I reach 9 ones in any counting sequence, my next number will be a multiple of 10. This is called crossing the tens boundary.	

The calculation policy:

The calculation policy is used to ensure consistency from Nursery to Y6 and across all schools in the GLC. (**See Appendix 9**)

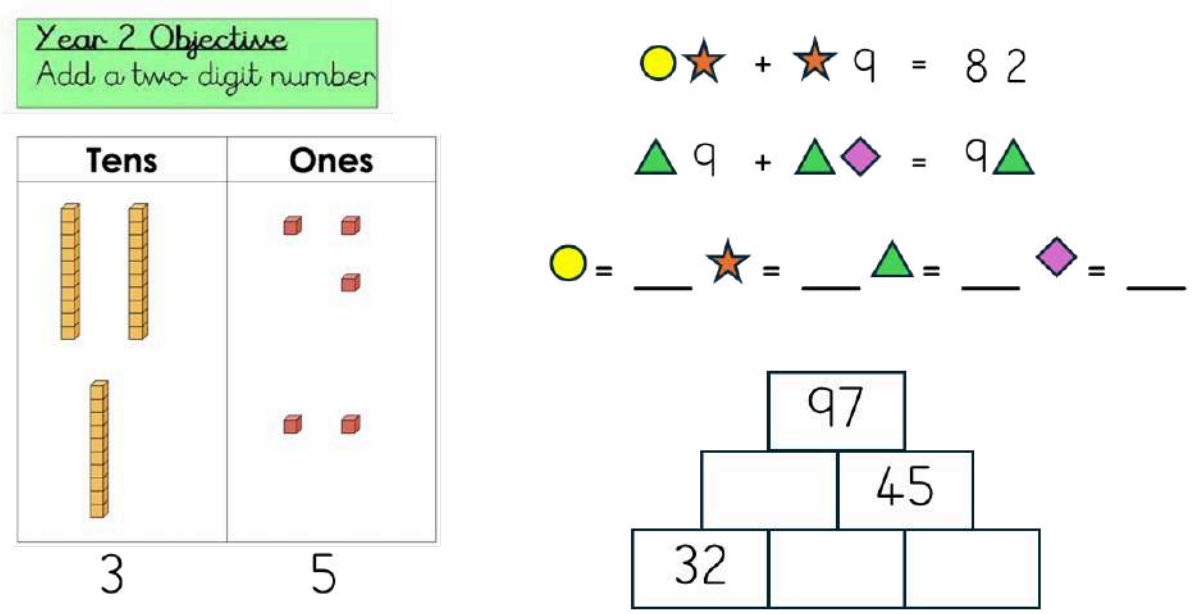
What makes a good maths lesson?

- The lesson will form part of a sequence of lessons, based on age-related expectations of what pupils need to achieve and will build upon solid foundations
    - The teacher demonstrates secure subject knowledge: modelling is precise and clear using software and concrete resources as appropriate
    - Common misconceptions are pre-empted, planned for and addressed
    - Pupils explore maths using concrete resources and pictorial images in order to develop their reasoning and problem solving skills
    - Pupils demonstrate learning through fluency/reasoning/problem solving tasks
    - Teachers provide variation of task at every stage of the maths lesson to secure depth of learning
    - Maths vocabulary is taught and pupils are expected to use it when verbalising their reasoning
    - Teachers model stem sentences and pupils are expected to use them when verbalising responses, supporting their Oracy
- Questioning is used to: probe thinking, challenge, extend upon given answers, clarify, assess and support generalisation
- Assessment between lessons is rigorous and teachers use check for understanding to reteach, defer or move on
- Teachers use ongoing assessment to intervene in learning for specific groups or individuals and only stop the whole class when it is appropriate to do so. Intervening in learning may include:
    - Taking pupils back to the previous phase of learning revisiting concepts in a concrete way
    - Moving pupils through the phases of CPA or fluency, reasoning or problem solving sooner
    - Providing further variation of task to add challenge and depth
- Teachers provide investigative activities which develop mathematical thinking and problem solving

"Communication is necessary for students developing their mathematical reasoning: purposeful talk can be part of that." (NCETM, "Reasoning through Talk" guide, based on Ofsted findings).

How do we plan to enable pupils to secure depth to their learning? <u>(Depth, not breadth)</u>

- There is a focus on deepening pupil's learning, as opposed to moving on to new content or objectives from the next year.
- An example of 'going deeper' through task variation can be seen in this example:



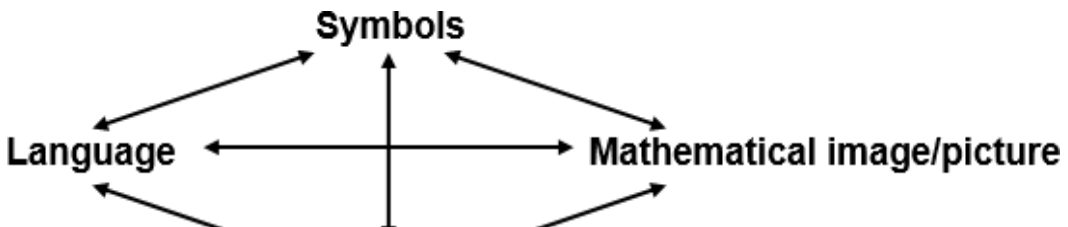
How do we develop procedural and conceptual understanding in tandem?

- Procedural variation is used to support pupils' deeper understanding of a mathematical procedure or process. This might be to compare the same procedure used to calculate two different sets of numbers. By asking the pupils to compare two successive procedures where the first is linked to a second. Pupils observe relationships and structures of the procedure **(what stays the same and what changes?)** leading to generalising about the procedure.
- Conceptual variation means the opportunity to work on different representations of the same mathematical idea. This might be for instance looking at multiple representations of the number 54 with Dienes, PV counters, arrow cards, 100 square etc. These multiple representations will 'showcase' to pupils the different conceptual ideas that underpin a mathematical idea. For example, in the context of place value, some will reveal the quantity/ value of a digit, some will reveal the importance of position of a digit, others will support the order of the number and some will reveal the additive or multiplicative nature of place value. Conceptual variation can also relate to the same mathematical idea but a different problem.
- **Concrete – Pictorial – Abstract**

  The Gateway Learning Community believe that all pupils, when introduced to a key new concept, should have the opportunity to build competency in this topic by taking this approach. This approach is not linear and the abstract stage should be written alongside the concrete and pictorial stages in order to build a deeper understanding.
  - **Concrete** – pupils should have the opportunity to explore and investigate all concepts using concrete objects and manipulatives to help them understand what they are doing.
  - **Pictorial** – pupils should then build on this concrete approach by using pictorial representations. These representations can then be used to reason and solve problems.
  - **Abstract** – with the foundations firmly laid, pupils should be able to move to an abstract approach using numbers and key concepts with confidence.

Effective learning takes place when the learner makes cognitive connections' (Haylock and Cockburn; 1989).

The Connections Model:



How do we support pupils to use the correct vocabulary and to reasoning mathematically?

- Pupils are supported to communicate their mathematical thinking to become confident, creative mathematical thinkers, developing mathematical 'habits of mind' as first described by Cuoco, Goldenbury and Mark (1996) (Appendix 2)
- Pupils are supported to communicate their ideas and reason about maths using stem sentences

Stem sentences:

What do you see? How many different ways do you see this?

There are boys and girls.
There are fewer boys than girls.
There are fewer girls than boys.
You will need more boys to be equal to girls.
You will need more girls to be equal to girls.
The difference between the number of girls and boys is .

This technique gives pupils the opportunity to respond in the form of a complete sentence to effectively communicate. Stem sentences provide scaffolding to help students reason and get them speaking or writing about the maths without the added pressure of thinking about how to correctly formulate a response. Stem sentences should be clearly identifiable in each lesson and typed on the SMART boards in blue ink. This will make it easily identifiable and distinctly different from the assessment and probing questions.

Stem sentences

- The ____ represents ____. The value of ____ is ____
- If _____ is a part and _____ is a part, the whole is _____
- What is the value of _____ in the number _____
- We can partition this number into ____, ____ and ____ I know that ____ is more/less/equal to ____ because ____
- I know that ____ is larger/smaller/equal to ____ because ____.
- I know that ____ is bigger than ____ because ____ I estimate that the answer will be larger than ____ because ____.

Working Walls

How do working walls act as the 'third teacher' supporting learning?

At the beginning of each unit of work a working wall will begin to be constructed and will continue to be co-constructed with the pupils over the course of a unit of work. (Appendix 3)

The content on the maths working wall is organised under four of the Teaching for Mastery: Five Big Ideas

Mathematical Thinking

Vocabulary

- Vocabulary strips to be used and colours to match the word classes in English and all other areas of the curriculum.
- Display the word or words you will teach and expect them to use for that lesson, with the definition or next to an example.
- Add and remove vocabulary when and where appropriate- long, exhaustive list of words that the pupils no longer

need are unnecessary.

Stem Sentences

- Stem sentences are used to reinforce the learning and should be put in the most appropriate section of your working wall.
- They should be recorded in blue pen

Fluency

Display the step by step strategy that pupils need to successful

- **Describing** – articulating observations about numbers, patterns or relationships.
- **Explaining** – can pupils explain why an answer is incorrect? For example, why is ¼ + ⅔ not ⅜?
- **Conjecturing** – making predictions and exploring possibilities. For example, if I double the number of apples, will I always get an even number?
- **Generalising** – identifying patterns and forming broader mathematical rules.
- **Justifying** – providing logical reasoning to support an answer or conclusion.
- **Proving** – demonstrating why the maths works through clear reasoning.

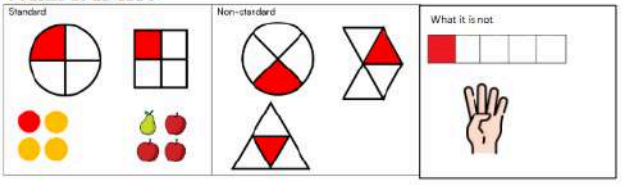
Representation and Structure

The **pictorial and/ concrete representation** which could be:

- A place value chart and counters
- A bar model or cuisenaire rods
- A number line
- A part/whole model and so on…

Variation

Variation influences the way children think about maths by drawing attention to essential structures and relationships within a concept. It is characterised by a carefully constructed small-step journey through learning, where consideration is given to what is kept the same and what changes.

Fluency/Procedural Variation a) $\frac{1}{3} \times 9$ b) $12 \times \frac{1}{4}$ c) $\frac{2}{5}$ of 15	**What it is (both standard and non-standard examples)** **What it is not** 
Conceptual Variation - Contextual Problem Sarah has a recipe that requires 43 of a cup of sugar for one batch of cookies. If she wants to make 5 batches of cookies, how many cups of sugar will she need in total? Show your working.	**Reasoning/Problem Solving Variation** a) $\frac{1}{2} \times \square = 7$ b) $\square \times \frac{2}{3} = 10$ c) If $\frac{3}{5}$ of a number is 18, what is the number?

Working walls should also include examples of number formation and highlight exemplar presentation in books.

What will learning look like in books?

The pupil's learning journey is recorded in squared books. Each pupil's book will contain:

- A clear layout and presentation (Appendix 5)
- Accurately formed number formation (Appendix 6)
- If pupils are recording learning during a session, a subheading showing: will be written
- Targeted objective and fluent in five will be recorded

How will pupils' learning be assessed?

6.3 Maths

How will pupils' learning be assessed?

During lessons:

- Teachers will monitor the progress of individual and groups of pupils to address misconceptions and deepen learning;
- Teachers will ensure that numeral formation is accurate and that presentation is in-line with the presentation code;
- Pupils will assess their work at the end of every lesson. This is to be indicated with a tick [in purple pen] next to the learning objective if the pupil feels they have understood the objective and a dot if the pupil feels they haven't understood the objective. This will be monitored for accuracy and corrected if necessary in green pen by the teacher
- Teachers will use specific verbal and/or written feedback to address basic skills and/or misconceptions;
- Teachers will use their assessment within the lesson and pupil outcomes to make a judgement against the learning objective on the maths online marksheet [Codes: D: Developing, S: Securing, M: Mastering, ABS: Absent;
- Teachers will use ongoing assessment for learning to adapt teaching and learning approaches between lessons: Re-teach, defer or move on

At the end of every lesson:

- Teachers will use their assessment within the lesson and pupil outcomes to make a judgement against the learning objective on the maths online marksheet [Codes: D: Developing, S: Securing, M: Mastering, ABS: Absent];
- Teachers will use ongoing assessment for learning to adapt teaching and learning approaches between lessons: re-teach, defer or move on;
- Teachers will provide whole class feedback, where required, at the start of each lesson. Pupils are expected to respond to feedback;
- Reasoning questions will be marked by the teacher and/or whole class feedback will be provided daily which moves the pupil's learning forward.

Weekly:

- Teachers will use a range of self and teacher marking in books to improve pupils' progress;
- Teachers will test pupils' knowledge of multiplication tables using the test session function on Maths Mania and record when they pass on SIMs

- Teachers will test pupils' knowledge of number-bonds and log the results on the number bonds/times-table chart on SIMS weekly.

Termly [Half Termly for Year 6]:

- Teachers will mark a test in-line with the data and assessment cycle [See appendix in Assessment policy].
- Full arithmetic tests will take place half termly;
- Gap analysis [QLAs] to be shared with all adults and used for planning including 'maths on a page' and interventions;
- Assessments and test outcomes will be shared with pupils and parents

Maths Assessment Trackers

Maths assessment overviews are created in Excel. Individual teachers are expected to fill in their pupil names on their own teacher assessment sheet an adapt the learning objectives according to the curriculum coverage

- Each teacher assessment sheet must be clearly labelled with the year group, teachers name and the half term it pertains to (i.e Year 6 Spring 2 maths teacher assessment – Jade Lauricourt) and saved in your year group planning folders.
- Teachers are expected to assess pupils learning every day, on the overview. This information must be completed using the codes indicated on the Excel sheet (D, S, M, ABS). This information must then be used to: identify the gaps; inform next steps; adapt planning as necessary and help identify pupils for targeted interventions.
- This teacher assessment overview must be completed by all teachers every day and is a non-negotiable and links to Teaching Standard 6: Make accurate and productive use of assessment.

Interventions:

Interventions are carefully planned and informed using QLAs, teacher assessment and number fluency data. The names of any children who have been identified for interventions are indicated on the year group tracker each half term with pre and post data which is used to monitor the impact of the intervention.

KS1 interventions

- Targeted interventions are carefully planned for children who have not secured ELGs (Number Challenge) and number bonds.
- Same day interventions are planned for any children who have not secured the learning objective in the main Mathematics lesson.
- Pre- teaching interventions are planned to inform future Mathematics lessons including the teaching of new vocabulary.

KS2 interventions

- Targeted interventions in KS2 are planned using red objectives taken from the most recent QLA (arithmetic)
- Interventions are mapped out starting with the earliest years and previously taught objectives (arithmetic)
- KS2 interventions include a pre-teaching (reasoning and problem solving) focus that informs future Mathematics lesson including the teaching of new vocabulary.

Nursery and EYFS

The GLC baseline is used to assess pupils on entry to Nursery and Reception. The GLC baseline is used alongside the DFE baseline assessment to assess pupils on entry. Online assessment tools will be used to support the assessment of pupil's learning and summative judgements made on a ½ termly basis. At the end of Reception pupils' assessments are recorded in their Foundation Stage Profiles.

How do we enable pupils to develop cultural capital and the real-world application of mathematics?

- Mathematical reasoning and problem solving is used to solve practical problems in everyday life
- Money (Measurement)
- Converting units (Measurement)

- Percentages (Decimals & percentages)
- Timetables (Statistics)
- Coordinates (Geometry- position and direction)
- My Money Week

Which resources are used to support effective learning?

The key resources we use to teach and assess mathematics are:

White Rose Resources

- Schemes of learning – Small steps guidance
- Premium resources: Powerpoint, worksheet, display sheets, answers, true/false Power Maths

NCETM

- Professional Development Mastery & Materials
- Mastery Challenge booklets
- Ready to Progress Criteria and exemplification
- Curriculum Prioritisation materials Number Sense Maths
- Programme

Third Space Learning
Numbers basics
Shanghai Project books
Everyday Problem Solving and Reasoning – Collins publication Target Maths
The GLC Calculation policy
Test Base
PiXL arithmetic tests PiXL
times table tests PiXL ½
termly tests

(Appendix 8)

Which approaches are used to address gaps in pupil's learning?

Intervention programmes available are:

- NCETM
- 1st Class at Number 1
- 1st Class at number 2
- Numicon Intervention Programme
- Numicon Breaking Barriers
- Numicon Big Ideas
- Y5,6,7,8 Success @ arithmetic programme
- Year 1 catch up programme
- The PiXL therapies and tests [DTT]
- PinPoint learning

How do we support parents in pupil's learning?

We encourage parents and carers to be involved by:

- Sharing current mathematical methods through providing information from the school calculation policy
- Holding workshops for parents/carers focusing on areas of mathematics
- Enrichment activities
- Appropriate homework
- Helping their pupils to learn number bond and times tables facts

IMPACT

- Pupils make good progress from their starting points and achieve attainment targets

Sequence context	**Learning the conventional sequence of counting words is not easy. Pupils learn the 1-10 range by rote, followed by 11, 12, 13. BUT 14 is the first number which has strong parallels with 4. They then learn the decades. This has implications for writing & pupils often struggle when arriving at a new decade.**
Counting context	**Number words are applied to objects. Pupils will often point or nod etc.**
Cardinal context	**The number word describes a set of objects – we have two hands, ten toes, wear two shoes etc.**
Measure context	**Children learn what the appropriate units are. Accuracy is an important concept to develop. Research shows that young pupils have great difficulty in making sense of the measure context.**
Ordinal context	**The number word describes the relative position of things, e.g. the first man on the moon, the third fastest runner etc.**
Non-Numerical context	**Number words to identify codes, e.g. phone numbers, registration numbers on cars etc..**

- Pupils make good progress within each lesson and become increasingly more able to reason and problem solve
- Pupils can apply their learning in a test situation answering single and multi-concept questions with increasing confidence
- Within a unit of work, pupil progress is evidenced through self and teacher assessment against the learning objective
- Pupils develop the ability to think analytically about the world and can take steps to solve mathematical problems they encounter with confidence and efficiency
- Pupils will build a firm foundation of mathematics which they will apply to their everyday life to help them better understand the world around them
- Pupils can readily apply mathematical skills throughout their adult lives, whether it be to spend wisely promoting economic well-being and financial capability, be on time to work or to work our multiple life decisions each day
- As pupils progress in to adulthood and the world of work, they are not disadvantaged by gaps in mathematical knowledge preventing them from achieving their career aspirations
- Throughout their lives, pupils are able to use efficient mental methods in a range of contexts which saves them time and avoids cognitive overload when learning new skills and concepts.

Appendix 1

Counting - Research by Fuson and Hall (1983) suggests that pupils are exposed to a variety of number words in at least 6 different types of contexts.

Gelman and Gallistel (1978) – Counting Principles

	The 1-1 principle	**Assigning a distinct counting word to each item, even if they say 1, 6,**

HOW TO COUNT		**2.**
	The Stable Order principle	**Knowing that the list of words must be a consistent one, even if a child repeatedly counts 1, 3, 2, 6. We should not be surprised if pupils make their own lists of numbers up, given the inconsistencies in our counting system.**
	The Cardinal principle	**Counting leads to a 'product' at the end. If a child has to count again in response to 'how many…..' they have not grasped the principle.**
WHAT TO COUNT	**The Abstract principle**	**Counting collections of abstract, miscellaneous items, even if they refer to them as 'things'.**
	The Order-Irrelevance principle	**Knowing that the order of counting is irrelevant – when they have grasped this, they know what they are doing when counting.**

Range of activities for Counting

<u>Different contexts - Making it fun – Maintaining motivation - Ensuring breadth</u>

Throwing, growing and hiding fingers: 'growing fingers' is important for *counting on* or adding a very small amount to a large quantity, whereas, 'hiding fingers' is important for counting back or subtracting a small amount from a large quantity. Pupils need to be able to instantly 'throw' a number of fingers in order to use them to 'hide fingers' when counting back. For pupils who have manual dexterity difficulties it may be beneficial to 'tap' fingers on a table top or lap, rather than growing fingers.

Counting up/down: it is important that pupils count up from 0 and 1 and down from various numbers to 0 or 1. Aim to practice counting down 3 times more frequently than counting up. Build upon prior knowledge in incremental steps **<u>– no more than 2 additional numbers</u>** from their starting point.

Counting on/back, from and to a number: this is important for finding a small difference. Pupils do not need to use their fingers at the beginning of this process (to track the number counted), however, this is very important to establish once they can instantly 'see' how many fingers they have 'grown'.

Counting certain number of steps: this is very important for adding or subtracting a small quantity**.** Start within a small range that pupils can track mentally e.g. count on 3. Once pupils can use fingers to track increase the range of numbers to 8 steps (do not exceed 8 as we want pupils to add 9 by adding 10 and subtracting one).

Counting in steps of …: precursor for tables facts (when counting from 0) vital for sequencing work, important for two digit mental calculation.

Gordon's /ITPs – counting in steps - hidden numbers (vertical & horizontal) counting on/back/counting	Counting piles of money/money on screen/money box	Objects & estimating (count out a set number, count how many, count in groups of)	Puppet – spotting mistakes (objects & rote counting)
Around the class or group, paired	Clapping, drum beat, stamping, jumping etc.	Finger counting/tapping (need to ensure accuracy)	Alternate counting – teacher /class
Changing speed	Changing voices	Zig-zags/flip flaps	Counting stick
Bean bag/ball, hot potato	Songs	Abacus/bead bar	Websites/Abacus Evolve

Range of activities to support pupils to gain Number Sense

Different contexts - Making it fun – Maintaining motivation- Ensuring Breadth

Relationships and patterns: Pupils need to make connections between numbers such as one more/less/ten more/less, ten times as big, ten times small etc. this needs to be modelled with apparatus and using written numerical symbols alongside each other. Pupils need to locate numbers on the number line and relate that position to the size of the number, Numicon, Cuisenaire or Multilink tower, presented as 'staircases' help pupils to make these connections. **Place value**: Knowledge of the Dienery system (base ten) is vital to understanding relative size and solving conversion problems for measures, fractions, decimals and percentages. Models using Dienes, money, Numicon & Cuisenaire need to be developed in KS1 so that in lower KS2 pupils can move towards a more abstract model using a spike abacus and/or place value counters. In upper KS2 use Dienes, Numicon and/or Cuisenaire to support conceptual understanding of fractions, decimals and percentages.			
Missing numbers, swap games and feely bag activities	Make Numicon, Cuisenaire or Multilink staircases and estimate where a higher number might be	Estimating – KS2 by looking at segments and then multiplying – counting ITP	Stories/songs with increasing/decreasing size
Piles of objects - largest/smallest set, more than/less than etc.	Ordering number cards or Numicon, find the number one more/less/higher than/lower than/between etc.	Make/say/write/ read (numerals & words) Make using arrow cards/partition into tens & ones/ recombine into tens and ones	Numberlines in different directions/ Posters & number lines going up to huge numbers
Subitising -recognising small number of objects instantly (up to 6) Dice, Tens frame & Numicon patterns (beyond 6)	Recognising common arrays: ITP array maker/ multi-array	Partitioning of 2 or 3 digit numbers in different ways	Numeral cards - matching pictures

Place value games	Estimation/subitising - ITP counting Subitising cards - higher/ lower game	Beadbars/abacus for whole numbers & decimal numbers	Cuisenaire rods for fractions Fraction blocks

Range of activities to support pupils to learn Number Facts

Different contexts - Making it fun – Maintaining motivation – Developing mental images

Feely bag, find the missing number	Finding all possibilities: 2 colours of multilink Or bead string	Gordon's ITP calculation balance, hit the answer, matching pairs, triangle cards	Find your partner – numbers or Numicon cards
Building towers	TP number facts	Number line with bee bot	Coins
Finger patterns on Matching cards	Small worlds	Bead strings/bead bar	Flip flaps
Writing (recognising the pattern)	Pelmonism – matching cards	Split box	Multilink rods
Bingo	5s/10s frames	Coat hanger and pegs	Websites
Skittles	Songs	Puppets	Balances
Snap cards	Sliders/triangle cards	Dominoes	Call & response e.g. Number bond is 7 Teacher says 5, pupils Say 2)

Range of activities to support pupils to learn Table facts

Different contexts - Making it fun – Maintaining motivation – Developing mental images

Abacus software – counting sticks & table facts	Dice games – multiply thrown number by times table	ITP multifacts, multiarray, multiplication board, multiplication tables, grouping	Gordon's ITP doubles & halves, dartboards, triangle cards
Counting stick	Scoring games	Nessy – Tables of Doom	Coins
Matching cards	Dominoes/snap cards	Abacus	
			Numicon fill the track
Writing (recognising the pattern)	Pelmonism – matching cards	Call & response	
	Sliders/triangle cards – Excel trio cards (on server)	Table aerobics	Websites
Bingo			
	Songs/raps	Finger patterns (for 9 Times table)	Pattern on hundred square – ITP
Bean bag/ball, hot potato			

71	??	??	??
100	100	100	100
0.71	0.81	???	???

Range of activities to support pupils to Generalise – Generalisation

Recognising patterns – Making connections – Visualising – Applying known facts

<table>
<tr>
<td colspan="2">Patterns of calculation
- What comes next?
646000-10000= 636000
636000 –10000 = 626000
626000- 10000 = 616000
Need to explain why, what is the same/different about the pattern
using mathematical language</td>
<td>Missing symbols
Write the missing symbols (+ - =) in these number sentences:
17 ☐ 3 ☐ 20
18 ☐ 20 ☐ 2</td>
<td>What do you notice?
11 – 1 = 10
11 – 10 = 1
Can you make up some other number sentences like this involving 3 different numbers?</td>
<td>Making links
Apples weigh about 170 g each. How many apples would you expect to get in a 2 kg bag?</td>
</tr>
<tr>
<td>Use a fact
3 x 75 = 225
Use this fact to work out
450 ÷ 6 =
225 ÷ 0.6 =</td>
<td>Complete the pattern
Complete the table.</td>
<td>Odd one out.
Which is the odd one out in each of these collections of 4 fractions
6/10 3/5 18/20 9/15
30/100 3/10 6/20 3/9
Why?</td>
<td>What’s the same, what’s different?
… when you round numbers to one decimal place and two decimal places?</td>
<td>Making links
7 x 8 = 56
How can you use this fact to solve these calculations?
0.7 x 0.8 =
5.6 ÷ 8 =</td>
</tr>
<tr>
<td colspan="2">Continue the pattern
¼ x 3 =
¼ x 4 =
¼ x 5 =
Continue the pattern for five more number sentences. How many steps will it take to get to 3?</td>
<td>Fact families
Which four number sentences link these numbers?
100, 67, 33
What else do you know?
If you know this:
12 – 9 = 3 what other facts do you know?</td>
<td colspan="2">Variation</td>
</tr>
</table>

Range of resources to support pupils to Generalise – Generalisation
Recognising patterns – Making connections – Visualising – Applying known facts

Commutativity (related facts)	**Inverses** (undoing something to return it to the original)	**Multiplying through powers of ten** (using place value to extend known facts to multiples of ten/divisors of ten)	**Partitioning** – to add, subtract, multiply and divide (including doubling & halving)	**Near doubles/halves, rounding** and **adjusting**
Coat hanger/pegs	Small worlds	Dienes & Numicon Used in pattern of Numicon units	Arrow cards (for tens and units)	Doubles add/take one game
5/10s/20 frames	Coat hanger/pegs	Abacus (decimals)	Numicon/Dienes/Cuisenaire for partitioning 2 digit numbers in various Ways	Stories/rhymes
Triangles/sliders	5/10s/20 frames	Finger patterns (labelling fingers tens etc)	Http://www.ictgames.com /woodseasy.html	Numicon track add ten/take away one
Abacus 25% = ¼ etc	Rekenrek 20 Frame	Coins e.g. 3 x 10p + 5 x 10p = 8 x 10p	Money	Abacus/beadbar
Numicon balancing scales Building towers	Double sided Counters	Packets of crayon/pens etc. Boxes of ten	Jigsaw numbers – complements for 100	ITP counting on/back
Flip flaps Double sided Counters	Gordon's ITP inverse operations	Dienes used as decimals (purple)	ITP counting on/back	Http://www.ictgames. Com/dinosaurdentist /index.html
Number facts or Multiarray ITP	Number facts & Multiarray ITP	ITP moving digits	Cuisenaire & number track	Skemp towers game

Range of activities to support pupils to develop Problem Solving skills
Analysing - Understanding the structure – Re/constructing a structure – Solving problems Ideas bank: NCETM reasoning documents & NCETM Mastery assessments

Read & identify Recognising the operation to be used. (ensure some problems are from past SATs papers)	**Change the numbers** Change the numbers, how can they be changed? What can't be changed?	**Play it** Apply new skills in a game situation	**Top tips** Explain how to round decimal numbers to one decimal place? *Also see rounding in place value*
Match it Match word problem with written algorithm	**Construct it** Write word problem based upon written algorithm	**What does it look like?** Pupils have opportunities to draw what they see/ visualise from maths story	**Spot the key words** Read the question, which words signal the situation/ way to solve the problem?
Spot the error Word questions that can't be solved/do not make sense, e.g. 6 eggs in the box, I cooked 8 how many left? Why can't it be solved?	**Work it backwards** Provide an answer/situation, what sort of question might have been asked? E.g. answer is 6 buses (Question might be about school trip, how many buses needed for certain number of people)	**What's the structure?** Recognising the sub-type of a particular operation (e.g. subtraction problem; is it: take away, difference, reducing, complement of set, counting up to ?)	**Compare it (group activity)** Compare different methods for solving problems (ensure problems give opportunities for more than one way of solving them through careful choice of numbers involved) (similar to 'strategies ')
Change the situation Re-write in different context, e.g. question about weight, use same numbers but write for capacity.	**What next?** Once a problem is completed, what other situations might occur? E.g. Granny shared £24 between 6 grandchildren; they all get £4 each. What could happen next? Is this a similar or different maths operation?	**Strategies (teacher led)** Pull out the *computational* skills/ strategies that were used to solve a problem – how did some children make it easier (e.g. rounding/partitioning numbers/ Using known facts/multiplying by ten and then dividing at the end to make decimals easier to manipulate etc.)	**Invent it** Create word problems based on new skill being taught e.g. learning about adding 9 by rounding to ten and adjusting, make up word problems that might utilise this skill

True, not true, sometimes true	Making an estimate	Do, then explain	Make up an example
Give a selection of statements and pupils have to discuss whether they are true, not true, sometimes true and give justification for choices/examples/counter examples	Which of these number sentences have the answer that is between 550 and 600 1174 - 611 3330 – 2779 9326 - 8777	5035 5053 5350 5530 5503 If you wrote these numbers in order starting with the largest, which number would be third? **Explain how you ordered the numbers**.	Create seven digit numbers where the digit sum is six and the tens of thousands digit is two. e.g 4020000 What is the largest/smallest number?
Possible answers A number rounded to the nearest thousand is 76000 What is the largest possible number it could be?	**Convince me** - 666 = 8 5 What is the largest possible number that will go in the rectangular box? What is the smallest? Convince me	**Hard and easy questions** Which questions are easy / hard? 213323 - 70 = 512893 + 37 = 8193.54 - 5.9 = Explain why you think the hard questions are hard?	**Size of an answer** The product of a two digit and three digit number is approximately 6500. What could the numbers be?
Prove It What goes in the missing box? 12 3 ÷ 6 = 212 Prove it 12 3 ÷ 7 = 212 22 3 ÷ 7 = 321 r 6	**Ordering** Put these numbers in the correct order, starting with the largest. 7/10, 0.73, 7/100, 0.073 71%	**Extend it** Party bags contain: whistle 25p balloon 5p chews 12p pencil 9p How much does the party bag cost? **Extension:** If you only put 3 items in the bags what combinations could you have? What would be the cost of the cheapest/dearest bag? If having a party for 12 people costs?	**Testing conditions** Shape A is a rectangle that is 4m long and 3m wide. Shape B is a square with sides 3m. The rectangles and squares are put together side by side to make a path which has perimeter between 20 and 30 m. For example
Possibilities Adult tickets cost £8 and Children's tickets cost £4. How many adult and children's tickets could I buy for £100 exactly? Can you find more than one way of doing this?	**Missing information** The mean score in six test papers in a spelling test of 20 questions is 15.Five of the scores were 13 12 17 18 16 What was the missing score?	**Write more statements** One battery weighs the same as 60 paperclips; One pencil sharpener weighs the same as 20 paperclips. Write down some more things you know.	Can you draw some other arrangements where the perimeter is between 20 and 30 metres?

Appendix 2

Mathematical Habits of Mind (Cuoco, Goldenberg and Mark (1996):

Look for patterns: to look for patterns amongst a set of numbers or figures

Tinker: to play around with numbers, figures, or other mathematical expressions in order to learn something more about them or the situation; experiment

Describe: to describe clearly a problem, a process, a series of steps to a solution; modulating language depending on the audience

Visualize: to draw, or represent in some fashion, a diagram in order to help understand a problem; to interpret or vary a given diagram

Represent symbolically: to use symbols to represent or solve problems efficiently, and also so as to communicate solutions more persuasively
Prove: to engage in dialogue aimed at clarifying an argument; to establish a deductive proof; to use indirect reasoning or a counter-example as a way of constructing an argument

Check for plausibility: to routinely check the reasonableness of any statement in a problem or its proposed solution, regardless of whether it seems true or false on initial impression and to look at special and limiting cases to see if a formula or an argument makes sense in some easily examined specific situations.

Take things apart: to break a large or complex problem into smaller chunks or cases, achieve some understanding of these parts or cases, and rebuild the original problem; to focus on one part of a problem (or definition or concept) in order to understand the larger problem

Conjecture: to generalise from specific examples; to extend or combine ideas in order to form new ones
Change or simplify the problem: change some variables or unknowns to numbers; change the value of a constant to make the problem easier; change one of the conditions of the problem; reduce or increase the number of conditions; specialise the problem; make the problem more general

Work backwards: to reverse a process as a way of trying to understand it or as a way of learning something new; to work a problem backwards as a way of solving

Re-examine the problem: closely examining a problem, thinking about the meaning and implications of each term, phrase, number and piece of information given before trying to answer it

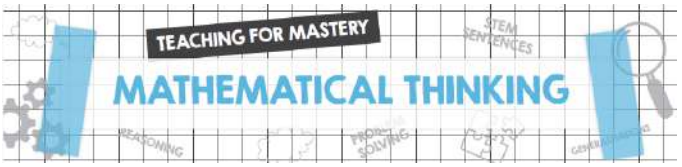
Change representations: to invent an equivalent problem, about a seemingly different situation, to which the present problem can be reduced; to use a different field (from the present problem's field) in order to learn more about its structure

Create: to invent mathematics both for utilitarian purposes (such as in constructing an algorithm) and for fun (such as in a mathematical game); to posit a series of premises (axioms) and see what can be logically derived from them

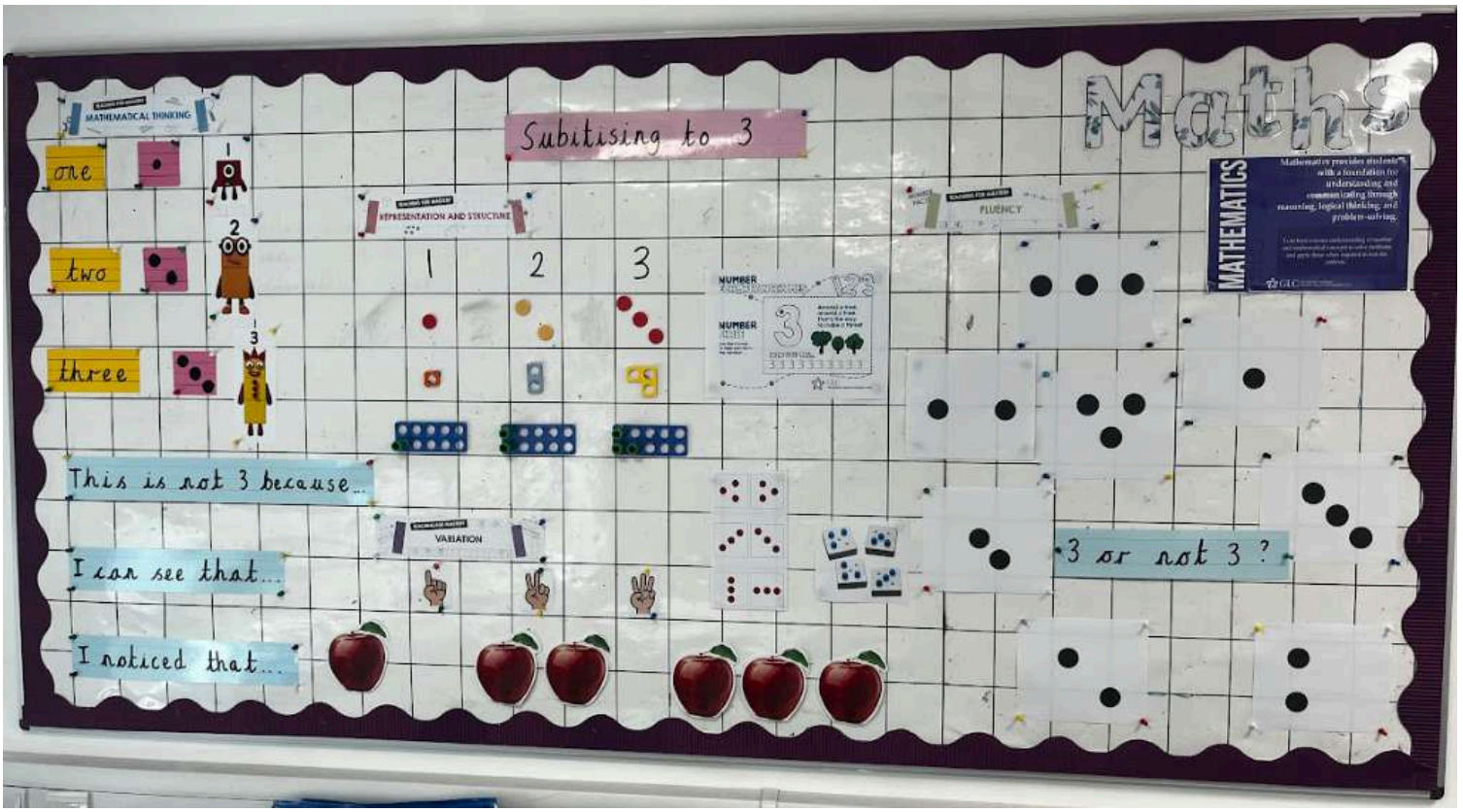
Appendix 3

Working wall

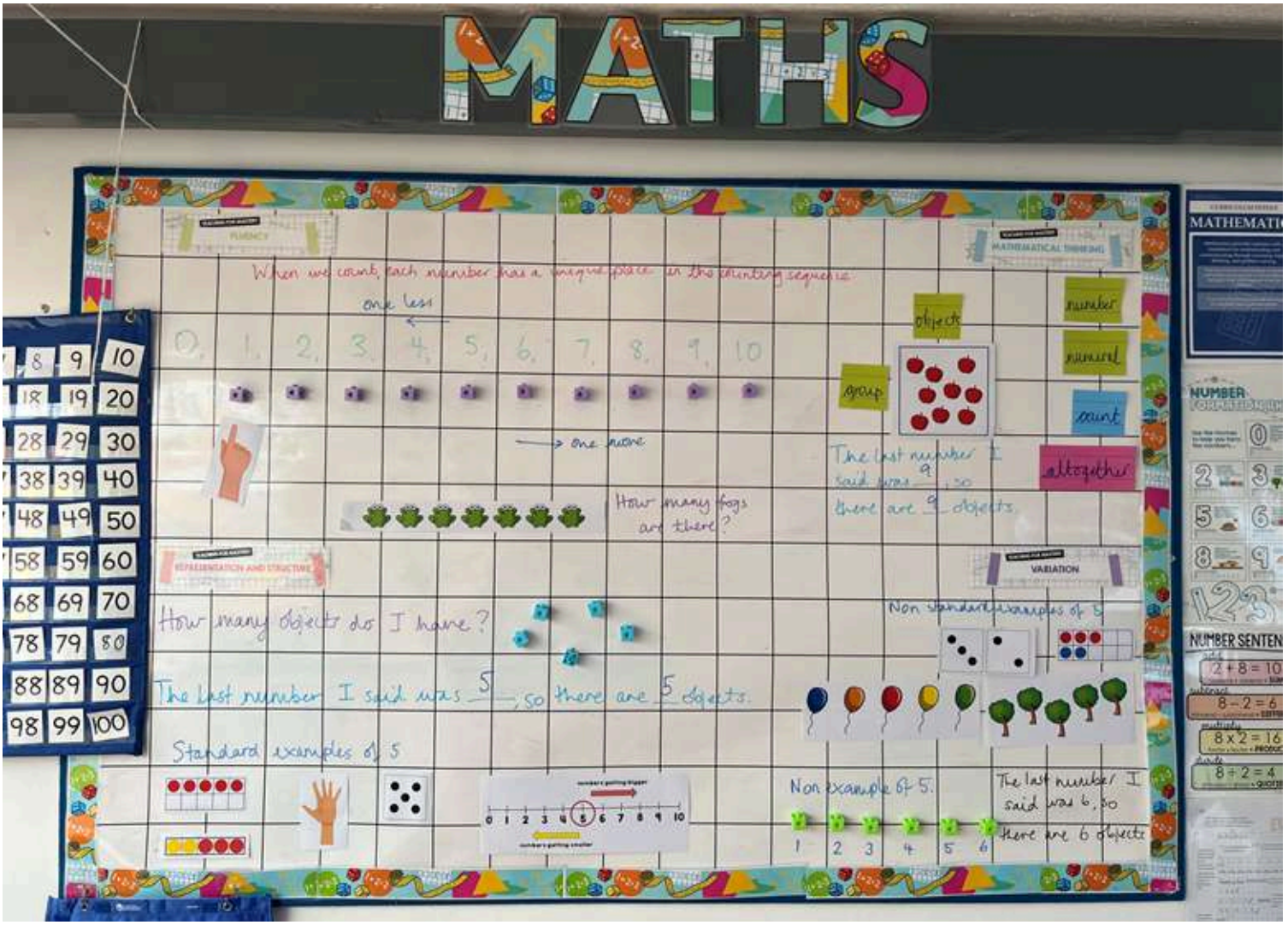
Headings for each section



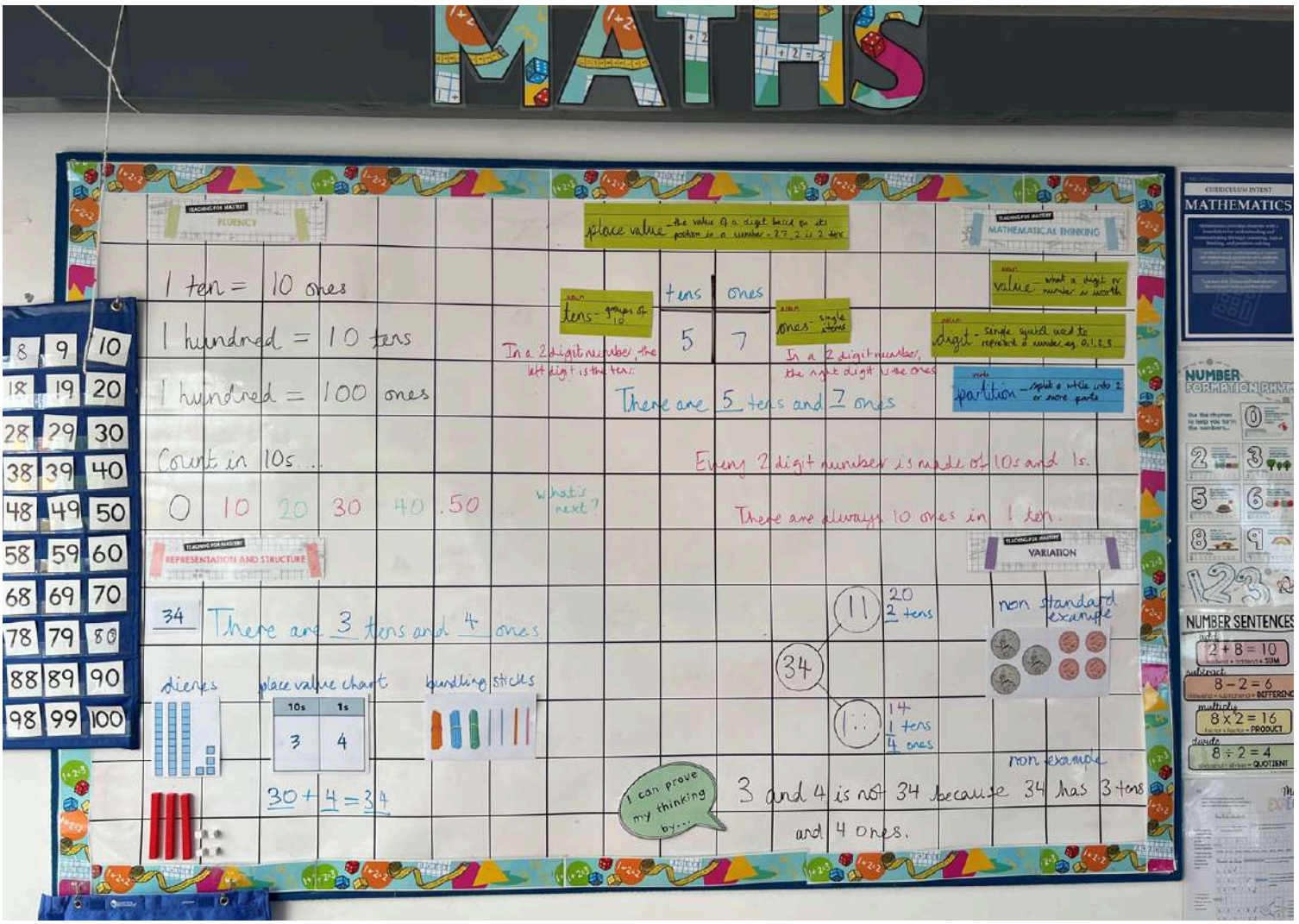
EYFS



Key Stage 1
Year 1

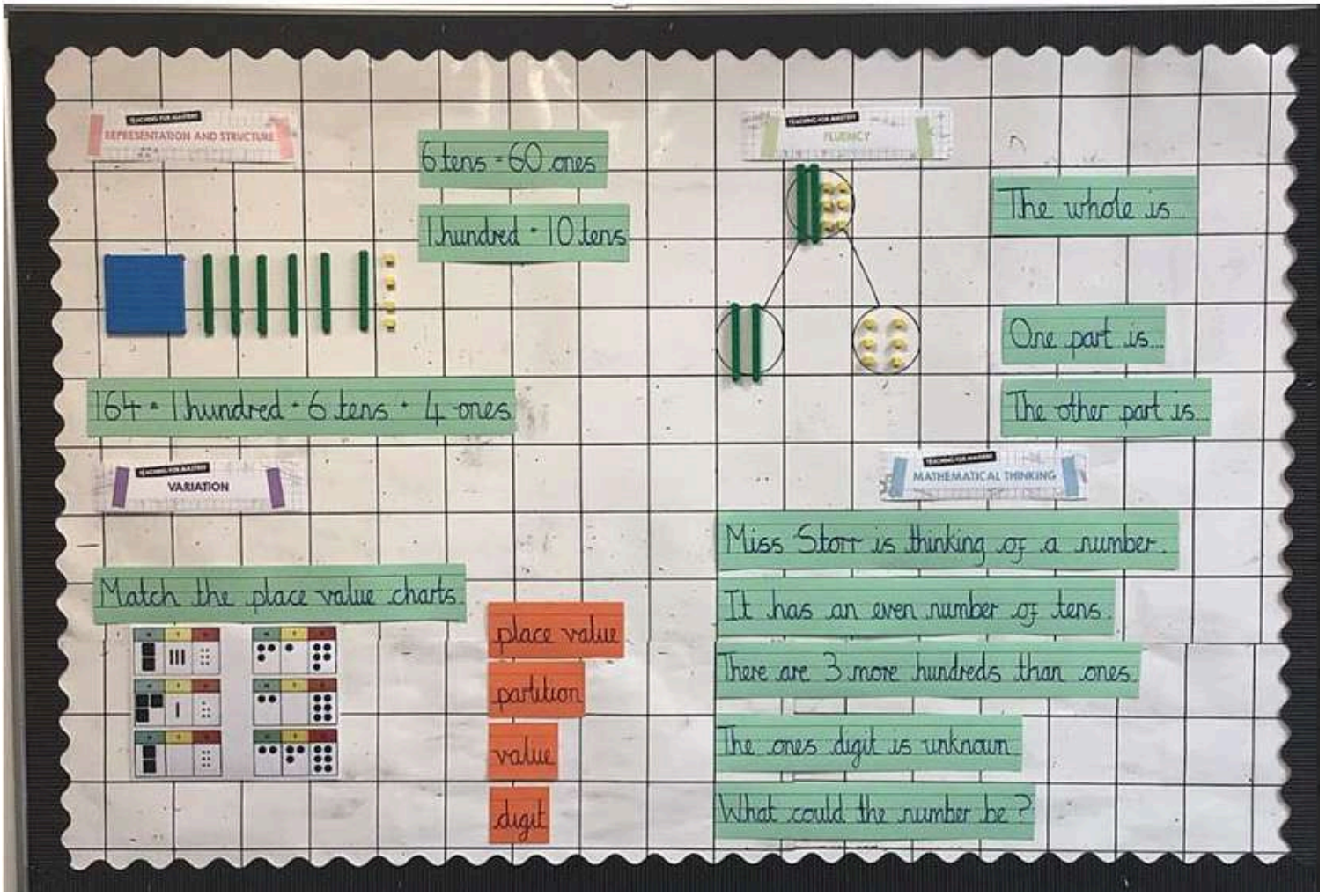


Year 2



Lower Key Stage 2

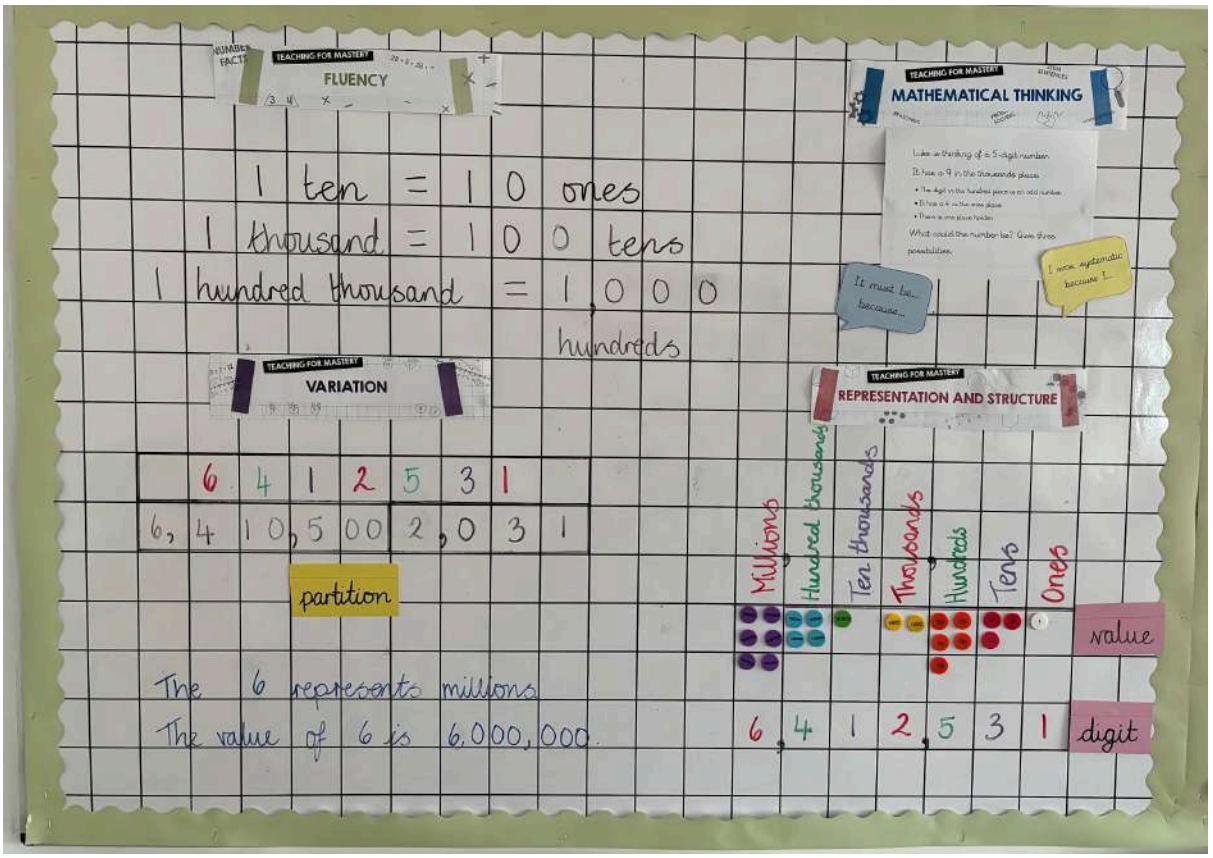
Year 3

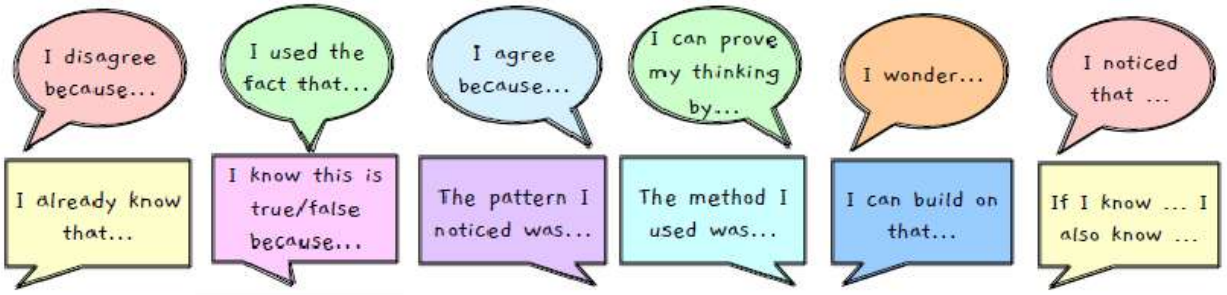


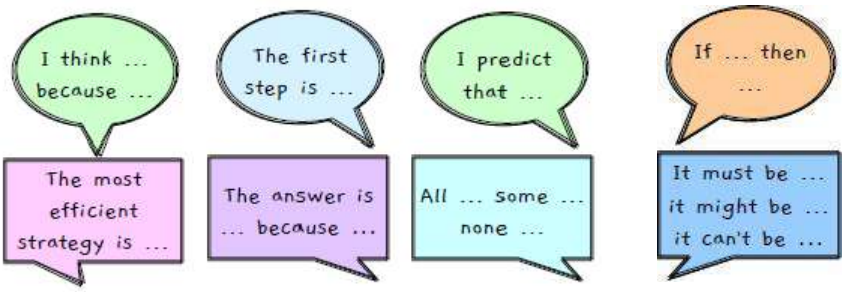
Upper Key Stage 2
Year 5


TEACHING FOR MASTERY
FLUENCY
1 ten = 10 ones
1 thousand = 100 tens
1 hundred thousand = 1,000 hundreds
TEACHING FOR MASTERY
MATHEMATICAL THINKING
There are six place value counters in this bag. What could the total value be?
numicon
TEACHING FOR MASTERY
VARIATION
My number has 4 hundred thousands
4 1 0,0 0 1
4 1 2,5 3 1
partition
2,5 3 0
value
digit
TEACHING FOR MASTERY
REPRESENTATION AND STRUCTURE
Hundred thousands
Ten thousands
Thousands
Hundreds
Tens
Ones
4 1 2,5 3 1

Year 6

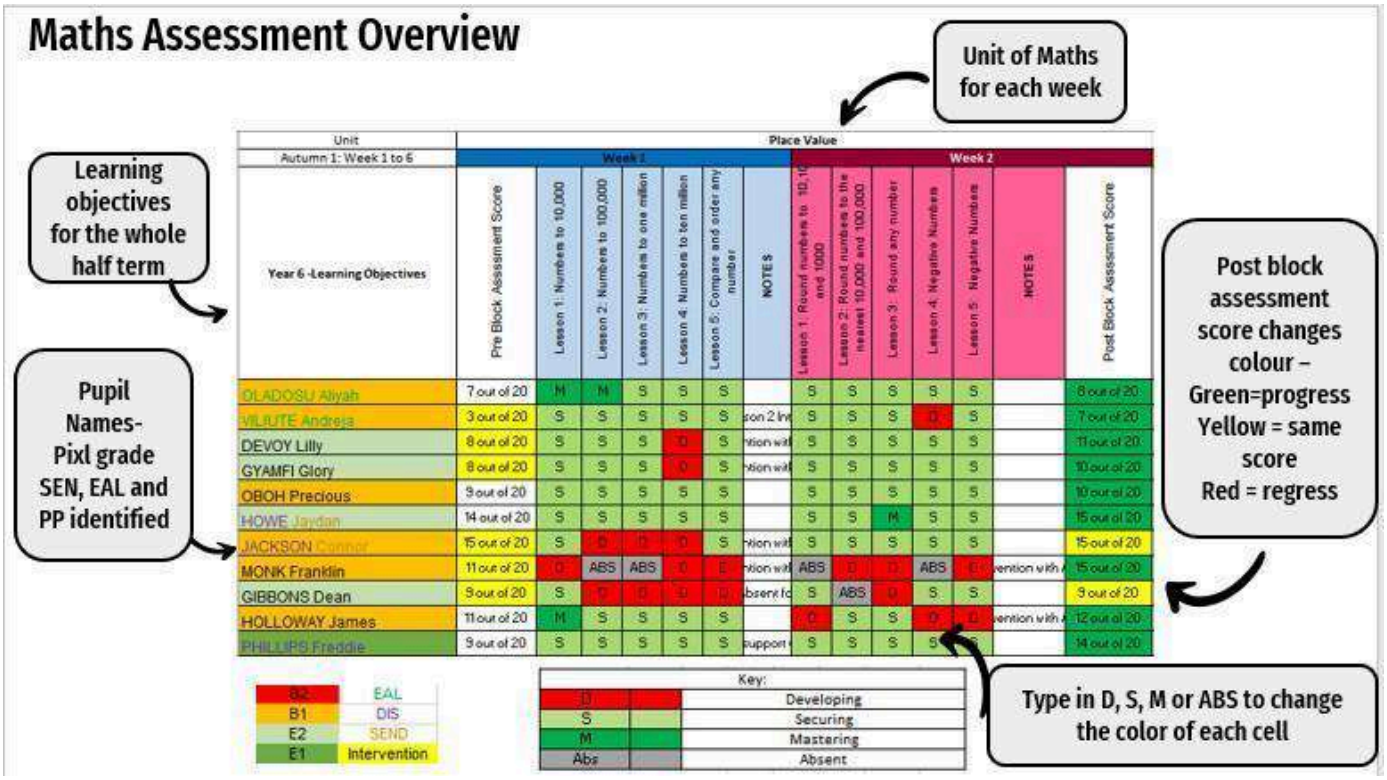

TEACHING FOR MASTERY
FLUENCY
1 ten = 10 ones
1 thousand = 100 tens
1 hundred thousand = 1,000 hundreds
TEACHING FOR MASTERY
MATHEMATICAL THINKING
Think of a 5-digit number.
It has a 9 in the thousands place.
What could the number be? Give three possibilities.
It must be... because...
I was systematic because I...
TEACHING FOR MASTERY
VARIATION
6 4 1 2 5 3 1
6, 4 1 0, 5 0 0 2, 0 3 1
partition
The 6 represents millions
The value of 6 is 6,000,000.
TEACHING FOR MASTERY
REPRESENTATION AND STRUCTURE
Millions
Hundred thousands
Ten thousands
Thousands
Hundreds
Tens
Ones
value
6, 4 1 2, 5 3 1
digit


I disagree because...
I already know that...
I used the fact that...
I know this is true/false because...
I agree because...
The pattern I noticed was...
I can prove my thinking by...
The method I used was...
I wonder...
I can build on that...
I noticed that ...
If I know ... I also know ...



Appendix 4

Math Assessment Overview

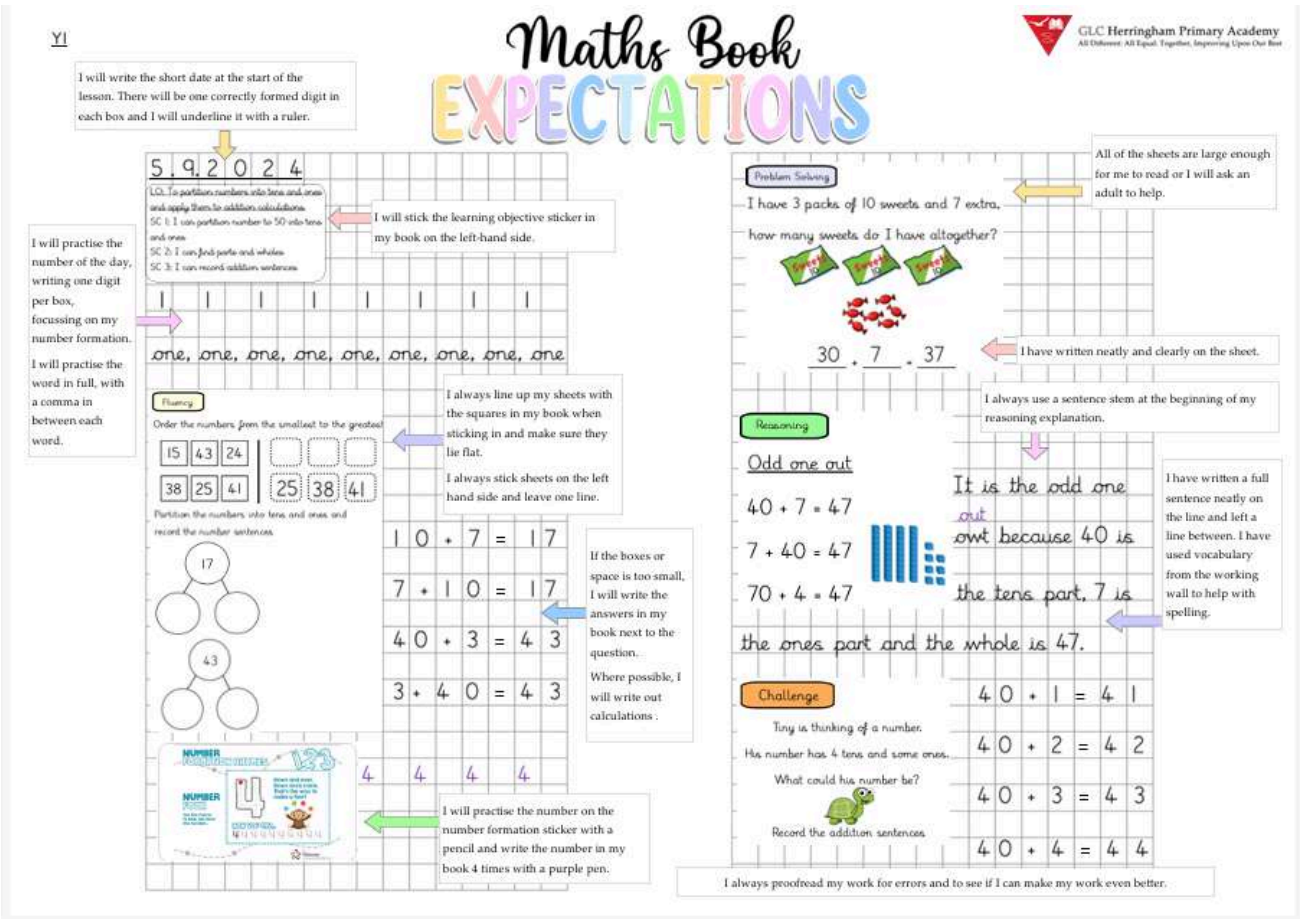


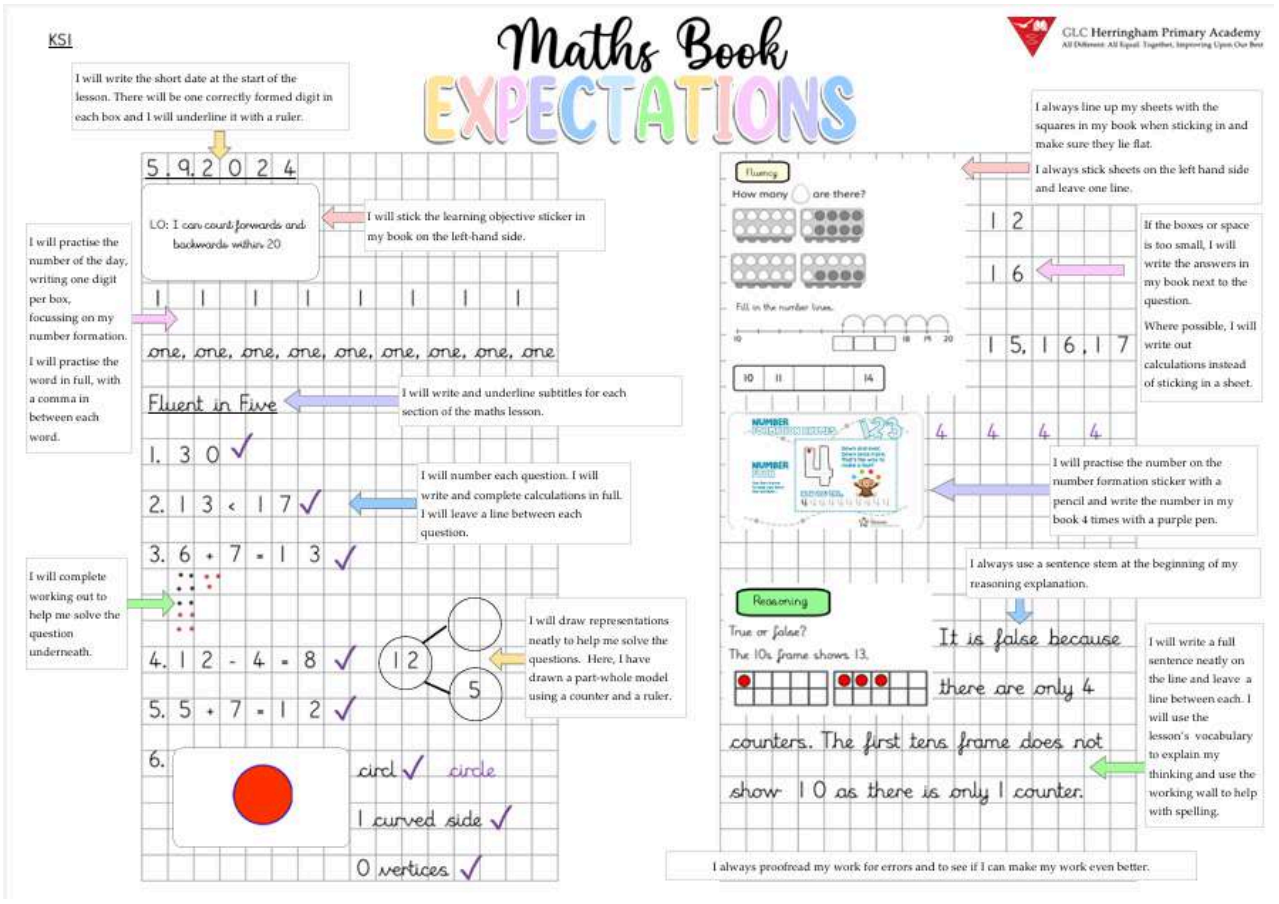
Appendix 5

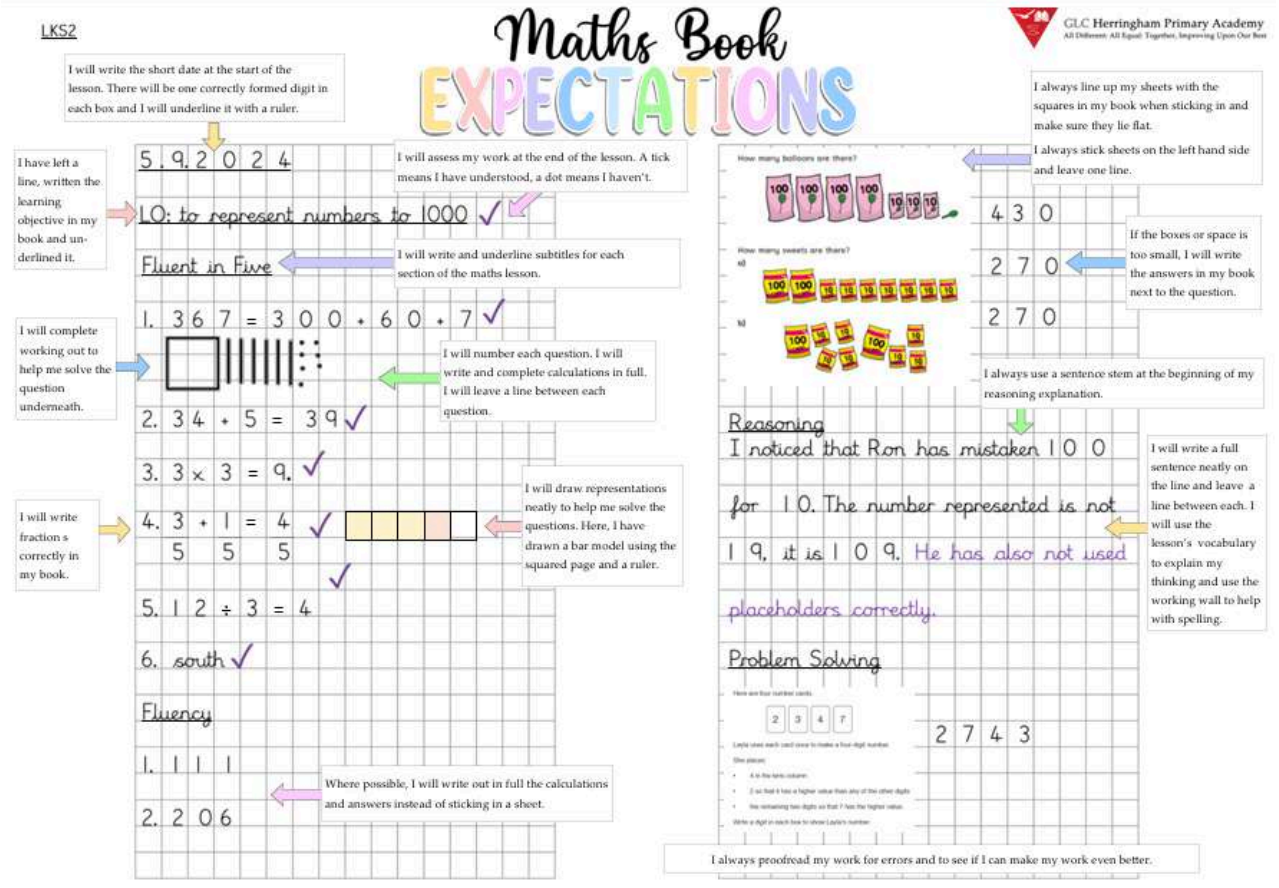
Layout and presentation of mathematics work

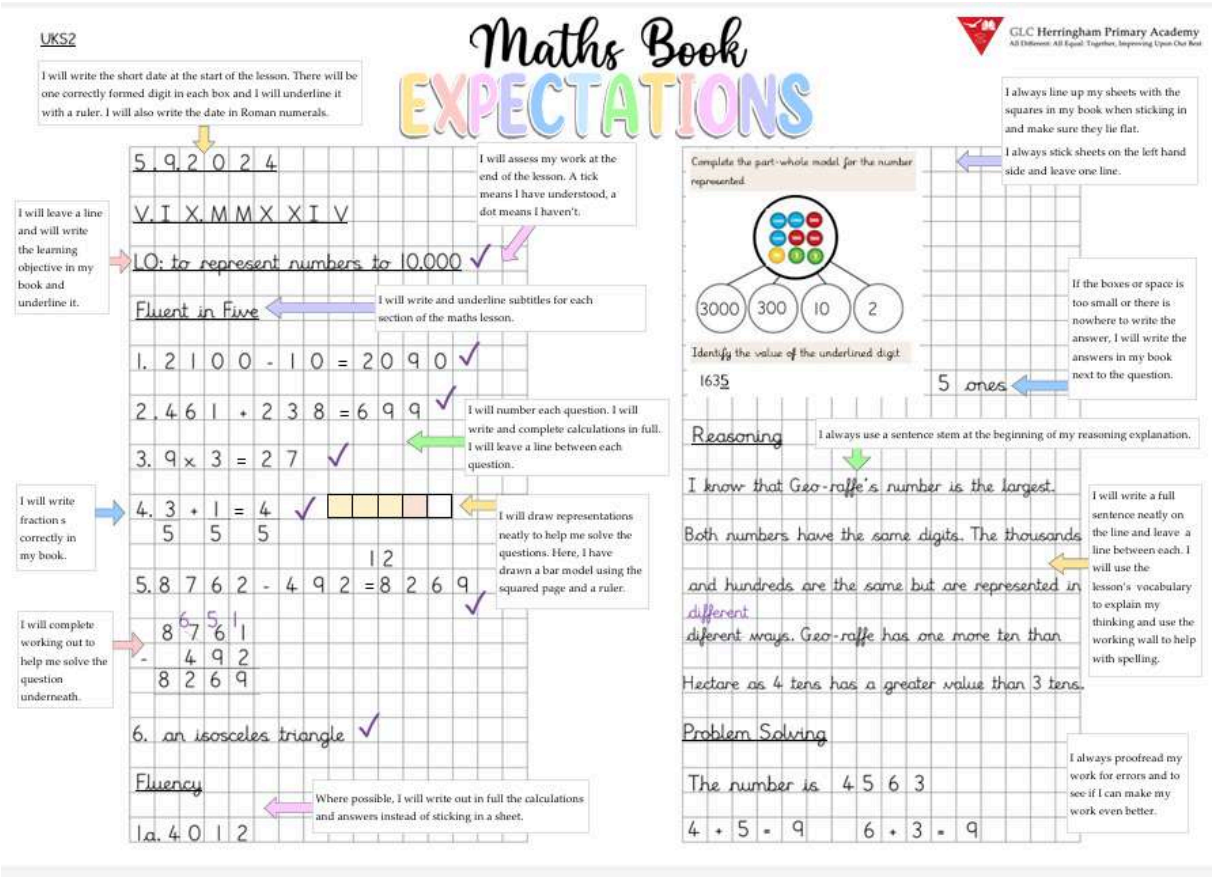
- All work dated with the short date: dd/mm/yyyy. This should be written on the left-hand side.
- Year 5 & 6 will also write the date using Roman Numerals.
- KS2 will write the Learning Objective to indicate the context of the lesson.
- KS1 will stick the Learning Objective sticker at the top left-hand side of the page.
- All dates, headings and subheadings to be underlined with a ruler.
- Consistent numeral formation.
- Where squared books are used, one digit or symbol per square.
- Miss a line between calculations.
- Pictorial representations that support the structure of the mathematics being taught should be stuck in the books.
- Challenge should be stuck in or clearly indicated.
- All other questions/calculations should be written out.

Year 1




KS1
Maths Book
EXPECTATIONS
GLC Herringham Primary Academy
All Different. All Equal. Together, Improving Upon Our Best
I will write the short date at the start of the lesson. There will be one correctly formed digit in each box and I will underline it with a ruler.
I always line up my sheets with the squares in my book when sticking in and make sure they lie flat.
I always stick sheets on the left hand side and leave one line.
LO: I can count forwards and backwards within 20
I will stick the learning objective sticker in my book on the left-hand side.
I will practise the number of the day, writing one digit per box, focussing on my number formation.
I will practise the word in full, with a comma in between each word.
one, one, one, one, one, one, one, one, one
Fluent in Five
I will write and underline subtitles for each section of the maths lesson.
I will number each question. I will write and complete calculations in full. I will leave a line between each question.
I will complete working out to help me solve the question underneath.
I will draw representations neatly to help me solve the questions. Here, I have drawn a part-whole model using a counter and a ruler.
circl
circle
1 curved side
0 vertices
Fluency
How many are there?
If the boxes or space is too small, I will write the answers in my book next to the question.
Where possible, I will write out calculations instead of sticking in a sheet.
I will practise the number on the number formation sticker with a pencil and write the number in my book 4 times with a purple pen.
I always use a sentence stem at the beginning of my reasoning explanation.
Reasoning
True or false?
The 10s frame shows 13.
It is false because
there are only 4
counters. The first tens frame does not
show 10 as there is only 1 counter.
I will write a full sentence neatly on the line and leave a line between each. I will use the lesson's vocabulary to explain my thinking and use the working wall to help with spelling.
I always proofread my work for errors and to see if I can make my work even better.


LKS2
Maths Book
EXPECTATIONS
GLC Herringham Primary Academy
All Different. All Equal. Together, Improving Upon Our Best
I will write the short date at the start of the lesson. There will be one correctly formed digit in each box and I will underline it with a ruler.
I always line up my sheets with the squares in my book when sticking in and make sure they lie flat.
I always stick sheets on the left hand side and leave one line.
I will assess my work at the end of the lesson. A tick means I have understood, a dot means I haven't.
I have left a line, written the learning objective in my book and underlined it.
LO: to represent numbers to 1000
Fluent in Five
I will write and underline subtitles for each section of the maths lesson.
I will complete working out to help me solve the question underneath.
I will number each question. I will write and complete calculations in full. I will leave a line between each question.
I will write fraction s correctly in my book.
I will draw representations neatly to help me solve the questions. Here, I have drawn a bar model using the squared page and a ruler.
south
Fluency
Where possible, I will write out in full the calculations and answers instead of sticking in a sheet.
If the boxes or space is too small, I will write the answers in my book next to the question.
I always use a sentence stem at the beginning of my reasoning explanation.
Reasoning
I noticed that Ron has mistaken 100
for 10. The number represented is not
19, it is 109. He has also not used
placeholders correctly.
I will write a full sentence neatly on the line and leave a line between each. I will use the lesson's vocabulary to explain my thinking and use the working wall to help with spelling.
Problem Solving
I always proofread my work for errors and to see if I can make my work even better.


UKS2
Maths Book
EXPECTATIONS
GLC Herringham Primary Academy
All Different. All Equal. Together, Improving Upon Our Best
I will write the short date at the start of the lesson. There will be one correctly formed digit in each box and I will underline it with a ruler. I will also write the date in Roman numerals.
5.9.2024
V.I X.M M X X I V
I will assess my work at the end of the lesson. A tick means I have understood, a dot means I haven't.
I will leave a line and will write the learning objective in my book and underline it.
LO: to represent numbers to 10,000
Fluent in Five
I will write and underline subtitles for each section of the maths lesson.
1. 2100 - 10 = 2090
2. 461 + 238 = 699
I will number each question. I will write and complete calculations in full. I will leave a line between each question.
3. 9 × 3 = 27
I will write fraction s correctly in my book.
4. 3/5 + 1/5 = 4/5
I will draw representations neatly to help me solve the questions. Here, I have drawn a bar model using the squared page and a ruler.
5. 8762 - 492 = 8269
I will complete working out to help me solve the question underneath.
6. an isosceles triangle
Fluency
Where possible, I will write out in full the calculations and answers instead of sticking in a sheet.
1a. 4012
I always line up my sheets with the squares in my book when sticking in and make sure they lie flat.
I always stick sheets on the left hand side and leave one line.
Complete the part-whole model for the number represented.
3000
300
10
2
If the boxes or space is too small or there is nowhere to write the answer, I will write the answers in my book next to the question.
Identify the value of the underlined digit
1635
5 ones
Reasoning
I always use a sentence stem at the beginning of my reasoning explanation.
I know that Geo-raffe's number is the largest.
Both numbers have the same digits. The thousands and hundreds are the same but are represented in different diferent ways. Geo-raffe has one more ten than Hectare as 4 tens has a greater value than 3 tens.
I will write a full sentence neatly on the line and leave a line between each. I will use the lesson's vocabulary to explain my thinking and use the working wall to help with spelling.
Problem Solving
The number is 4563
4 + 5 = 9
6 + 3 = 9
I always proofread my work for errors and to see if I can make my work even better.

22.2.2022

Lesson 10

LO: To see arrays in two different ways

83 83 83 83 83 83 83

eighty three eighty three eighty three

Fluent in Five

1. 10 ✓
2. 78 68
3. 37 ✓
4. 10 ✓
   90 ✓
5. 3 faces, 5 vertices, 2 edges

Fluency

Sort the expressions according to which times table can be used to solve them.

5×4 2×9 7×5 10×12 6×2
10×8 12×5 2×7 3×10 5×11

Can use 2 times table	Can use 5 times table	Can use 10 times table
~~2×4~~ 2×9 ✓ 2×7 ✓	5×4 ✓ 5×11 ✓	10×12 ✓ 10×8 ✓

Fill in the missing numbers or symbols (<, > or =)

2 × 5 = 5 × 2 ✓
2 × 4 = 4 × 2
7 × 1 = 10 × 7
4 × 2 < 5 × 2 ✓
0 = 0 × 2

Reasoning

Mr. John has five boxes. Each box contains ten pineapples.

- Ann says that she can use the ten times table to solve this.
- Dan says he can use the five times table to solve this.

Who is correct? Why?

Ann and Dan are both correct because Ann says she can use the ten times table and 5 × 10 = 50. Dan says he can use the five times table and 5 × 10 = 50. ✓

Challenge

Which descriptions and expressions represent the mittens?

	Do represent the mittens (✓) or Do not represent the mittens (×)
7 groups of 1	×
1 group of 7	×
2 groups of 3 and 1 more	×
3 groups of 2 and 1 more	✓ ✓
7 × 1	×
1 × 7	×
3 × 2 + 1	✓ ✓
2 × 3 + 1	×

Problem Solving

Part of this array is hidden.

The total is less than 16

What could the array be?

27.4.2022

Lesson 5

LO: To find a half

118 118 118 118 118

One hundred and eighteen

Fluent in Five

1. 

5 faces ✓ 8 edges ✓ 5 vertices ✓
2. 88
3. 16 ✓
4. 3 ✓
5. 82 ✓
6. quarter past 5 ✓

Fluency

Find $\frac{1}{2}$ of each number.

Use the arrays to help you.

a) $\frac{1}{2}$ of 10 = 5 ✓

b) $\frac{1}{2}$ of 16 = 8 ✓

c) $\frac{1}{2}$ of 20 = 10 ✓

Show the halves on these bar models.

28	
14 ✓	14 ✓

32	
~~17~~ 17 ✓	17 ✓

Complete the number sentences.

$\frac{1}{2}$ of 20 = 10 ✓ $\frac{1}{2}$ of 8 = 10 ✓ $\frac{1}{2}$ of 14 = 7 ✓

half of 16 = 8 ✓ 11 = half of 22 ✓

Problem Solving

On Monday a shop has 12 bags of crisps. It sells 1/2 of the bags.

On Tuesday the shop has 18 bags of crisps. It sells 1/2 of the bags during the day.

How many bags of crisps did the shop sell altogether? 15 ✓

Reasoning

True or false?

$\frac{1}{2}$ of 12 = 12 ÷ 2

It is true because a half of 12 is 6 and 12 ÷ 2 = 6 when finding half we find 2 equal parts and when you divide by 2 you get two equal parts. ✓

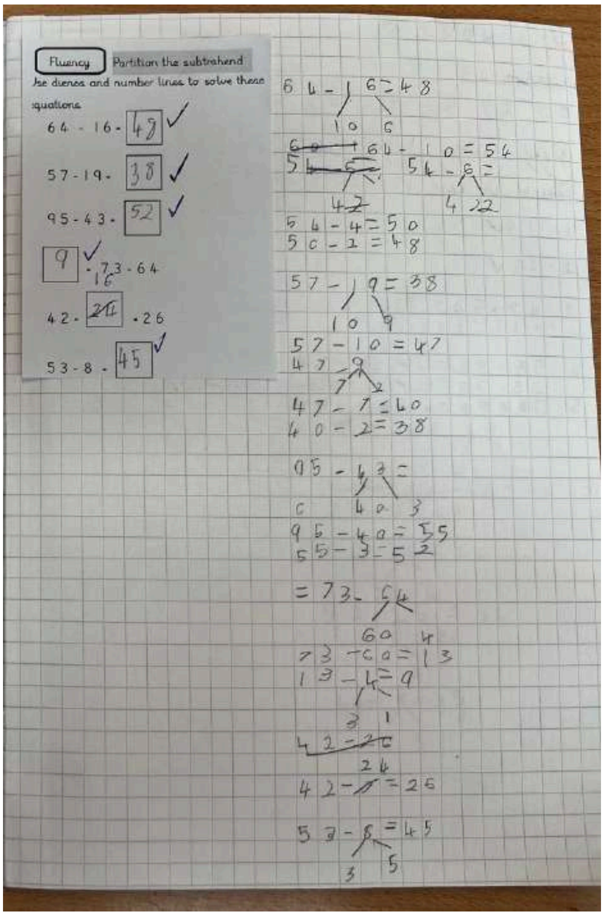
Challenge

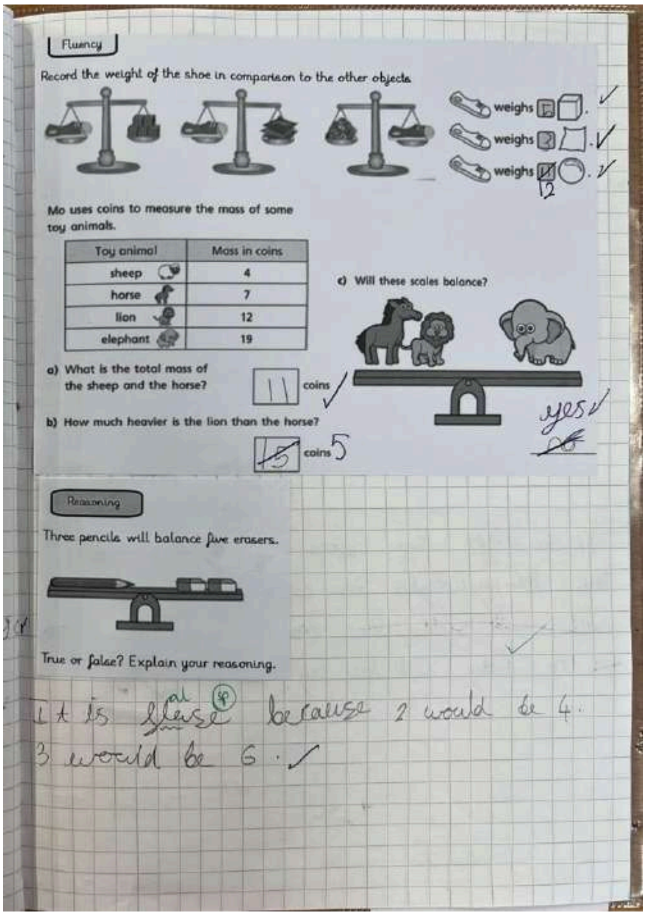
I am thinking of a number. Half of my number is more than 10 but less than 15.

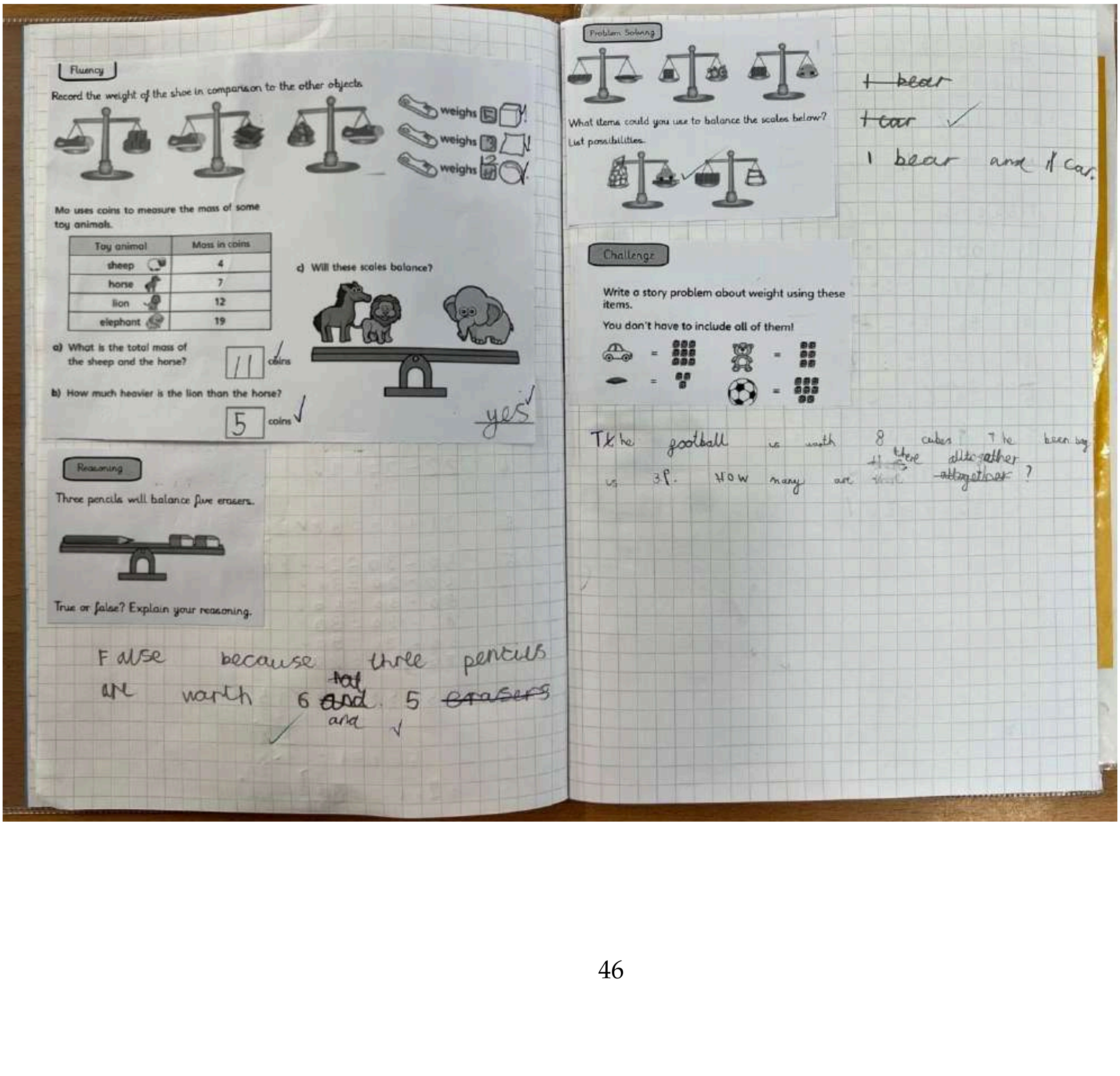
What could my number be?

Is there more than one possible answer?

22, 24, 26, 28 ✓


Fluency
Partition the subtrahend
Use dienes and number lines to solve these equations
64 - 16 =
57 - 19 =
95 - 43 =
= 73 - 64
42 - = 26
53 - 8 =


Fluency
Record the weight of the shoe in comparison to the other objects
weighs
weighs
weighs
Mo uses coins to measure the mass of some toy animals.
Toy animal
Mass in coins
sheep
4
horse
7
lion
12
elephant
19
a) What is the total mass of the sheep and the horse?
coins
b) How much heavier is the lion than the horse?
coins
c) Will these scales balance?
Reasoning
Three pencils will balance five erasers.
True or false? Explain your reasoning.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sheep
4
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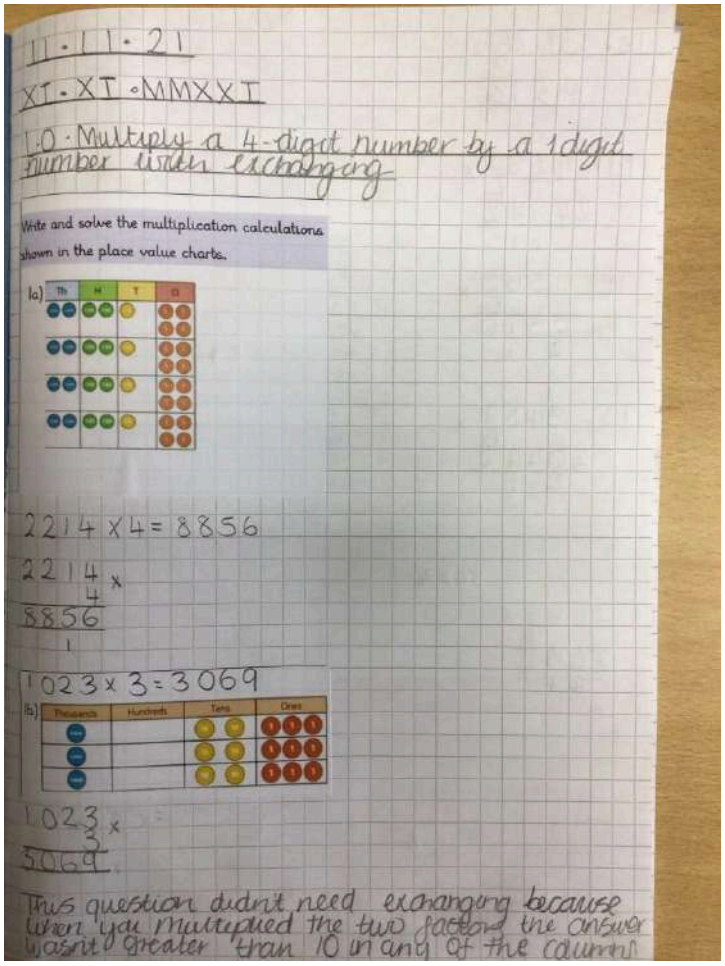
7
lion
12
elephant
19
a) What is the total mass of the sheep and the horse?
coins
b) How much heavier is the lion than the horse?
coins
c) Will these scales balance?
Reasoning
Three pencils will balance five erasers.
True or false? Explain your reasoning.
Problem Solving
What items could you use to balance the scales below? List possibilities.
Challenge
Write a story problem about weight using these items.
You don't have to include all of them!

KS2


11.11.21

XI.XI.MMXXI

1.0 Multiply a 4-digit number by a 1digit number when exchanging

Write and solve the multiplication calculations shown in the place value charts.

1a)

2214 x 4 = 8856

2214 x 4 = 8856

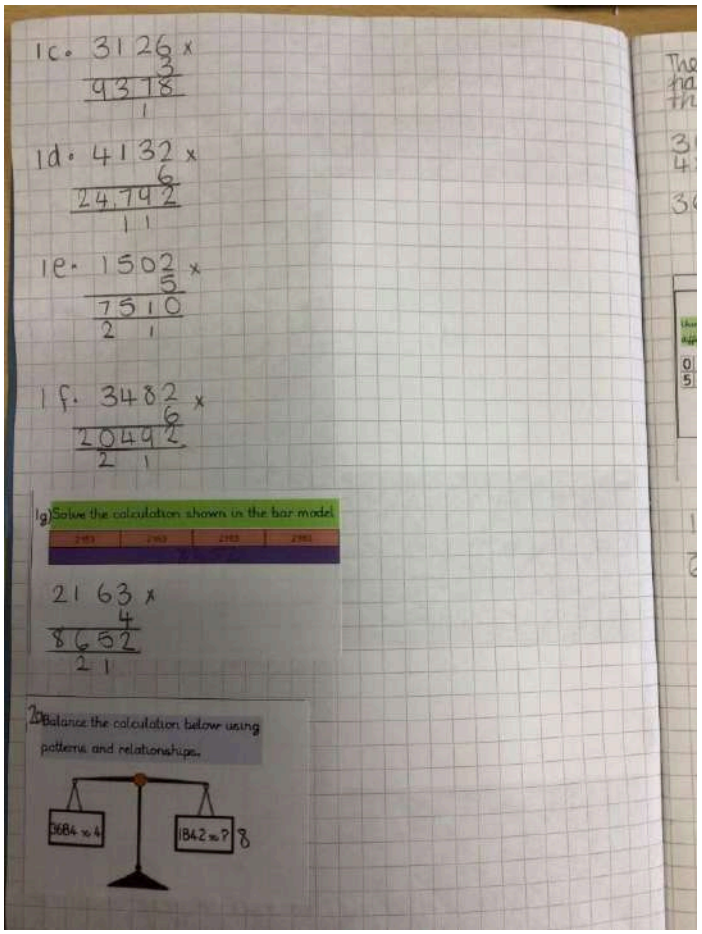
1

1023 x 3 = 3069

1b)

1023 x 3 = 3069

This question didn't need exchanging because when you multiplied the two factors the answer wasn't greater than 10 in any of the columns


1c. 3126 x 3 = 9378

1

1d. 4132 x 6 = 24,792

1 1

1e. 1502 x 5 = 7510

2 1

1f. 3482 x 6 = 20892

2 1

1g) Solve the calculation shown in the bar model

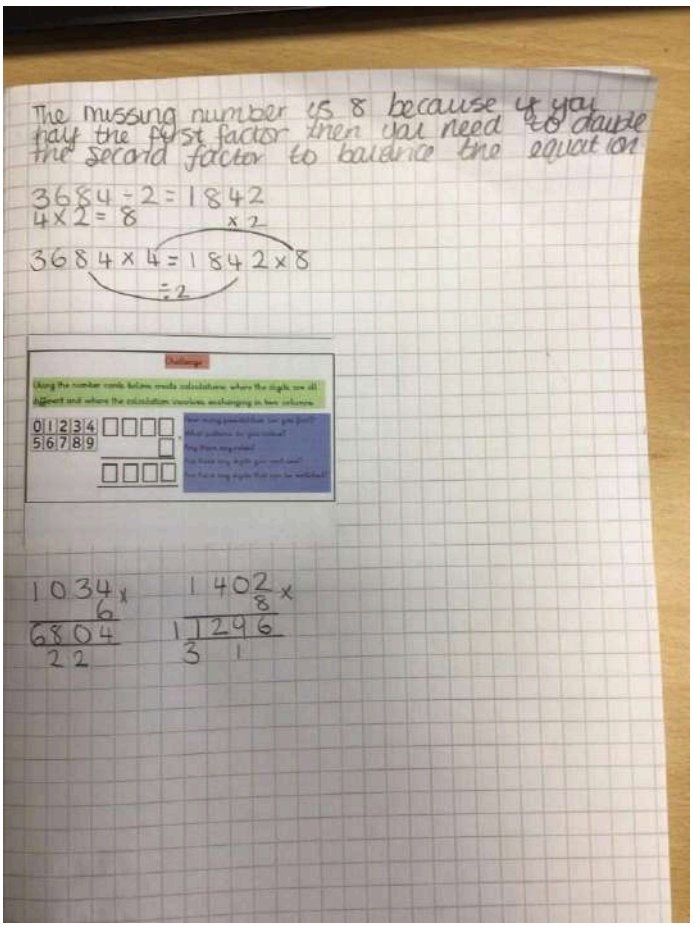
2163 x 4 = 8652

2 1

2) Balance the calculation below using patterns and relationships.

3684 ÷ 4

1842 x ? 8


The missing number is 8 because if you half the first factor then you need to double the second factor to balance the equation

3684 ÷ 2 = 1842

4 x 2 = 8

x 2

3684 x 4 = 1842 x 8

÷ 2

Challenge

Using the number cards below create calculations where the digits are all different and where the calculation involves exchanging in two columns.

0 1 2 3 4 5 6 7 8 9

1034 x 6 = 6804

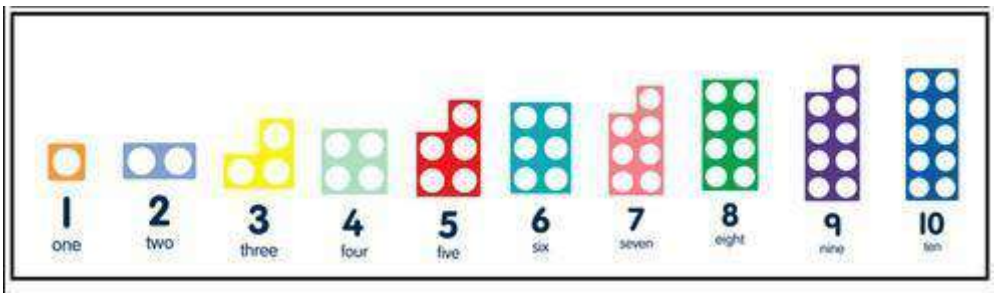
2 2

1402 x 8 = 11296

3 1

Appendix 6

Numeral and symbol formation



Number formation is taught through lessons and handwriting lessons.

Pupils should be explicitly taught to read, write and say numbers. Numeral formation should be taught during normal handwriting lessons, where they fit the pattern being taught or as independent entities where they don't conform to normal handwriting patterns:

Pupils need to know that they are writing numerals (also called digits) and that combining these we can make 2 digit and 3 digit numbers; in the same way as we teach pupils to write letters which make words.

G:\Shared drives\GLC Central Folder\2023-2024\Maths\2. Maths Resources\16. Number Formation

What could feedback marking look like in mathematics...

Rewrite or remodel an example

52 – 38 =

50 – 30 = 20

8 – 2 = 6

52 – 38 = 26 Child recorded

.....

52 - 38 =

52 - 30 = 22

22 - 2 - 6 = 14 Corrected recording

Now you try this one...

Self-correcting

- ✓ Can you see where you have made your mistake?
- ✓ Check your *'place value in question 5'*
- ✓ I make the answer to this question ... check that I'm right
- ✓ 2 of your answers are wrong, spot which ones they are and correct them

Remember...

- ✓ *'one hundred and two is 102 not 1002'*
- ✓ *'to count on from the larger number'*

Using a symbol or code e.g.

- learning objective achieved
- ✓ correct answer
- • try this one again
- oral feedback given

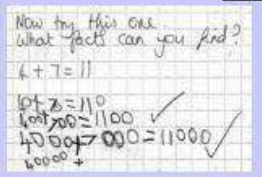
Check your schools marking policy!

Ask a closed question...

- ✓ If you start with 93 and count back in tens, what would be the smallest number you would reach on a 1-100 grid? Would 14 be one of the numbers you say?
- ✓ Put these numbers in order:
  835, 535, 538, 388, 508.
  What would the third number be?
- ✓ Which of these numbers is closest to the answer of 342 - 119?
  200 220 230 250 300
- ✓ I buy 6 books that cost £4.99 each. How much will I pay to the nearest pound?
- ✓ There are 28 children in the class. $^3/_7$ are girls. How many girls is this?
- ✓ A film starts at 6.30 p.m and ends at 8.10 p.m. How many minutes does the film last?
- ✓ What is the difference between 1999 and 4003?
- ✓ What number is 30 less than 64?
- ✓ What is the missing digit?

  5□
  × 8
  456
- ✓ Shade $\frac{1}{4}$ of this shape 
- ✓ Fill in numbers on the 100 grid

45		57



Ask an open question...

- ✓ Tell me two two-digit numbers with a difference of 12
- ✓ What even numbers lie between 10 and 20?
- ✓ Find 3 ways of completing: ...% of ... = 30
- ✓ □ × O = 20 What could the missing numbers be?
- ✓ These numbers are in order, largest to smallest 56 □ 45 □ 37 □ 33 Think of a number that could go into each of the empty boxes.
- ✓ Draw a triangle with a line of symmetry that does not have a right angle
- ✓ If 7 × 8 = 56 what is 0.07 × 8? Give some other decimal facts that are linked to this fact
- ✓ Give me 3 division questions that have a remainder of 1
- ✓ Suggest sensible units you might use to measure the height of your table
- ✓ Tell me two lengths that together make 1 metre
- ✓ Write what the missing digits could be:
  □□□ ÷ 10 = 3□

Finishing a sentence...

- ✓ 36 can be partitioned into ..... and .....
- ✓ Two numbers < 200 are ..... and .....
- ✓ All multiples of 5 end in ..... and .....
- ✓ Two fractions equivalent to a half are ..... and .....
- ✓ Capacity can be measured in ..... or .....
- ✓ Acute angles are .....
- ✓ A pencil weighs about .....
- ✓ Squares have ..... and .....
- ✓ 1.6 is between ..... and .....
- ✓ 3 of the factors of 24 are ....., ... and .....

Ask for an explanation

- ✓ Would a chocolate lover rather have $^1/_2$ or $^3/_5$ of a bar of chocolate? Explain your answer
- ✓ What tips would you give someone who is learning how to round numbers to the nearest 10 or 100?
- ✓ Explain why a number which ends in '3' cannot be a multiple of 4
- ✓ Explain why two of the three angles in my triangle can't be obtuse
- ✓ Explain why 16 is a square number
- ✓ How could you subtract 37 from 82?
- ✓ How could we test a number to see if it is divisible by 6?

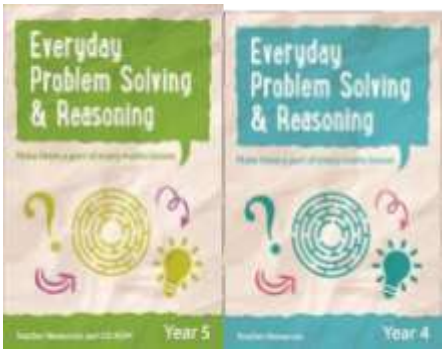
Encouraging reflection

- ✓ Could there be a quicker way of doing this?
- ✓ Do you think that this would work with other numbers?
- ✓ When could you use this strategy?
- ✓ Have you thought of all the possibilities? How can you be sure?
- ✓ Why did you decide to use this method?
- ✓ Can you think of another method that might have worked?
- ✓ Why did you decide to use this method?

Appendix 8

Power Maths teacher guides, textbooks, practice books and online resources

Everyday Problem Solving and Reasoning – Collins publication (Examples – Available for all year groups)



Shanghai Maths Project Books

Numicon handbooks and implementation guides

There are also hand books for Geometry and Statistics with an accompanying implementation guide.

Pupil books are available for Year 3 to 6

Appendix 9

GLC Progression in Calculation Policy

Introduction

Pupils are introduced to the processes of calculation through concrete, pictorial and abstract activities. As they begin to understand the underlying ideas, they develop ways of recording to support their thinking and calculation methods, so that they develop both conceptual understanding and fluency in the fundamentals of mathematics. Whilst interpreting signs and symbols involved with calculation, orally in the first instance, pupils use models and images to support their mental and written methods of calculation. As pupils' mental methods are strengthened and refined they begin to work more efficiently, which will support them with using succinct written calculation strategies.

Strategies for calculation need to be supported by familiar models, images and practical activities to reinforce understanding. When teaching a new strategy it is important to start with numbers the child can easily manipulate so that they can understand the concept. Pupils should be given sufficient practice to ensure that they are fluent in using a method and that they can use and apply this into different situations, revisiting each stage at regular intervals to ensure that they maintain their understanding and develop efficient and speedy ways of calculating. Previous levels should be revisited to consolidate understanding when introducing a new strategy.

The ability to calculate mentally forms the basis of all methods of calculation and has to be maintained and refined. A good knowledge of numbers or a 'feel' for numbers is the product of structured practice through progression in relevant practical maths experiences and visual representations.

By the end of Year 6, pupils will be equipped with efficient mental and written calculation methods, which they will be able to use with fluency.

Decisions about when to progress should always be based on the security of pupils' understanding and their readiness to progress to the next stage. At whatever stage in their learning, and whatever method is being used, pupils' strategies must still be underpinned by a secure understanding and knowledge of number facts that can be recalled fluently.

The overall aims are that when pupils leave primary school they:

Are able to recall number facts with fluency, having developed conceptual understanding through being able to visualise key ideas (such as those related to place value) through experience with practical equipment and visual representations;
Make use of diagrams and informal notes to help record steps and part answers when using mental methods that generate more information than can be kept in their heads;
Have an efficient, reliable, written method of calculation for each number operation that they can apply with confidence when undertaking calculations that they cannot carry out mentally;
Are able to make connections between all four number operations, understanding how they relate to one another, as well as how the rules and laws of arithmetic can be applied

The GLC believes that pupils in EYFS should have access to a rich mathematical environment that supports the development of a strong conceptual understanding of numbers, the number system and a sense of the size and relationships between numbers.

Numbers are introduced through a wide variety of experiences using 'real-life', unstructured and structured materials and through games, songs and role-play.

There are fundamental skills that it is important for pupils to develop an early understanding of as building blocks to future learning in maths, including that linked to calculation. A selection of the skills include:

- **Ordinality** – 'the ordering of numbers in relation to one another' – e.g. (1, 2, 3, 4, 5…)

- **Cardinality** – 'understanding the value of different numbers' – e.g. (7 =

17 =  14 

- **Equality** – 'seven is the same total as four add three' – e.g. 

- **Subitising** – 'instantly recognizing the number of objects in a small group, without counting them'

e.g. 

- **Conservation of number** – 'recognising that a value of objects are the same, even if they are laid out differently'

e.g. 

- **One-to-one correspondence** – e.g. 

- **Counting on and back from any number** – e.g. 'five add three more totals eight' 'ten take away three totals seven'

- **Using apparatus and objects to represent and communicate thinking** – e.g.

- **Maths language – using mathematical words verbally in every-day situations** – e.g. 'climb up to the top' / 'climb down to the bottom'

Models and Images to Support Mathematical Understanding

The GLC believe that to develop strong conceptual understanding a range of structured and unstructured manipulatives need to be used; Numicon, Cuisenaire rods, Dienes, bead strings, number lines, money, place value grids, multiplication grids and hundred squares.

All manipulatives need to be thoroughly explored by pupils and used interactively (hands-on- experience) to gain a sense of what the equipment illustrates before using it as a vehicle for teaching.

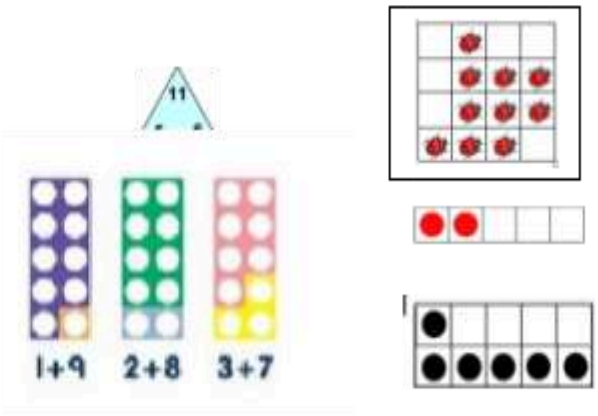
All pupils need access to relevant equipment throughout lessons; the child needs to make the decision about when they understand the concept sufficiently to work in the abstract.

Addition

Mental Skills

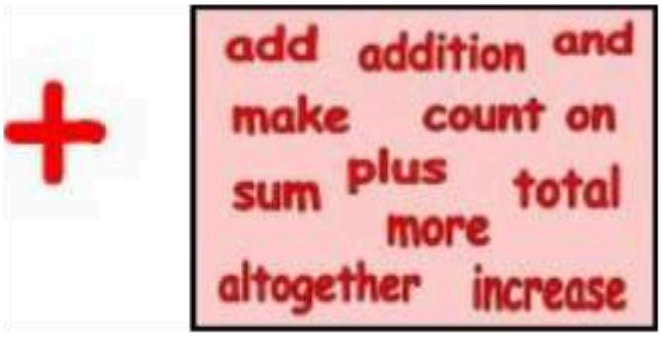
- **Recognise the size and position of numbers**
- **Count on in ones and multiples of ten**
- **Know number bonds for all numbers to twenty**
- **Add multiples of ten to any number**
- **Partition and recombine numbers**
- **Bridge through ten**
- **Round and adjust**
- **Derive 2-digit addition from known facts**

Models, Images and Apparatus



- **Numicon**
- **Five frames and tens frames**
- **Arrow cards**
- **Number tracks**
- **Numbered number lines**
- **Marked but unnumbered number lines**
- **Empty number lines**
- **Hundred square**
- **Counting stick**
- **Bead string**
- **Flip Flaps**
- **Models and Images charts**
- **ITPs – Number Facts; Ordering Numbers; Number Grid; Counting on and back in ones and tens**
- **Gordon's ITPs – Dienes & coins (in calculating folder)**

Key Vocabulary



- **addend**
- **augend**
- **add**
- **addition**
- **plus**
- **and**
- **count on**
- **more**
- **sum**
- **total**
- **altogether**
- **increase**
- **aggregation**
- **augmentation**

Addition Structures

Structure	Examples	Models & Images using Numicon structured apparatus
Putting together (aggregation)	I have 3 books on my shelf and another 4 books on my bedside table. How many books do I have? There are 5 frogs on one log and 3 frogs on another log, how many altogether?	Model with real objects – bring two sets together
Increasing structure (augmentation)	I have 7 liters of water. I add another 2 liters, what have I got now?	Jug/container already containing amount, then add to it (ITP)

Type	Example
O +	3 + 5
O O	8 – 4
– O	60 + 20
T + T	60 – 10
T – T	40 + 6
T +	30 – 5
O T	53 + 4
– O	46 – 4
TO + O without crossing tens	53 + 8
boundary TO – O without crossing	33 – 5
tens boundary TO + O with crossing	38 + 40
tens boundary TO - O with crossing	64 – 20
tens boundary TO + T	73 + 52
TO - T	59 – 24
TO + TO without crossing tens	46 + 37
boundary TO - TO without crossing	53 – 28
tens boundary TO + TO with crossing	
tens boundary TO - TO with crossing	
tens boundary	

Addition: Early Years

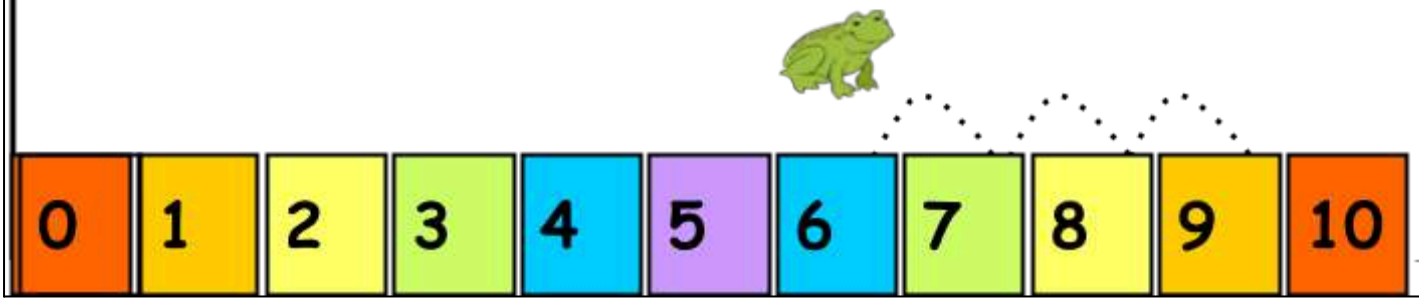
Early learning goals:
- ✓Count reliably with numbers from 1 to 20, place them in order.
- ✓Say which number is one more than a given number.
- ✓Using quantities and objects, they add two single-digit numbers and count on to find the answer.

Recognise numbers up to 20 and understand the meaning of each number by recognising and knowing their clusters

Count on in ones and say which number is one more than a given number using a number line or number track to 20.

Begin to relate addition to combining two groups of objects using practical resources, role play, stories and songs.

Know that counting on is a strategy for addition. Use numbered number lines to 20.



Addition: Year 1

Mental Strategies

- count on in ones;
- 1 more than a number;
- 10 more than a multiple of 10;
- add by counting on from the larger number;
- reorder numbers in a calculation;
- look for pairs that make 10;
- look for doubles and near doubles;
- begin to bridge through 10 when adding a one-digit number;
- use known facts and place value to add pairs of one-digit numbers;
- partition and recombine by breaking units of 6, 7, 8 or 9 into '5 and a bit';
- Add 9 to single-digit numbers by adding 10 then subtracting 1;
- use patterns of similar calculations;

- add and subtract one-digit and two-digit numbers to 20 including zero
- represent and use number bonds and related subtraction facts within 20
- *Pupils memorise and reason with number bonds to 10 and 20 in several forms (e.g. 9 + 7 = 16; 16 - 7 = 9; 7 = 16 - 9).*
- *They should realise the effect of adding or subtracting zero.*

Instant recall: All number bonds to 14

Doubles to 10+ 10 and corresponding

Add two one-digit numbers
e.g. 3 + 5, 6 + □ = 9

Add two one-digit numbers
e.g. 8 + 6, 5 + □ = 12

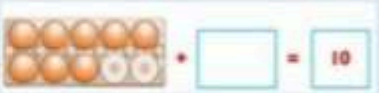
Add a 'teens' number and ones
e.g. 13 + 5, □ + 3 = 17

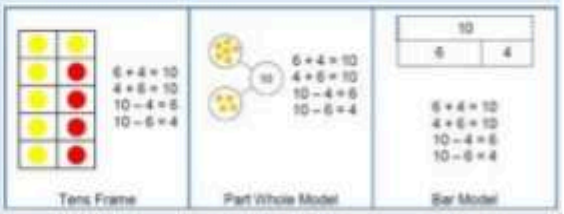
Also include:

Adding zero
e.g. 3 + 0, 15 + 0, 0 + □ = 5

Identify and represent numbers using objects and pictorial representations (multiple representations)

Memorise and reason with number bonds to 10 and 20 in several forms.

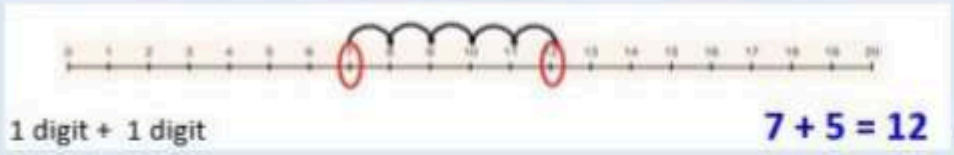




Addition: Year 1

Calculation Strategies

Use concrete resources and a number line to support the addition of numbers. Know and use strategy of finding the larger number, and counting on in ones from this number.



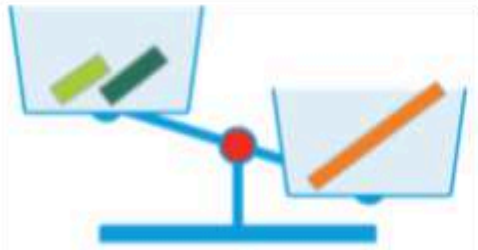
1 digit + 1 digit

7 + 5 = 12

18 + 5 = 23

2 digit + 1 digit

Begin to use the + and = signs to write calculations in a number sentence.



Understand equality and inequality and relate to mathematical symbols – record in number sentence

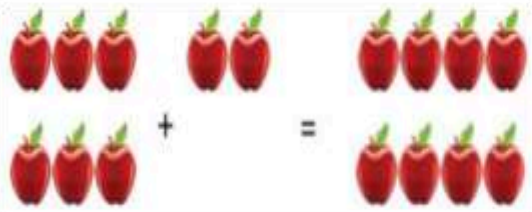
$6 + 3 \neq 10$

$6 + 3 < 10$

$10 > 6 + 3$

$6 + 3 + ? = 10$

Solve one-step problems using concrete objects and pictorial representations.



Tom picks 6 apples and Raj picks 2 apples.
How many apples do they have altogether?

Addition: Year 2

Mental Strategies

- count on in tens or ones;
- reorder numbers in a calculation;
- add three 1-digit numbers; put the largest number first, using known facts (pairs to 10, doubles);
- add by partitioning into tens and ones then recombine;
- bridge through a multiple of 10;
- use number facts and place value to add pairs of numbers;
- add 9, 19, 11 or 21 by rounding and compensating;
- use patterns of similar calculations;

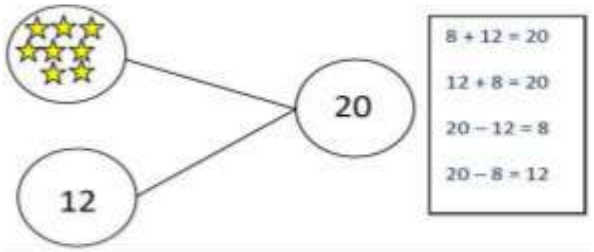
- add and subtract numbers using concrete objects, pictorial representations, and mentally, including:
  - a two-digit number and ones, a two-digit number and tens, two two-digit numbers
  - adding three one-digit numbers
- recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100

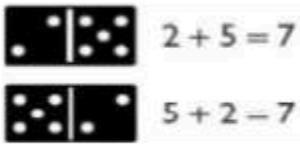
Instant recall: Know by heart number bonds for every number to 20

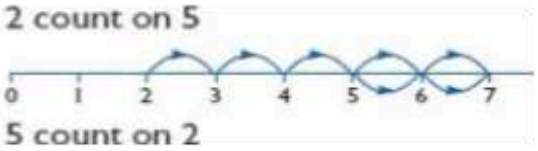
Know all doubles to 20 and corresponding halves

Doubles of multiples of ten e.g. 30 + 30

Memorise and reason with number facts to 20 in several forms.







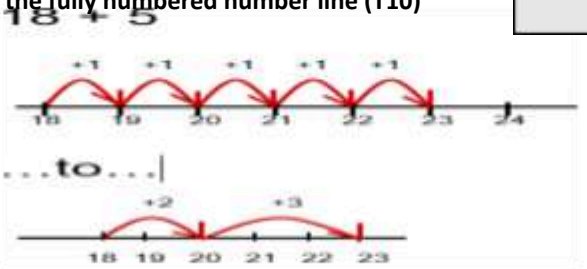
Put the bigger number first and count on

Addition: Year 2

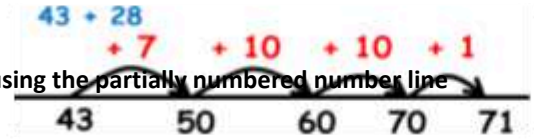
Calculation Strategies (jottings)

'Target the 10' using the fully numbered number line (T10)

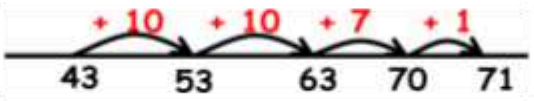
Add 2-digit number and ones



'Target the 10' using the partially numbered number line

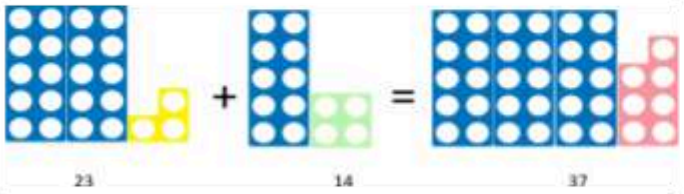


Add 2-digit number and tens



'Jumps of ten' (J10) using the partially numbered number line

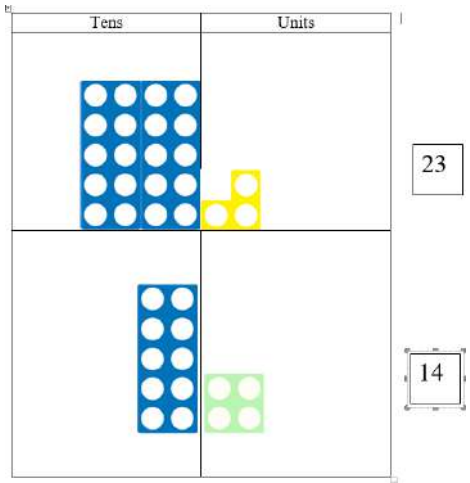
Pupils need to gain understanding that you can partition in different ways but the value remains the same So 30+4 is the same as 20+14



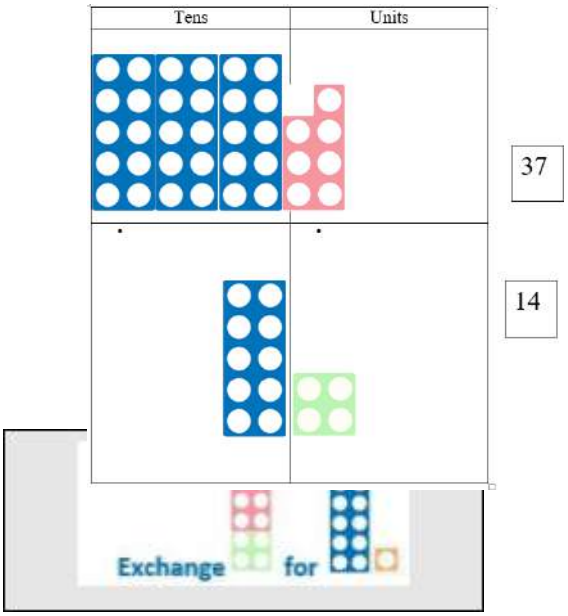
Partition numbers to add two 2-digit numbers- expanded method
- USING APPARATUS

Written (column) Method

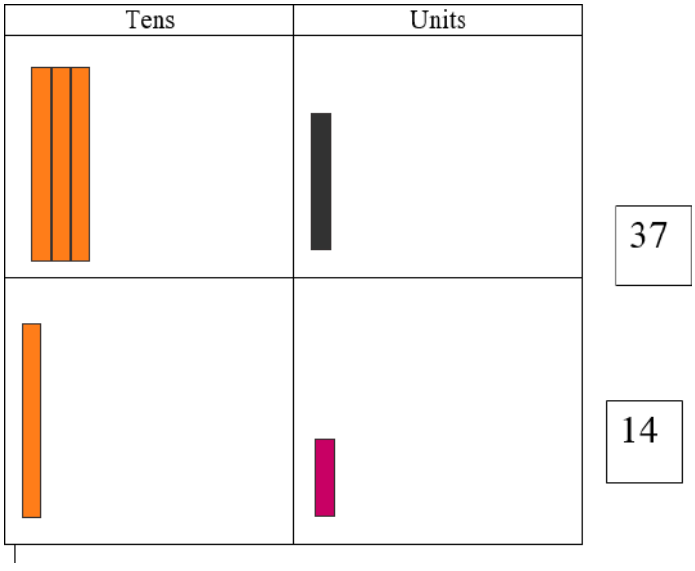
Moving to column method without exchange



FOR GREATER DEPTH-Moving to column method with exchange



For 3-digit numbers either the Numicon baseboard can be used to model 100 or 10 x 10 shapes grouped together in an elastic band



3 digits using Cuisenaire rods: use the Dienes chart for with the rods

Addition: Year 3

Mental Strategies

- count on in hundreds, tens or ones;
- add mentally a 'near multiple of 10';
- add 3 or 4 small numbers;
- partition into hundreds, tens and ones and in different ways, then recombine (724 = 700 + 20 + 4) (724 = 600 + 110 + 14);
- reorder numbers in a calculation;
- bridge through a multiple of 10, then adjust;
- use known facts and place value to add;
- use patterns of similar calculations;
- use the relationship between addition and subtraction;

- add and subtract numbers mentally, including:
  - a three-digit number and ones
  - a three-digit number and tens
  - a three-digit number and hundreds

Add a three-digit number and ones
e.g. 231 + 6, 241 + □ = 248, 175 + 8

Add a three-digit number and tens
e.g. 249 + 50, 167 + 60, 431 + □ = 481

Add a three-digit number and hundreds
e.g. 381 + 400, 751 + 300, 231 + □ = 531

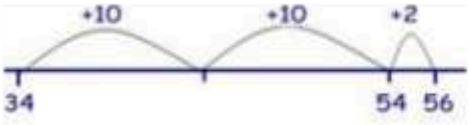
Also include:

Add pairs of two-digit numbers
e.g. 72 + 41, 87 + □ = 121, 65 + 57

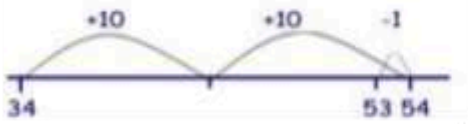
Added to any three-digit number to make the next ten or hundred
e.g. 247 + □ = 250, 647 + □ = 700

Add three small numbers
e.g. 13 + 8 + 7, 8 + 13 + 8, 8 + 15 + 17

Mental methods

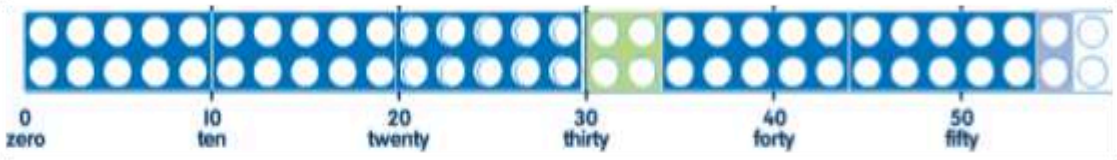


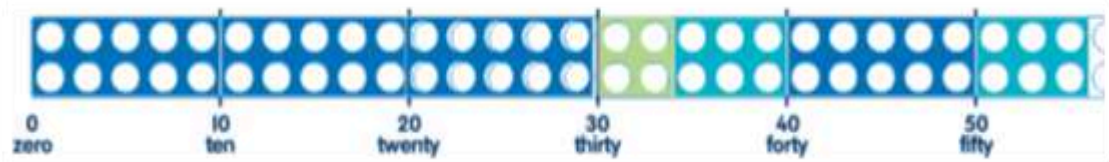
34 + 22



34 + 19

Models to support mental methods





Addition Year 3

Written strategies

Column Method

Consolidating work from Year 2 with 2-digit numbers and then move to 3-digit numbers

Moving towards written methods *without* scaffolding of equipment

Note that there should be 2 lines below the calculation like an equals sign – you need to emphasis that this is what the lines represent. All carry over numbers should be written as a small number below the line.

Pupils should be encouraged to look at the calculation and make informed choices about whether to solve the *problem mentally* or using *column method*: the example above could be solved by adding 30 and subtracting 2 if the child is comfortable with the method.

Pupils should continue to use Numicon, Cuisenaire and Dienes equipment if they need it.

Addition: Year 4

Mental Strategies

Pupils continue to practise both mental … addition and subtraction with increasingly large numbers to aid fluency

- Add a four-digit number and ones
  e.g. 4312 + 6, 3441 + □ = 3443, 1029 + 5
- Add a four-digit number and tens
  e.g. 1735 + 40, 2143 + □ = 2193, 3781 + 70
- Add a four-digit number and hundreds
  e.g. 2175 + 400, 3248 + □ = 3948, 4505 + 600
- Add a 4-digit number and thousands
  e.g. 1367 + 4000, 5648 + □ = 7648

Add HTO mentally

- count on in steps of 1, 10, 100, or 1000;
- reorder numbers in a calculation;
- add 3 or 4 small numbers;
- partition, adding the most significant digit first;
- use known facts and place value to add;
- add the nearest multiple of 10 or 100 then adjust;
- use the relationship between addition and subtraction;

- Add a two-digit number to a three-digit tens
  e.g. 430 + 54, 610 + □ = 637, 560 + 76
- Add any pair of three-digit multiple of 10
  e.g. 430 + 260, 570 + 250
- Added to any three-digit number to make the next multiple of 1000
  e.g. 370 + □ = 1000, 1452 + □ = 2000
- Add three two-digit numbers
  e.g. 34 + 13 + 43, 33 + 52 + 21

528 + 288?

528 + 288
528 + 200 = 728
728 + 80 = 808

528 +300= 828
828 – 12 = 816

528 +288
500 + 200= 700
20 + 80 = 100
8 + 8 = 16

Pupils need to have the lots of experience of the empty number line to enable them to add in these ways.

Addition: Year 4

Written Strategies

Written methods- Year Four continue to practice column method alongside mental methods making informed choices about which method to use. Extend to money.

```
  5271
+ 2357
------
  7628
------
     1
```

By the end of year 4, pupils should be adding numbers up to 4 digits using compact column addition method.

By the end of year 4, use written methods to add decimals to 2 decimal places.

£4.25 + £3.38

£4.25

+ £3.38

£7.63

Addition: Year 5

Mental Strategies

Mental methods- as previous years +

- add and subtract numbers mentally with increasingly large numbers
- *They practise mental calculations with increasingly large numbers e.g.12462 - 2300 = 10 162).*
- *They mentally add and subtract tenths, and one-digit whole numbers and tenths.*
- *complements of 1 (0.83 + 0.17 = 1)*

- count on in steps of 0.1, 1, 10, 100, or 1000;
- reorder numbers in a calculation;
- partition, adding the most significant digit first;
- use known facts and place value to add;
- add the nearest multiple of 1, 10 or 100 then adjust;
- develop further the relationship between addition and subtraction;

Add tenths to a one-digit whole number and tenths
e.g. 5.4 + 0.3, 2.6 + 0.8, 4.3 + □ = 4.9

Add two one-digit whole numbers and tenths
e.g. 5.4 + 2.5, 2.4 + 8.1, 2.4 + □ = 7.6

Add several one-digit whole numbers and tenths
e.g. 2.3 + 5.7 + 3.9, 1.2 + 4.6 + □ = 7.3

Add decimals with different number of places
e.g. 0.67 + 0.2, 0.5 + □ = 0.87

Added to any number with two decimal places to make the next tenth or whole
e.g. 3.65 + □ = 4, 7.36 + □ = 7.4

Added to any number with three decimal places to make the next tenth or whole
e.g. 6.173 + □ = 6, 1.306 + □ = 1.4

Add any pair of 4-digit multiples of 100
e.g. 5700 + 2500, 2400 + 8700

Instant recall: Common fraction decimal and percentage relationships.

- **Round decimals to 1 by generalising rounding to 10**
- **Know complements for 1 by generalising about number bonds**

Addition: Year 6

Mental Strategies

- *They undertake mental calculations with increasingly large numbers and more complex calculations.*

Add large numbers
e.g. 129 000 + 34 000

Add negative numbers in context
e.g. rise from -3°C by 1°C, from -6°C by 9°C

Instant recall: Prime

- consolidate all strategies from previous years;
- partition, adding the most significant digit first;
- use known facts and place value to add;
- add the nearest multiple of 0.1, 10, 100 or 1000, then adjust;
- continue to use the relationship between addition and subtraction;

Add several one-digit whole numbers and tenths
e.g. 2.3 + 5.7 + 3.9, 1.2 + 4.6 + □ = 7.3

Add decimals with different number of places
e.g. 0.67 + 0.2, 0.5 + □ = 0.87

Added to any number with two decimal places to make the next tenth or whole
e.g. 3.65 + □ = 4, 7.36 + □ = 7.4

Added to any number with three decimal places to make the next tenth or whole
e.g. 6.173 + □ = 6, 1.306 + □ = 1.4

Add any pair of 4-digit multiples of 100
e.g. 5700 + 2500, 2400 + 8700

Addition: Year 5 and 6

Written Strategies

$$\begin{array}{r} 46892 \\ +\ 32758 \\ \hline 79650 \\ \hline 111 \end{array}$$

In year 5 and 6 pupils should be adding numbers using compact column addition method for increasingly larger numbers, beginning with 5 digits.

12.5 + 23.7

$$\begin{array}{r} 12.5 \\ +\ 23.7 \\ \hline 36.2 \\ \hline 1 \end{array}$$

34.5 + 27.43

$$\begin{array}{r} 34.50 \\ +\ 27.43 \\ \hline 61.93 \\ \hline 1 \end{array}$$

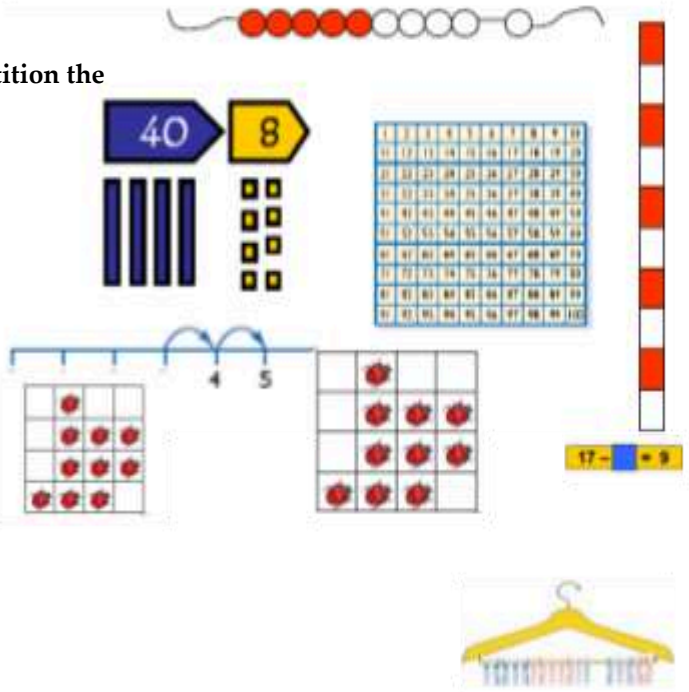
When adding decimals, it is essential that the decimal point does not move and kept in line.

Where necessary, a zero should be added as a *place holder*.

Subtraction

Mental Skills

- **Recognise the size and position of numbers**
- **Count back in ones and tens**
- **Know number facts for all numbers to 20**
- **Subtract multiples of ten from any number**
- **Partition and recombine numbers (only partition the number to be subtracted)**
- **Bridge through ten**
- **Round and adjust**
- **Derive 2 digit subtraction from known facts**



Models, Images and Apparatus

- **Place value apparatus- Dienes**
- **Numicon**
- **Arrow cards**
- **Number tracks**
- **Numbered number lines**
- **Hundred square**
- **Marked but unnumbered number lines**
- **Empty number lines**
- **Counting stick**
- **Bead strings**
- **Flip Flops**
- **Models and Images Charts**
- **ITPs – Number Facts; Counting on and back in ones and tens; Difference**

Key Vocabulary

- **minuend**
- **subtrahend**
- **difference**
- **reduction**
- **subtract**
- **take away**
- **minus**
- **count back**
- **less**
- **fewer**
- **difference between**

Subtraction Structure

Structure	Examples	Models & Images
The partitioning structure (take away)	There are six ducks on the pond, 2 waddle away, how many left? I have £40 in my purse and spend £25, how much have I got left?	Use objects, beads, money etc., and physically 'take away' Model on card number tracks with object on each space, take away the objects and discuss count back on the number line Dienes apparatus taking away using decomposition
The comparison structure (difference)	John is 7 and his brother is 9, what is the difference in their ages? I get £3.50 pocket money and my sister gets £5. How much more than me does she get?	Overlay either Numicon shapes, Cuisenaire or rods of multilink to show the difference
The complement of a set structure	There are 7 butterflies. 4 are red and the rest are blue. How many are red? I built a tower with 9 bricks. It was blue and green. There were 4 blue bricks. How many green bricks did I use?	Use either Numicon shape for the **whole number** and place in both sets (pegs representing the butterflies).
The reducing structure (counting back)	A man weighed 55kg. He lost 5kg. How much does he weigh now?	Model on the number line Use scales with weights on and show number dial going down.
The counting up to structure	I bought a silver birch which is 4 metres high. It will eventually be 20 metres. How much is it going to grow?	Place known number on number line indicate number that needs to be reached. How many more do you need? Quite nice to do this with the number line vertically.

Type	Example
O + O	3 + 5
O – O	8 – 4
T + T	60 + 20
T – T	60 – 10
T + O	40 + 6
T – O	30 – 5
TO + O without crossing tens boundary	53 + 4
TO – O without crossing tens boundary	46 – 4
TO + O with crossing tens boundary	53 + 8
TO - O with crossing tens boundary	33 – 5
TO + T	38 + 40
TO - T	64 – 20
TO + TO without crossing tens boundary	73 + 52
TO - TO without crossing tens boundary	59 – 24
TO + TO with crossing tens boundary	46 + 37
TO - TO with crossing tens boundary	53 – 28

This progression continues through to millions following the pattern above.

Subtraction: Reception

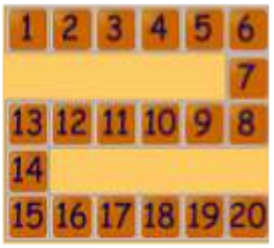
Continue the count back in ones from a given number

Instant recall: subtraction facts from ~~3,4,5,6 & 10~~

Begin to count backwards in familiar contexts such as number rhymes or stories.

Three teddies take away two teddies leaves one teddy

Begin to relate subtraction to 'taking away' using concrete objects and role play.



Find one less than a number up to 10

Say which number is one less than a given number using a number line or number track to 20.

'one less than six is five'

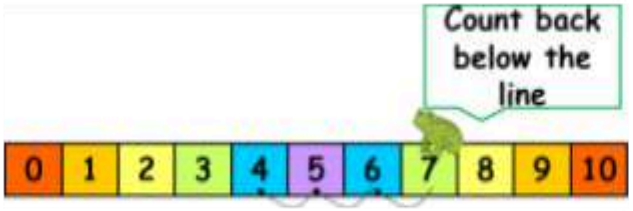
Count backwards along a number line to 'take away'

1 less than 10 is 9
10 subtract 1 equals 9
10 – 1 = 9

Subtraction: Year 1
Mental strategies

- count back in ones;
- 1 less than a number;
- 10 less than a multiple of 10;
- take away a small number by counting back;
- find a small difference by counting on *(using equipment)*;
- begin to bridge through 10, when subtracting a one-digit number;
- use known number facts and place value to subtract one-digit numbers;
- use patterns of similar calculations;

Instant recall:
subtraction facts for all numbers to 14



Small differences in numbers to10 Counting up to (how many more to make?) Counting back to take away.

- add and subtract one-digit and two-digit numbers to 20 including zero
- represent and use number bonds and related subtraction facts within 20
- *Pupils memorise and reason with number bonds to 10 and 20 in several forms (e.g. 9 + 7 = 16; 16 - 7 = 9; 7 = 16 - 9).*
- *They should realise the effect of adding or subtracting zero*

Subtract a small number from one-digit numbers
e.g. 9 – 2, 8 - 3, 8 - □ = 7

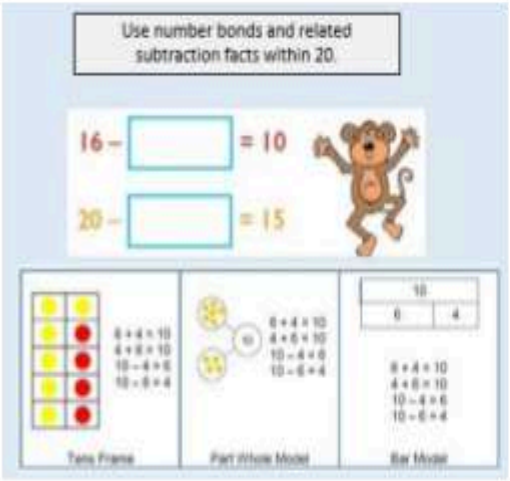
Subtract two one-digit numbers (small difference)
e.g. 8 - 6, 9 - □ = 6

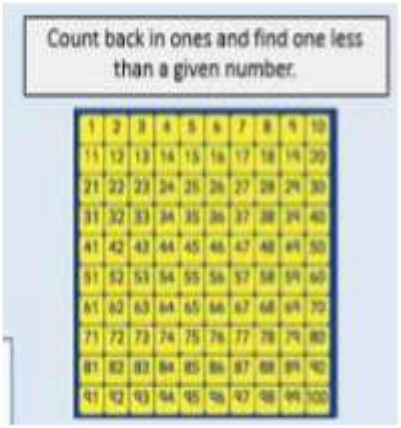
Subtract a ones from a 'teens' number
e.g. 16 - 5, 14 - 6, □ - 3 = 11, 14 - □ = 9

Also include:

Subtract zero
e.g. 3 - 0, 15 - 0, 12 - □ = 7

Subtract ones from 10 or 20
e.g. 10 - 4, 20 - 4, 10 - □ = 2, 20 - □ = 11





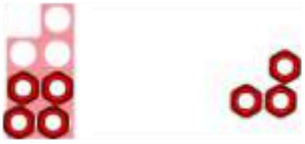
What's the difference?

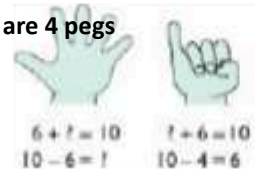
There are 3 more blue cubes

There are 3 less red cubes

Counting on should only be used when the language used is 'find the difference', 'difference between' and 'distance between'.

7 pegs take away 3 pegs leaves 4 pegs
7 minus 3 equals 4
If you take away 3 pegs from 7 pegs there are 4 pegs remaining 7 – 3 = 4

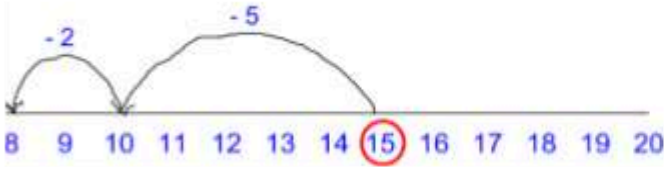




Use a numbered number line to support the subtraction of numbers. Know and use strategy of counting back to subtract one-digit and two-digit numbers to 20.

Dan has 15 football stickers.

He gives 7 to Ben. How many stickers does he have left?



Subtraction: Year 2
Mental strategies

- count back in tens or ones;
- subtract mentally a 'near multiple of 10';
- take away a small number by counting back;
- find a small difference by counting up from the smaller to the larger number (on a number line);
- bridge through a multiple of 10, then adjust;
- use knowledge of number facts and place value to subtract pairs of numbers;
- subtract by partitioning second number and subtracting tens then ones;
- use patterns of similar calculations;

- add and subtract numbers using concrete objects, pictorial representations, and mentally, including:
  - a two-digit number and ones, a two-digit number and tens, two two-digit numbers
  - adding three one-digit numbers
- recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100

Subtract ones from a two-digit number
e.g. 48 - 5, 36 - □ = 31, 23 - 6, 56 - □ = 59

Subtract tens from a two-digit number
e.g. 73 - 30, 51 - □ = 21, □ - 30 = 61,

Subtract pairs of two-digit numbers
e.g. 47 - 22, 85 - □ = 54, 63 - 47, 72 - □ = 56

Also include:

Subtract pairs of two-digit numbers (difference less than 10)
e.g. 47 - 42, 63 – 58, 71 - □ = 68

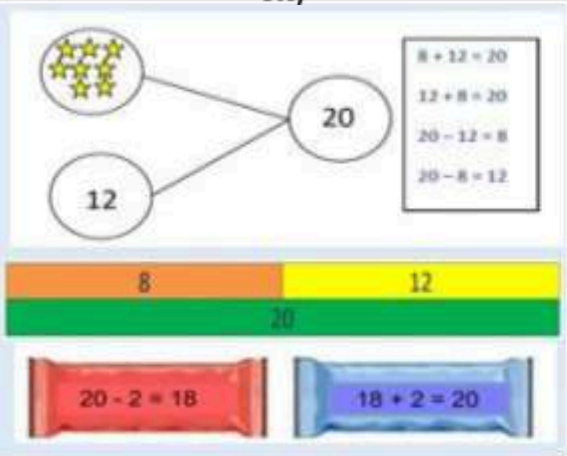
Subtract ones from a tens number
e.g. 30 – 4, 70 - □ = 61

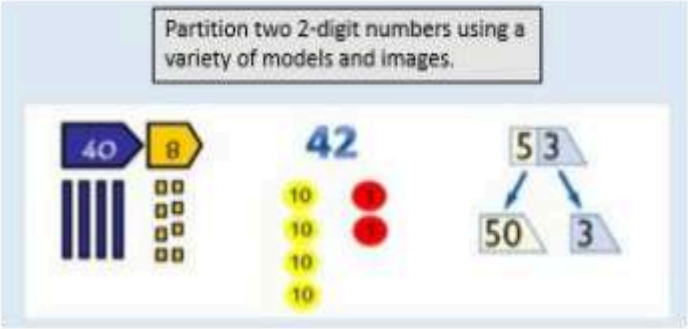
Subtract tens from a tens number
e.g. 80 – 40, 70 - □ = 20, 100 – 20, 120 - 50

Instant recall: Fact families for all numbers to 20

Subtraction facts from 100 (inverse of addition)

Subtracting near multiples of ten by subtracting multiples of ten and adjusting (e.g. subtracting 19, 22 etc)

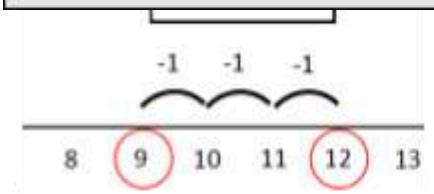




Partition two 2-digit numbers using a variety of models and images.

Subtraction: Year 2
Calculating strategies
(jottings)

Subtract 2 digit and ones

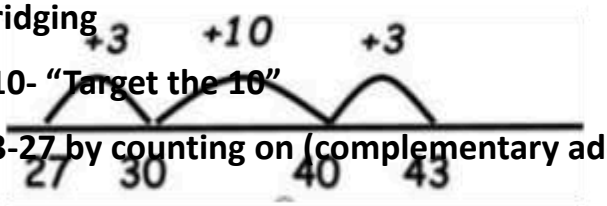


Subtract 2 digit and tens

Bridging

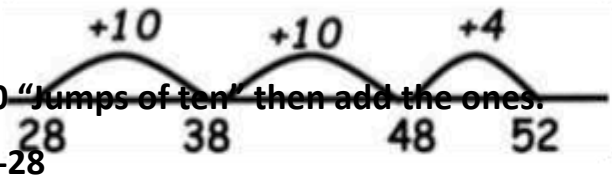
T10- "Target the 10"

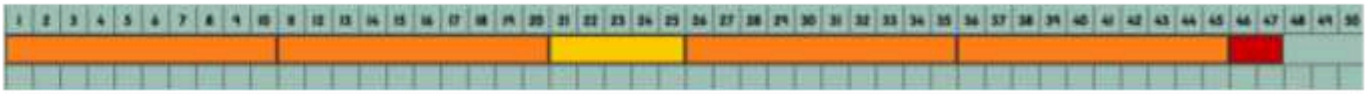
43-27 by counting on (complementary addition)



J10 "Jumps of ten" then add the ones.

52-28





Subtraction: Year 3
Mental strategies

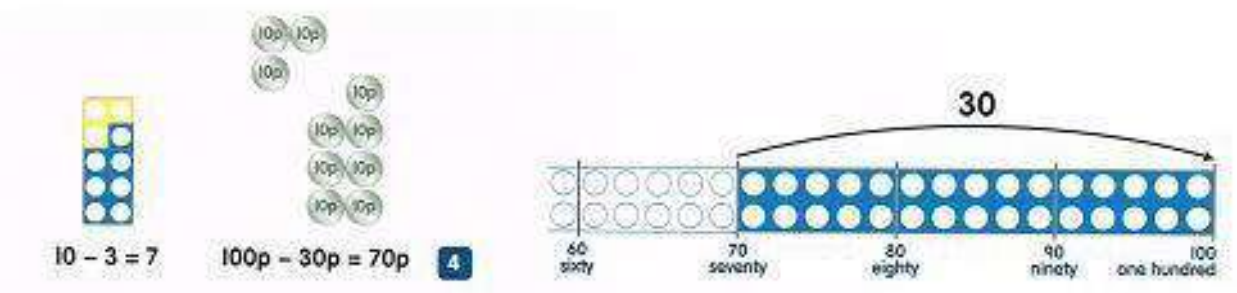
- count back in hundreds, tens or ones;
- subtract mentally a 'near multiple of 10';
- find a small difference by counting up from the smaller to the larger number (on a number line);
- bridge through a multiple of 10, then adjust;
- use knowledge of number facts and place value to subtract pairs of numbers;
- subtract a 2-digit number by partitioning it subtracting its tens then ones;
- use patterns of similar calculations;
- use the relationship between addition and subtraction;

Instant recall:

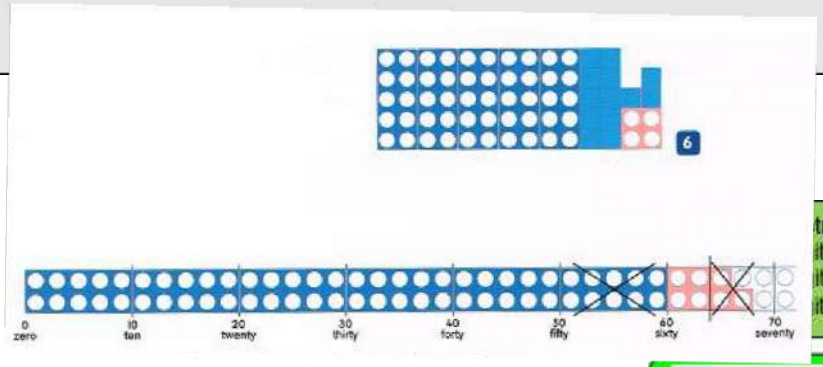
Difference between multiples of ten, subtract 10 from any 2-digit number

Also see mental methods for subtracting using the number line (below)

Subtracting multiples of ten using known facts



Subtracting 2 and 3-digit numbers without crossing multiples of ten (number line jotting)

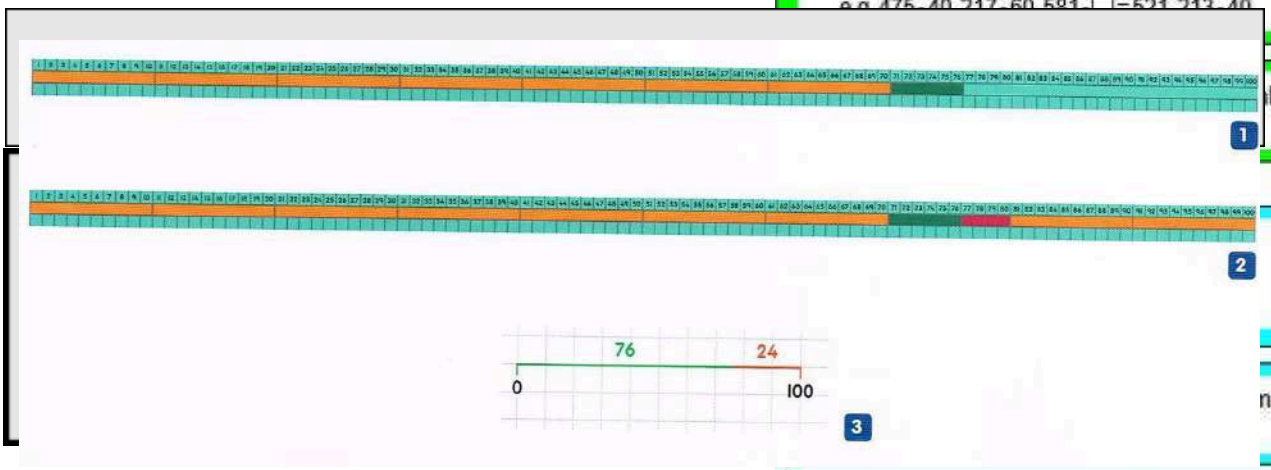


tract numbers mentally, including:
it number and ones
it number and tens
it number and hundreds

Subtract ones from a three-digit number
e.g. 237 - 6, 258 - □ = 252, 375 – 8, 301 - 3

Finding the difference between two 2-digit numbers using the number line jotting. Counting on (complementary addition)

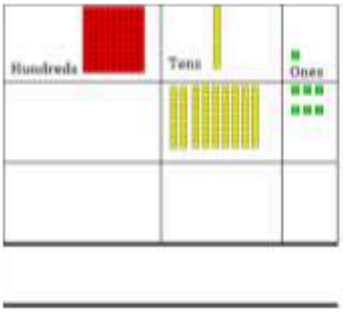
Subtract tens from a three-digit number
e.g. 475 - 40, 217 - 60, 581 - □ = 521, 213 - 40



Subtract a two-digit number from a one hundred three-digit number
e.g. 127 – 72, 143 - 86

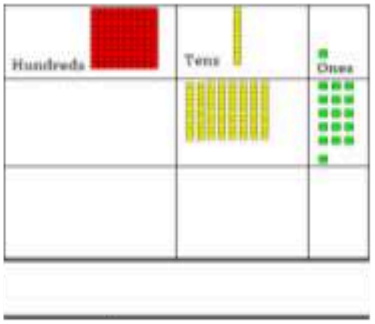
Subtraction: Year 3
Written strategies

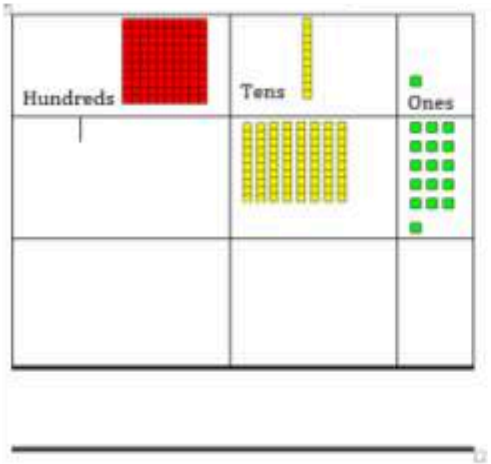
Column method involving *exchanging* *one ten for 10 ones*



96

- 9

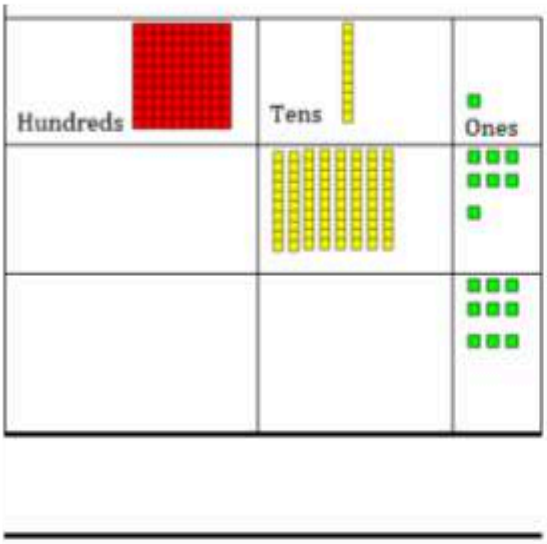




$^{8}\cancel{9}^{1}6$ 80 + 16

- 9

You may need to **expand** the calculation to show that you have regrouped the problem as 80 + 16



$^{8}\cancel{9}^{1}6$ 80 + 16

- 9 -9

8 7 80 + 7

If you have written in **expanded form** in the previous example, do the same with the examples for 3 digit numbers

Subtraction: Year 4
Mental strategies

- count back in steps of 1, 10, 100, or 1000;
- use known facts and place value to subtract;
- find a difference by counting up through the next multiple of 10, 100 or 1000;
- subtract the nearest multiple of 10 or 100 then adjust;
- use the relationship between addition and subtraction;

Pupils continue to practise both mental ... addition and subtraction with increasingly large numbers to aid fluency

Subtract ones from a four-digit number
e.g. 4319 - 6, 3486 - □ = 3481, 2023 - 5

Subtract tens from a four-digit number
e.g. 1375 - 40, 5163 + □ = 5113, 3731 - 70

Subtract hundreds from a four-digit number
e.g. 5629 - 400, 4648 - □ = 4148, 4505 - 600

Subtract a four-digit number and thousands
e.g. 6173 - 4000, 8649 - □ = 3649

Also include:

Subtract three-digit multiple of 10 from a three-digit number
e.g. 742 – 210, 516 – □ = 146, □ – 340 = 685

Subtract three-digit multiple of ten from a thousands number
e.g. 3000 – 230, 7000 – □ = 6480, 5000 – 540

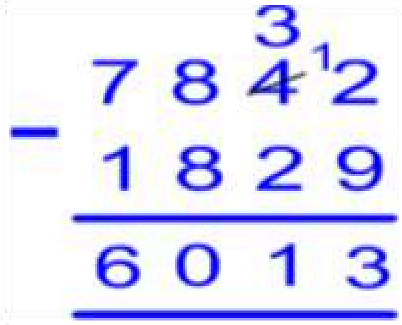
Subtract a pair of numbers lying either side of a thousands number
e.g. 7003 – 6988, 6004 – □ = 19

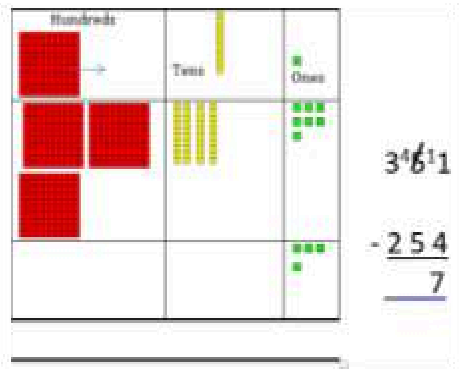
Instant recall:
Use of all prior subtraction facts in problem solving contexts Differences for 1000

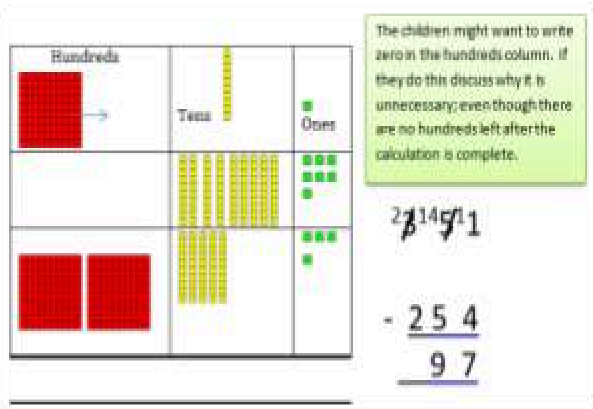
Subtraction: Year 4
Written strategies

Column method involving *exchanging* one hundred for 10 tens and one ten for 10 ones

By the end of year 4, pupils should be subtracting numbers up to 4 digits using compact column subtraction method.







Subtraction: Year 5
Mental strategies

- count back in steps of 0.1, 1, 10, 100, or 1000;
- use known facts and place value to subtract;
- find a difference by counting up through the next multiple of 10, 100 or 1000;
- subtract the nearest multiple of 1, 10 or 100 then adjust;
- develop further the relationship between addition and subtraction;

- add and subtract numbers mentally with increasingly large numbers
- *They practise mental calculations with increasingly large numbers (e.g. 12462 - 2300 = 10 162).*
- *They mentally add and subtract tenths, and one-digit whole numbers and tenths.*
- *...complements of 1 (0.83 + 0.17 = 1)*

Subtract tenths from a one-digit whole numbers and tenths
e.g. 5.4 - 0.3, 2.6 - 0.8, 4.3 - □ = 3.9

Subtract two one-digit whole numbers and tenths
e.g. 5.4 - 2.5, 8.2 - 5.7, 2.4 - □ = 1.6

Subtract four-digit multiple of 100 from a five-digit number
e.g. 25 935 - 2 100, 19 412 + 7 500

Subtract two numbers with tenths and hundredths
e.g. 0.57 - 0.32, 0.41 - 0.26, 0.64 - □ = 0.37

Subtract a one-digit whole number and tenths from a whole number
e.g. 7 - 5.4, 12 – 7.6, 21 - □ = 17.6, 20 – 2.7

Subtraction: Year 6
Mental strategies

- consolidate all strategies from previous years;
- use known facts and place value to subtract;
- find a difference by counting up through the next multiple of 10, 100 or 1000;
- subtract the nearest multiple of 0.1, 10, 100 or 1000, then adjust;
- continue to use the relationship between addition and subtraction;

They undertake mental calculations with increasingly large numbers and more complex calculations.

Subtract large numbers
e.g. 269 000 – 42 000

Subtract negative numbers in context
e.g. decrease from 2°C to -4°C,
reduce -6°C by -5°C

Also include:

Subtract four-digit multiples of 100
e.g. 6200 – 3800, 6100 – □ = 3700

Subtract any number with three decimal places from a whole number
e.g. 5 – 0.314, 12 – 0.176, 1 - □ = 0.368

Subtract decimals with a different number of decimal places
e.g. 0.67 - 0.2, 0.9 - □ = 0.53

Subtraction: Year 5 and 6
Written strategies

Written methods- consolidation. Choose and use the most appropriate method.

When subtracting decimals, it is essential that the decimal point does not move and kept in line.

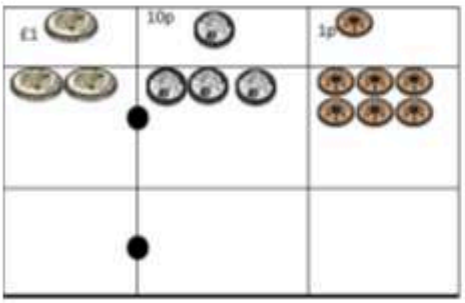
Where necessary, a zero should be added as a ***place holder.***

$$\begin{array}{r} 4 \\ 5.^{1}37 \\ -\ 2.54 \\ \hline 2.83 \end{array}$$

	~~1~~	~~0~~	15	.	~~3~~	11	9	kg
−		36	.	08		0		kg
		69	.	33		9		kg

$$\begin{array}{r} 8 \quad\ 7 \\ \cancel{9}\ ^{1}6\ 7\ \cancel{8}\ ^{1}3 \\ -\ 5\ 8\ 7\ 3\ 5 \\ \hline 3\ 8\ 0\ 4\ 8 \end{array}$$

Use column methods to add money and in the context of measures using decimals.



£2.36

- £1.78

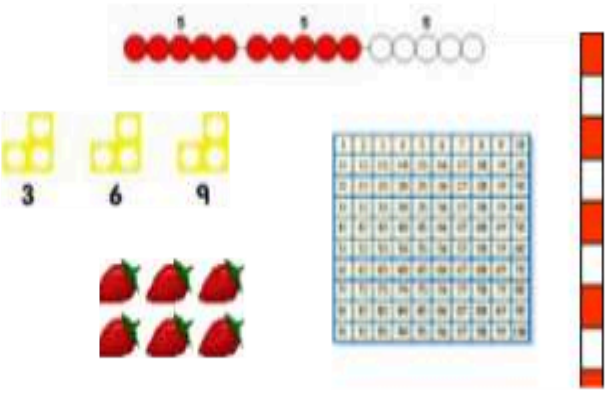
Ensure pupils understand that £1 is the Unit, 10p a tenth of the £1 and 1p a hundredth of a £1.

Multiplication

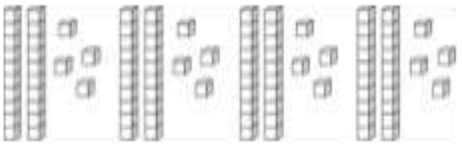
Mental skills

- Recognise the size and position of numbers
- Count on in different steps- 2s, 5s, 10s
- Double numbers to ten
- Recognise multiplication as repeated addition
- Quick recall of multiplication facts
- Use known facts to derive associated facts
- Multiply by 10, 100, 1000 and understand the effect of so doing
- Multiply by multiples of 10

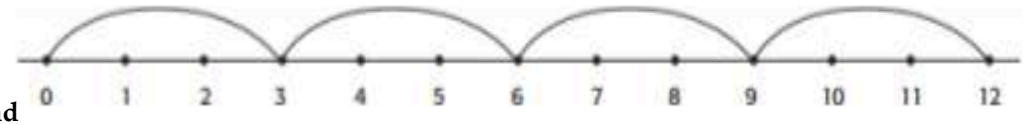
Models, Images and Apparatus



- Place value apparatus – Dienes
- Bead strings
- Numicon
- Arrays
- 100 square
- Number tracks
- Numbered number lines
- Marked but unnumbered number lines
- Empty number lines
- Multiplication squares
- Counting stick
- Models and Images charts
- ITPs – Multiplication Grid; Number Dials; Multiplication Facts



Vocabulary



- factor
- multiplicand
- multiplier
- lots of
- groups of
- times
- multiply
- multiplication
- multiple
- product
- array, row, column
- double
- repeated addition

Multiplication Structures

Structure	Examples	Models & Images
Repeated groups structure	There are six doughnuts in the bag. You have three bags. How many doughnuts?	Use objects, beads, biscuits, doughnuts.
The scaling structure	The walk to school takes 15 minutes. There and back will be double.	Drawing on number lines etc.
The area structure of multiplication (arrays)	The room is 3m x 4.5 m. How many m^2 of carpet do you need to buy?	Area grid model Cuisenaire in an array Counters in an array
The rate of change structure	The driver was driving for 3 hours at 60 mph. How far has he driven?	Repeated jumps on the number line Numicon or Cuisenaire rods in a line – represent 'change' Bar modelling – repeated bars

Multiplication: Early Years

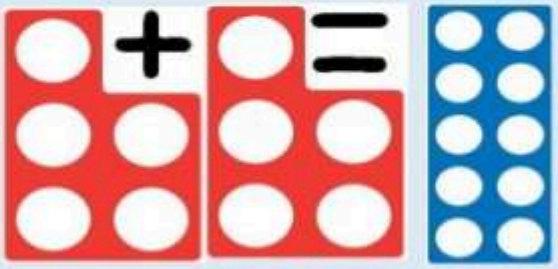
Early learning goal statutory requirement:
✓They solve problems, including doubling, halving and sharing.

Instant recall:

Know what 'doubling' means

Know double 1, 2, 3, 5

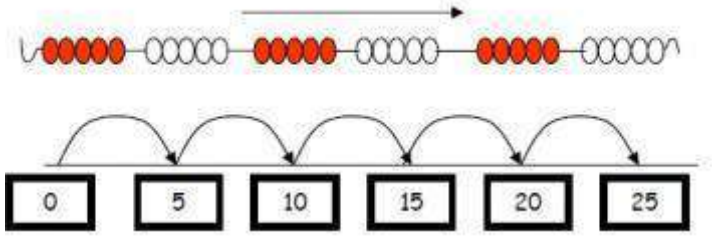
Use pictorial representations and concrete resources to double numbers to 10.

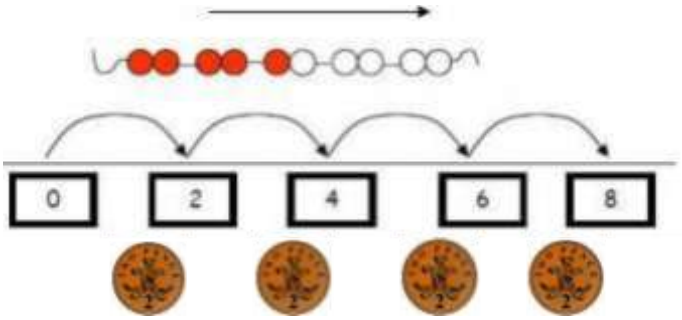


Use concrete sources, role play, stories and songs to begin counting in twos, fives and tens.

Multiplication: Year 1

- counting in twos, fives and tens;
- repeated addition;
- links to doubling;
- use arrays;





- solve simple one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.
- *They make connections between arrays, number patterns, and counting in twos, fives and tens.*

Give children experience of counting equal group of objects in 2s, 5s and 10s.

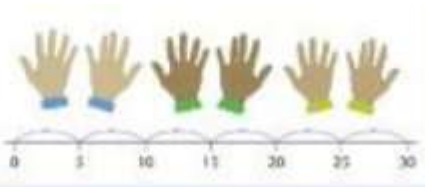
Present practical problem solving activities involving counting equal sets or groups

Also include:

Doubles of all numbers to 10

Calculation methods-recognise arrays and repeated addition as models for counting in 2s, 5s and 10s (as above)

Count in twos, fives and tens using practical resources, role play, stories and songs.



Use pictorial representations

3 x 5

3 groups of 5

2 + 2 + 2 + 2

Multiplication: Year 2
Mental strategies

- counting in twos, fives and tens;
- repeated addition;
- use arrays;
- use known facts and place value to multiply by 2, 5 or 10;
- links to doubling;
- reorder a calculation, knowing multiplication can be done in any order (**commutative**);

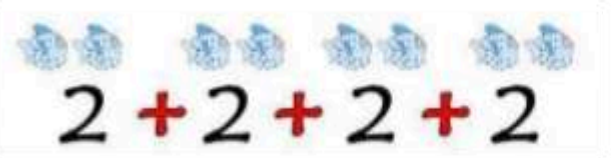
Understand multiplication as repeated addition

- recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers
- solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts
- *They begin to use other multiplication tables and recall multiplication facts … to perform … mental calculations.*

Multiplication facts for x2, x5 and x10
e.g. 2 x 5, 5 x 6, 10 x 5, 5 x □ = 20

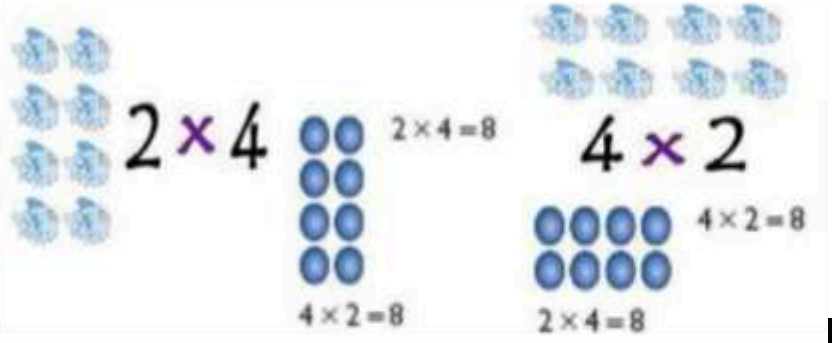
Also include:

Doubles to 20
e.g. double 11, double 16, 13 + 13

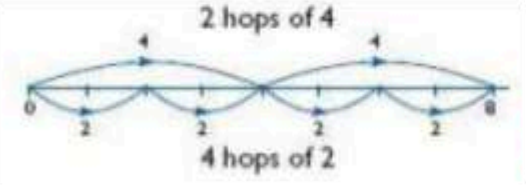


2+2+2+2 =8 — 2 multiplied by 4

4 x 2 = 8 — 4 lots of 2



Understand multiplication as an array



Understand how to represent arrays on a number line

Multiplication: Year 3
Mental strategies

- counting in 2s, 5s, 10s, 3s, 4s and 8s;
- repeated addition;
- use known facts and place value to multiply by 2, 3, 4, 5 8 or 10;
- use doubles to link x2, x4 and x8 tables;
- reorder a calculation using commutativity;
- use the rule of associativity;
- scaling up using known facts;
- use the relationship between multiplication and division;

Please note that the GLC has decided that in addition to the 3, 4 and 8 x tables, year 3 will also learn the 6 x table.

Learn 3x and double to find 6x.

Learn 4 x and double to find 8x.

- recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables
- write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including:
  - two-digit numbers by one-digit numbers ... using mental methods
- *Pupils develop efficient mental methods, for example, using commutativity and associativity (e.g. 4 × 12 × 5 = 4 × 5 × 12 = 20 × 12 = 240) and multiplication and division facts (e.g. using 3 × 2 = 6,) to derive related facts (30 × 2 = 60, ...).*

Multiplication facts for x3, x4 and x8
e.g. 8 x 6, 3 x 6, 4 x 7, 3 x □ = 24

Multiply a 'teens' number by 2, 3, 4, 5 or 8
e.g. 14 x 3, 17 x 4

Multiply a one-digit by a multiple of 10
e.g. 30 x 2, 5 x 40, 8 x □ = 320

Multiply a two-digit by a one-digit number
e.g. 32 x 3, 4 x 23, 5 x □ = 155

Also include:

Doubles to 50

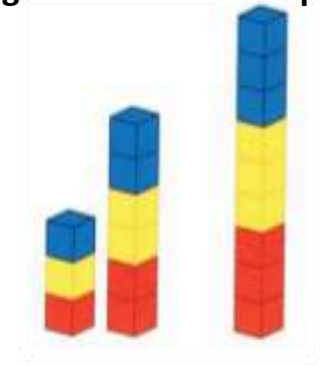
Multiply 3 numbers within known tables
e.g. 3 x 2 x 8, 4 x 3 x 5

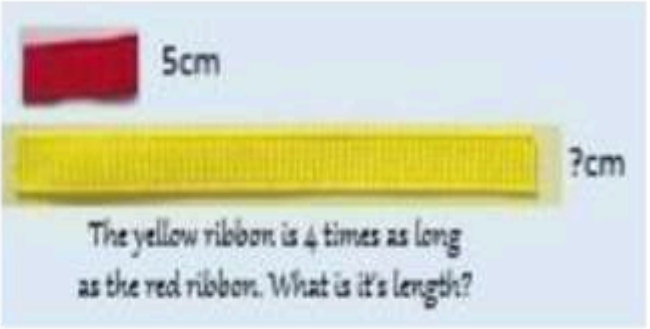
x	3	4	8
5			
6			
4			

x	4	?	?
?	8	6	10
6	24	18	30
?	32	24	40

Calculating Methods

Scaling structure of multiplication – how many times larger or smaller.





Multiplication: Year 3
Written strategies

Use concrete resources to develop conceptual understanding of the compact method introduced in Year 4.

Short written method of multiplying

x	10	3
4		

13

X 4

—

	10	3
4	40	12

40 + 12 = 52

Multiplication: Year 4
Mental strategies

- counting in 6, 7, 9, 25 and 1000;
- use commutativity and tables to multiply;
- use partitioning and Distributive Law to multiply;
- use factor pairs and the Associative Law to multiply;
- use known facts and place value to multiply;
- use related facts to multiply;
- scaling up using known facts;

- recall multiplication and division facts for multiplication tables up to 12 x 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
- *Pupils practise mental methods and extend this to three-digit numbers to derive facts, (e.g. 600 ÷ 3 = 200 can be derived from 2 x 3 = 6).*

Please note that the GLC has decided that in addition to the 6, 7 and 9 x tables, year 4 will also learn the 11 and 12x tables.

Also include:

Multiply a number to 12 by a multiple of 10
e.g. 12 x 70, 90 x 6, 8 x □ = 560

Multiply a number to 12 by a multiple of 100
e.g. 300 x 7, 9 x 400, 900 x □ = 8100

Multiply a 'teens' number by a 1-digit number
e.g. 15 x 8, 16 x 9, 6 x 17

Doubles of any 2-digit numbers

Multiplication: Year 4
Written strategies

1) Using grid multiplication to scaffold learning of short written method including multiples of ten . This should not be taught as a written method. Only use as a model to understanding the place value of the written method.

	10	10	5
5	5 × 10 = 50	5 × 10 = 50	5 × 5 = 25

Short written method

		2	5
×			5
	1	2	5
		2	

		3	6
×			7
	2	5	2
		4	

Multiplication: Year 5
Mental strategies

- counting in steps of powers of 10;
- use commutativity and tables to multiply;
- use partitioning and Distributive Law to multiply;
- use factor pairs and the Associative Law to multiply;
- use known facts and place value to multiply;
- use related facts to multiply;
- scaling up using known facts;
- use the relationship between multiplication and division;
- recognise and use square and cube numbers;

If 4 X 7 = 28

Then 4 x 70 = 280

- multiply and divide numbers mentally drawing upon known facts
- multiply and divide whole numbers and those involving decimals by 10, 100 and 1000
- solve problems involving multiplication and division including using their knowledge of factors and multiples, squares and cubes

Multiply a two-digit by a one-digit number
e.g. 4 x 35, 23 x 6, 28 x □ = 140

Multiply whole numbers by 10, 100 and 1000
e.g. 327 x 10, 96 x 100, 83 x 1000

Multiply decimals by 10, 100 and 1000
e.g. 3.27 x 10, 5.4 x 100, 0.82 x □ = 82

Also include:

Multiply a multiple of 10 by a multiple of 10
e.g. 50 x 60, 90 x 70, 60 x □ = 42 000

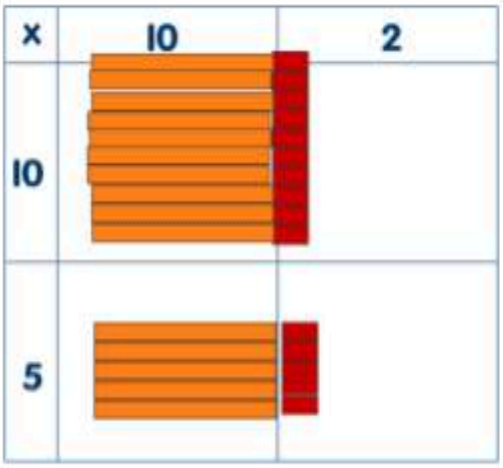
Multiplying 3 numbers (including tens)
e.g. 3 x 40 x 6, 70 x 5 x 20

Double any multiple of 5 up to 500

Instant recall: Common fraction/decimal/percentage relationships, Fractions of 100: ½, ¼, $^{1/5}_{1}$, /, /$^{1}_{10}$ ^{8}, ¾, $^{1}/_{20}$, Square numbers to 12 x 12, derive facts through multiplying by powers of ten.

Multiplication: Year 5
Written strategies

1) Using grid multiplication to scaffold learning of long written method (standard method).



	30	3		
10	300	30	= 330	300
4	120	12	= 132	120
			462	30 + 12
				462

2)Introduce Long multiplication

Note: Multiply starting from the bottom right digit (lowest value). Remember to put in the place holder.

Multiplication: Year 6
Mental strategies

- use commutativity and tables to multiply;
- use partitioning and the Distributive Law to multiply;
- use factor pairs and the Associative Law to multiply;
- use known facts and place value to multiply;
- use related facts to multiply;
- scaling up using known facts;
- use the relationship between multiplication and division;

- multiply one-digit numbers with up to two decimal places by whole numbers
- multiply and divide numbers by 10, 100 and 1000 where the answers are up to three decimal places
- *Pupils multiply decimals by whole numbers, starting with the simplest cases, such as 0.4 x 2 = 0.8, and in practical contexts, such as measures and money.*
- *Pupils continue to use all the multiplication tables to calculate mathematical statements in order to maintain their fluency.*

Also include:

Multiply a multiple of 10 by a multiple of 100
e.g. 30 x 500, 900 x 50, 60 x □ = 42 000

Multiply a tenths number by a multiple of 10
e.g. 0.7 x 20, 50 x 0.3, 0.2 x 20

Multiply a units and tenths number by a one-digit number e.g. 3.7x5, 4.2x4, 3.9x6

Double a units and tenths and decimals less than 1 (2 decimal places)

Multiply a tenth number by a one-digit number
e.g. 0.4 x 9, 6 x □ = 4.8, □ x 7 = 4.9

Multiply a hundredths number by a one-digit number
e.g. 0.06 x 3, 9 x 0.03, 8 x □ = 0.56

Instant recall:

Multiply by powers of ten for numbers to 3 decimal places, partition to multiply

Multiplication: Year 6
Written strategies

Written methods. Consolidate previous learning:
Multiplying decimals by multiplying whole numbers.

Column method in the context of money using a grid and then standard method (Year 7 objective)

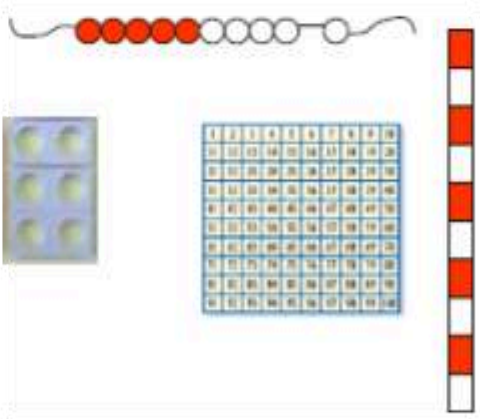
Division

Mental Skills

- Recognise the size and position of numbers
- Count back in different steps- 2s, 5s and 10s
- Halve numbers to 20
- Recognise division as repeated subtraction
- Quick recall of division facts
- Use known facts to derive associated facts
- Divide by 10, 100, 1000 and understand the effect of doing so
- Divide by multiples of 10

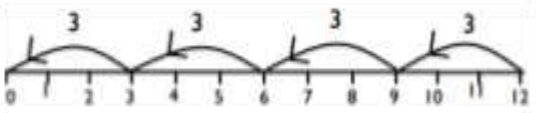
Models, Images and Apparatus

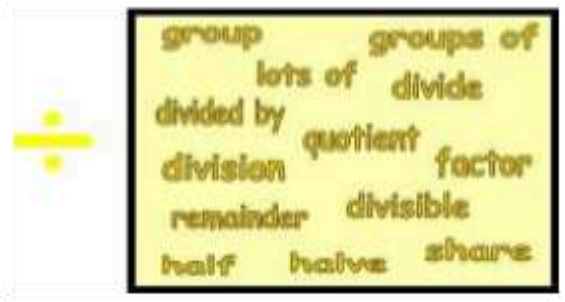
- Counting apparatus
- Arrays
- 100 square
- Number tracks
- Numbered number lines
- Marked but unnumbered number lines
- Empty number lines
- Multiplication squares
- Models and Images charts
- ITPs – Multiplication; Remainders Grid; Number Dials; Grouping



Vocabulary

- dividend
- divisor
- quotient
- groups of (quotative division)
- share
- shared between (partitive division)
- divide
- divide into
- division
- divided by
- remainder
- divisible





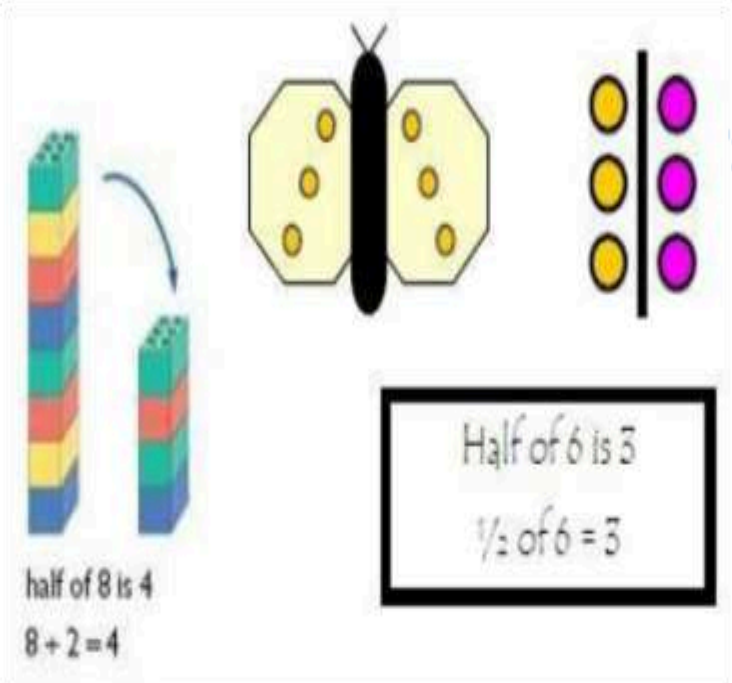
Division Structures

Structure	Examples	Models & Images
The sharing structure (partitive division)	There are six doughnuts in the bag. Three friends share them equally, how many do they each get?	Use objects, beads, biscuits, money etc., and physically share
The grouping structure (quotative division)	The hens lay 42 eggs. The farmer puts them into boxes with 6 eggs in each. How many boxes of eggs are there?	Use Numicon shapes, empty egg boxes, empty crayons etc., to model how many in the set. Bar modelling /Repeated subtraction on number line.
The scaling structure	The dress cost £18; it was sold in the sale for half price. How much is the sale price of the dress?	Cutting paper strips Bar modelling /Dividing a number line Relating to fractions
The area model of division	The area of a field is ¾ of an acre^2. The farmer is going to use 1/5 of the field for the sheep. How much space have they got?	Area model Fractions of a number line

Division:

Instant recall:

Understand half as sharing equally between two, know half of 2, 4, 6, 8 & 10



Begin to share quantities using practical resources, role play, stories and songs.

Role play example:
It is the end of the party and the final two teddies are waiting for their party bags. Provide empty party bags and a small collection of items such as gifts, balloons and slices of cake. Ask the children to share the objects between the two bags.

Division: Year 1

- counting in twos, fives and tens;
- links to halving;
- use arrays;

Relate division to inverse of multiplication and 'groups of' (within Numbers Basics)

Give each bear 2 sweets – how many sweets do we need?

- solve simple one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.
- *Through grouping and sharing small quantities, pupils begin to understand multiplication and division; doubling numbers and quantities, and finding simple fractions of objects, numbers and quantities.*
- *They make connections between arrays, number patterns, and counting in twos, fives* and tens.

- Share these pencils equally between Asif and Ben. How many pencils will each of them get.

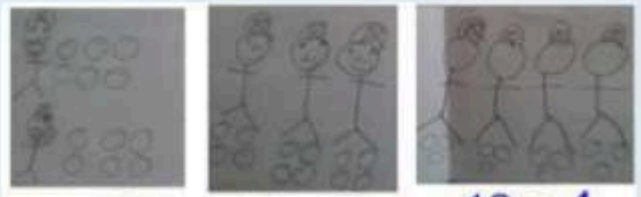
- Put half of these ten animals in the ark. How many of the animals are in the ark?
- How many children can have two squares of this chocolate?

Also include:

Halves of corresponding doubles to 10

Understand division as **sharing** using concrete resources.

Pictorial representation of sharing **12 gold coins** between 2, 3 and 4 pirates!

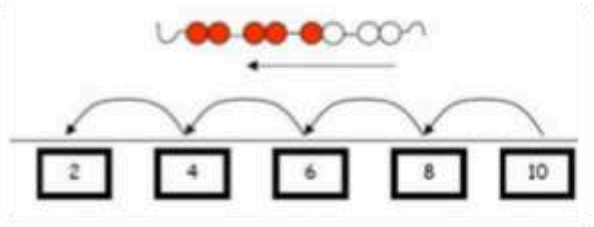


12 ÷ 2 12 ÷ 3 12 ÷ 4

Division: Year 2

- counting in twos, fives and tens;
- link to arrays;
- use known facts and place value to divide;
- partition in different ways to divide;
- links to halving;

Relate counting back in steps to repeated subtraction – dividing into groups of ….



- recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers
- solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts
- *Pupils work with a range of materials and contexts in which multiplication and division relate to grouping and sharing discrete and continuous quantities, and relating these to fractions and measures (e.g. 40 ÷ 2 = 20, 20 is a half of 40). …*

Division facts for the 2, 5 & 10 times tables
e.g. 10 ÷ 5, 30 ÷ 5, 50 ÷ 5, 20 ÷ □ = 4

Also include:

Halves of corresponding doubles to 20
e.g. half of 22, half of 32

Divide a two-digit number by 2, 5 or 10 to give a 'teens' answer
e.g. 70 ÷ 5, 32 ÷ 2

How many 5s in 35?

Model division as grouping on a number line (ITP 'Grouping')

Division: Year 3
Mental strategies

- counting in 2s, 5s, 10s, 3s, 4s and 8s;
- use known facts and place value to divide by 2, 3, 4, or 10;
- partition in different ways to divide;
- use halving to link ÷8, ÷4 and ÷2 tables;
- scaling down using known facts;
- use the relationship between multiplication and division;

- recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables
- write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including:
  - two-digit numbers by one-digit numbers ... using mental methods

Division facts for the 3, 4 & 8 times tables
e.g. 48 ÷ 6, 18 ÷ 6, 28 ÷ 7, 24 ÷ □ = 3

Divide a number by 3, 4 or 8 to give a 'teens' answer e.g. 42 ÷ 3, 68 ÷ 4, 104 ÷ 8

Divide a tens number by a one-digit or tens number
e.g. 60 ÷ 3, 200 ÷ 40, 320 ÷ □ = 40

Divide a two or three-digit number by 3, 4 or 8
e.g. 96 ÷ 3, 92 ÷ 4, 184 ÷ 8

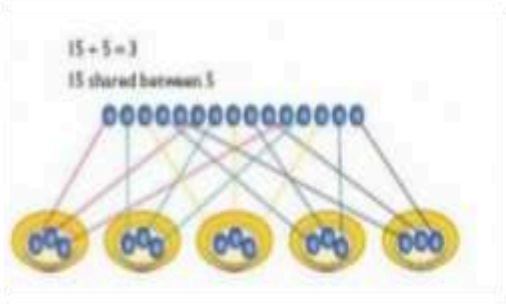
Also include:

Halves of corresponding doubles to 50

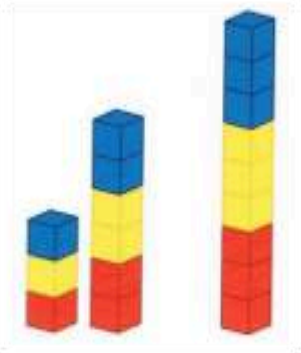
Please note, in year 3, the pupils also learn the division facts for the 6 x table linked to the 3x table.

Calculation methods

1. Sharing structure of division



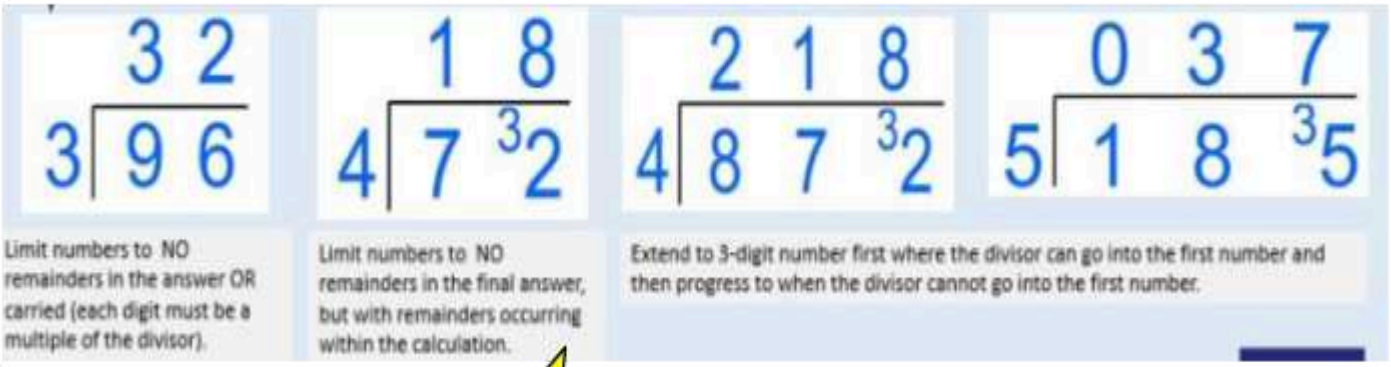
2) Ratio and scaling structure of division



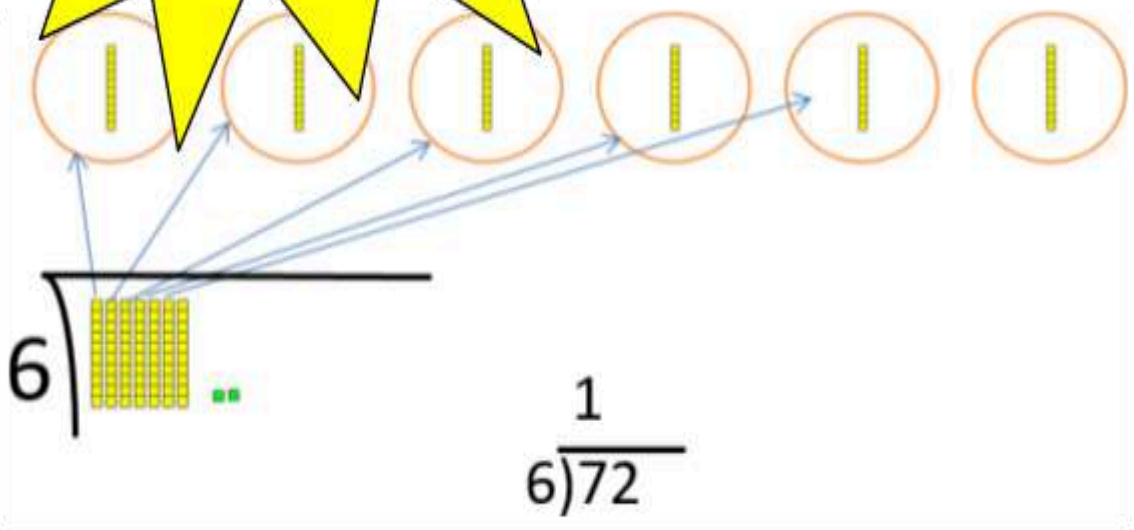
3)Multiplying and dividing by 10

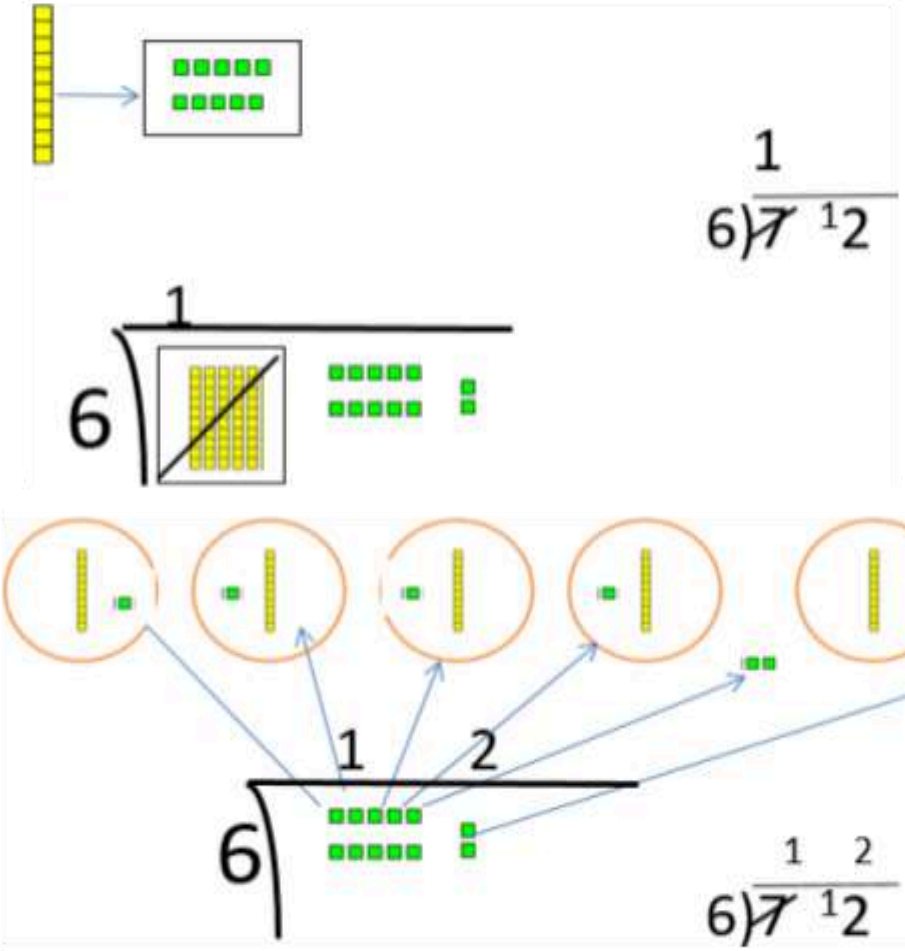
Division: Year 3
Written strategies

Short written method of dividing



NPC 3 Calculating 15 Activity 8 – do with counters as biscuits first as sharing before looking at grouping)




1
6)7 12
1
6

1 2
6
1 2
6)7 12

Division: Year 4
Mental strategies

- counting in 6, 7, 9, 25 and 1000;
- use partitioning and the Distributive Law to divide;
- use known facts and place value to divide;
- use related facts to divide;
- use factor pairs to divide;
- scaling down using known facts;
- use the relationship between multiplication and division;
- include calculations with remainders;

Also include:

Division linked to tables facts times a multiple of 10
e.g. 840 ÷ 70, 540 ÷ 6, 560 ÷ □ = 80

Division linked to tables facts times a multiple of 100
e.g. 2100 ÷ 7, 3600 ÷ 400, 8100 ÷ □ = 900

Divide a number to give a 'teens' answer
e.g. 105 ÷ 7, 144 ÷ 9, 96 ÷ 6

Halves of corresponding doubles of any two-digit numbers

- recall multiplication and division facts for multiplication tables up to 12 x 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
- *Pupils practise mental methods and extend this to three-digit numbers to derive facts, (e.g. 600 ÷ 3 = 200 can be derived from 2 x 3 = 6).*

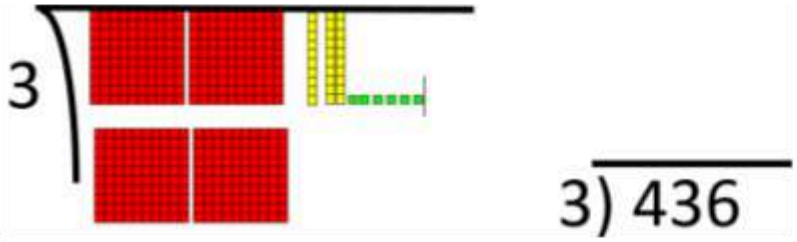
Division facts for the tables to 12 x 12
e.g. 96 ÷ 12, 63 ÷ 7, 72 ÷ 6, 121 ÷ □ = 11

Dividing by 1

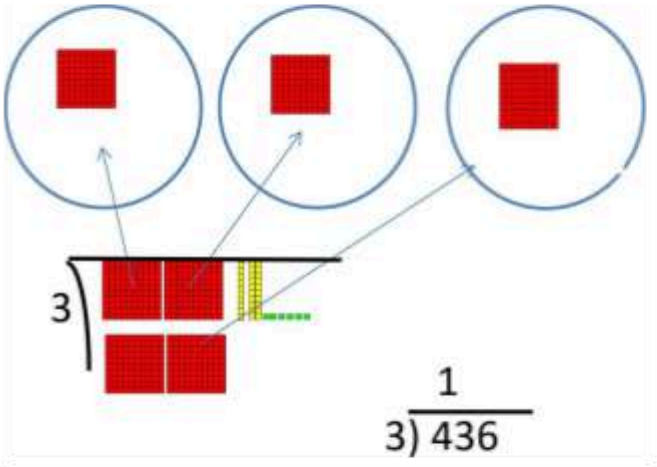
Instant recall Year 4: Fractional amounts of 100 (25,50,75,10..)

Division: Year 4
Written strategies

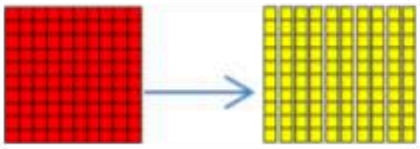
Short division with 3 digit numbers

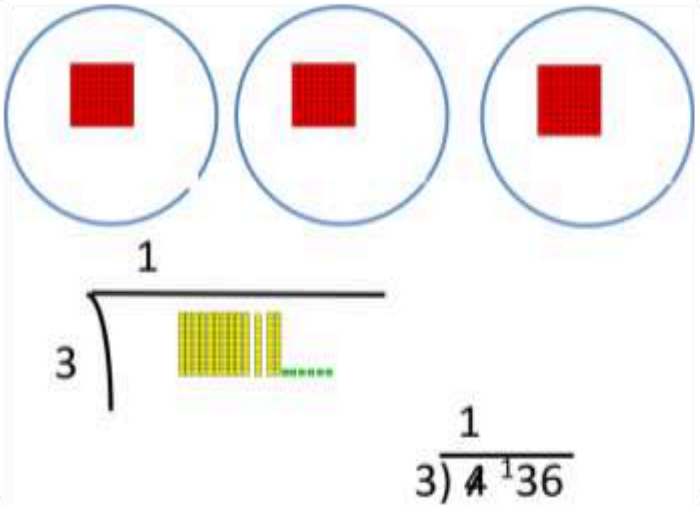


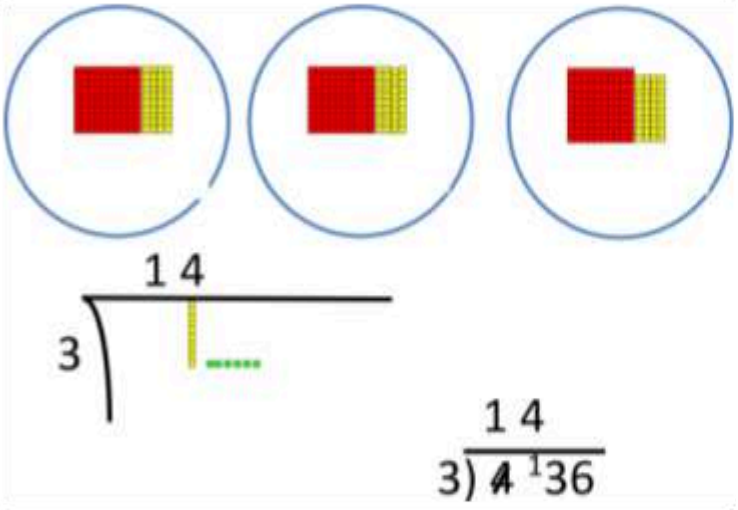
With dienes or place value counters



Exchange remaining hundred




1
3
1
3) 4 1 36


1 4
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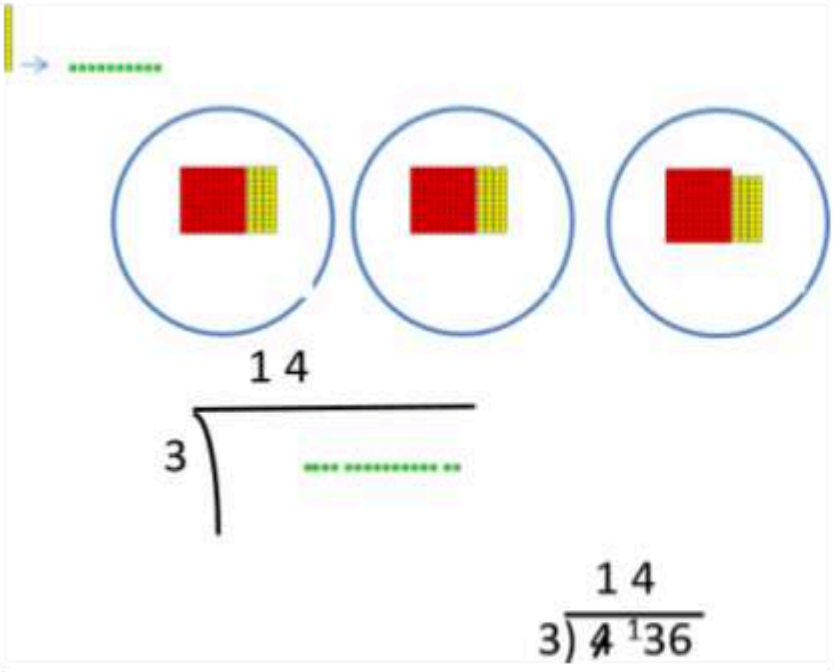
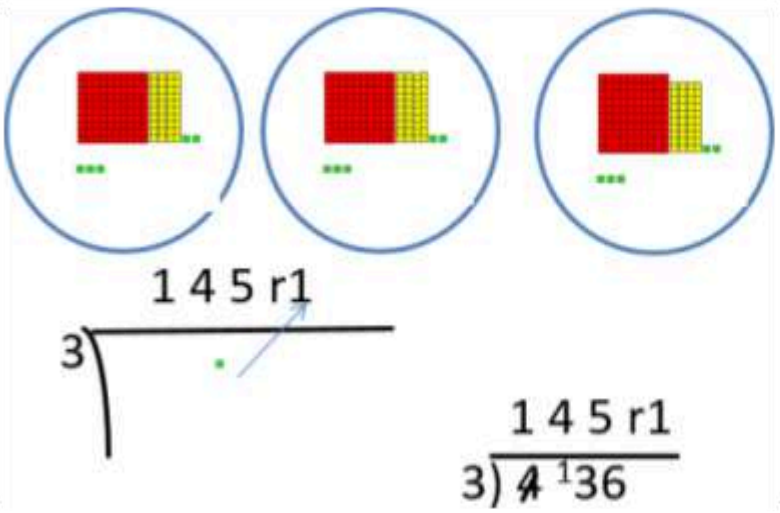

1 4
3
1 4
3) 4 1 36



$$\begin{array}{r} 145\ r1 \\ 3\overline{)436} \end{array}$$

Division: Year 5
Mental strategies

- counting in steps of powers of 10
- use partitioning and the Distributive law to divide;
- use known facts and place value to divide;
- use related facts to divide;
- use factor pairs to divide;
- scaling down using known facts;
- use the relationship between multiplication and division;

- multiply and divide numbers mentally drawing upon known facts
- multiply and divide whole numbers and those involving decimals by 10, 100 and 1000
- *They apply all the multiplication tables and related division facts frequently, commit them to memory and use them confidently to make larger calculations.*

Divide a three-digit number by a one-digit
e.g. 154 ÷ 7, 138 ÷ 6, 208 ÷ 8

Divide whole numbers by 10, 100 and 1000
e.g. 32700 ÷ 10, 9600 ÷ 100, 830000 ÷ 1000

Divide decimals by 10, 100 and 1000
e.g. 32.7 ÷ 10, 251.4 ÷ 1000, 82.34 ÷ □ = 8.234

Also include:

Division linked to multiple of 10 times a multiple of 10
e.g. 3000 ÷ 60, 6300 ÷ 70

Halves of corresponding doubles of any multiple of 5 up to 500

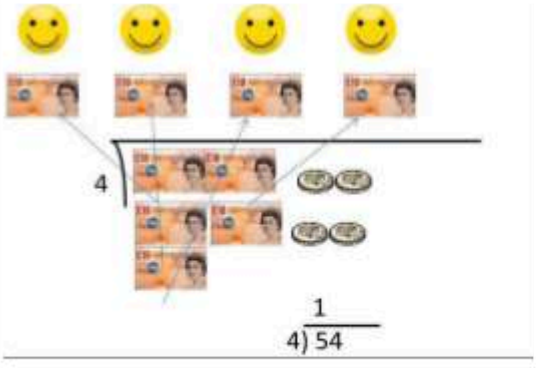
Division involving remainders expressed in different ways
e.g. 98 ÷ 4 = $^{98}/_{4}$ = 24 r 2 = 24½ = 24.5 ≈ 25

Instant recall:

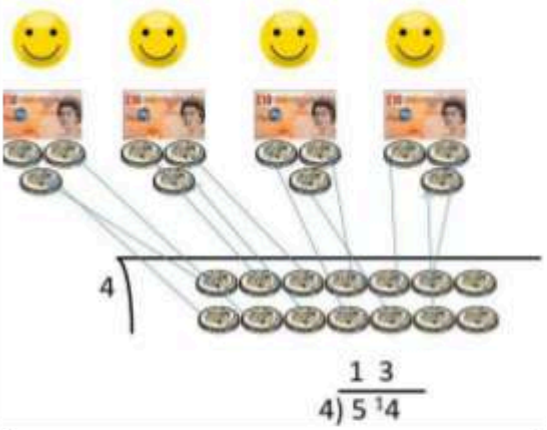
Divide by powers of 10, common fdp equivalents

Division: Year 5
Written strategies

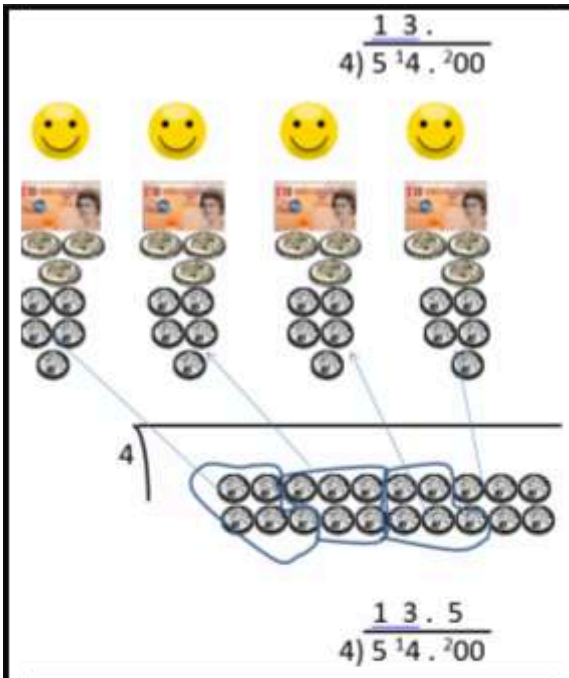
Dividing in a money context



Exchange remaining £10 note for 10 x £1 coins



Exchange remaining £2 for 20 x 10p coins



Note: you need to discuss why you must put a zero in the pennies column (place holder)

Division: Year 6
Mental Strategies

- counting in steps of powers of 10
- use partitioning and the Distributive Law to divide;
- use known facts and place value to divide;
- use related facts to divide;
- use factor pairs to divide;
- scaling down using known facts;
- use the relationship between multiplication and division;
- include calculations with remainders;

Also include:

Division linked to multiple of 10 times a multiple of 100
e.g. 42000 ÷ 600, 45000 ÷ 50

Division linked to tenths times a multiple of 10
e.g. 14 ÷ 20, 15 ÷ 0.3, 56 ÷ 70

Halves of corresponding doubles of ones and tenths and decimals less than 1 (2 d.p.)

- multiply and divide numbers by 10, 100 and 1000 where the answers are up to three decimal places
- *Pupils continue to use all the multiplication tables to calculate mathematical statements in order to maintain their fluency.*
- *Pupils are introduced to the division of decimal numbers by one-digit whole numbers*

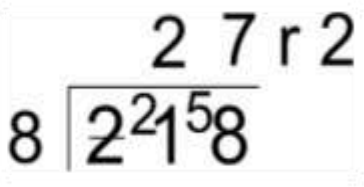
Division linked to tenths times a one-digit number
e.g. 3.6 ÷ 9, 4.8 ÷ □ = 0.6, □ ÷ 7 = 0.7

Division linked to hundredths number times a one-digit number
e.g. 0.18 ÷ 3, 0.27 ÷ 9, 0.56 ÷ □ = 0.7

Divide numbers by 10, 100 and 1000
e.g. 0.7 ÷ 100, 25 ÷ 1000, 82.34 ÷ □ = 8.234

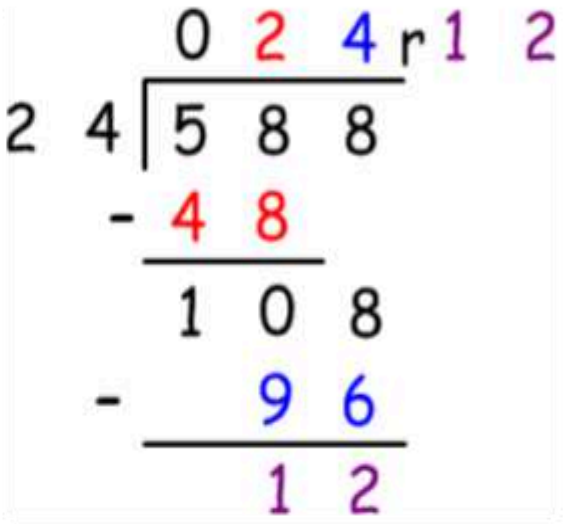
Division: Year 6
Written Strategies

Continue to use compact short division to divide numbers up to 4 digits by a 1-digit whole number.



- Whole number remainder = 27 r 2
- Fraction remainder = $27\frac{2}{8} = 27\frac{1}{4}$
- Decimal remainder = $27\frac{1}{4} = 27\frac{25}{100} = 27.25$

Use long division to divide numbers up to 4 digits by a 2-digit whole number.



Multiplication Structures

Structure	Examples	Models & Images
Repeated groups structure	There are six doughnuts in the bag. You have three bags. How many doughnuts.	Use objects, beads, biscuits, doughnuts.
The scaling structure	The walk to school takes 15 minutes. There and back will be double.	Drawing on number lines etc.
The area structure of multiplication (arrays)	The room is 3m x 4.5 m. How many m^2 of carpet do you need to buy?	Area grid model Cuisenaire in an array Counters in an array
The rate of change structure	The driver was driving for 3 hours at 60 mph. How far has he driven	Repeated jumps on the number line Numicon or Cuisenaire rods in a line – represent 'change' Bar modelling – repeated bars

Division Structures

Structure	Examples	Models & Images
The sharing structure (partitive division)	There are six doughnuts in the bag. Three friends share them equally, how many do they each get?	Use objects, beads, biscuits, money etc., and physically share
The grouping structure (quotative division)	The hens lay 42 eggs. The farmer puts them into boxes with 6 eggs in each. How many boxes of eggs are there?	Use Numicon shapes, empty egg boxes, empty crayons etc., to model how many in the set. Bar modelling /Repeated subtraction on number line.
The scaling structure	The dress cost £18; it was sold in the sale for half price	Cutting paper strips Bar modelling /Dividing a number line Relating to fractions
The area model of division	The area of a field is ¾ of an $acre^2$. The farmer is going to use 1/5 of the field for the sheep. How much space have they got?	Area model Fractions of a number line

Appendix 10

Glossary of terms used

Aggregation	See 'Putting together' in 'Addition structures' (pg. 79).
Array	A set of objects or pictures arranged in a pattern of rows and columns. This is a vital image for developing an understanding of the relationship between multiplication and division.
Augmentation	See 'Addition structures' (pg. 79).
Conservation of number	If a group of objects is rearranged, the total number of objects stays the same.
Complement of a set	See 'Subtraction structures' (pg. 79).
Complement of a number **(jigsaw number)**	A number that is added to another to make a target number. In 'complements' or 'jigsaw numbers' 'refer to complements of 10, 20 and 100. When making 10, the complement of 6 is 4.
Counting up to	See 'Subtraction structures' (pg. 79).
Counting Contexts	
Sequence context	Learning the conventional sequence of counting words is not easy. Pupils learn the **1-10** range **by rote**, followed by 11, 12 and 13. BUT 14 is the first number which has strong parallels with 4. They then learn the decades. This has implications for writing & pupils often struggle when arriving at a new decade.
Counting context	**Number words are applied to objects**. Pupils will often point or nod etc.
Cardinal context	**The number word describes the total of a set of objects** i.e. the last number in the count– we have two hands, ten toes, wear two shoes etc.
Measure context	Pupils learn what the **appropriate units** are. Accuracy is an important concept to develop. Research shows that young pupils have great difficulty in making sense of the measure context.
Ordinal context	The number word **describes the relative position** of things, e.g. the first man on the moon, the third fastest runner etc.
Non-Numerical context	**Number words to identify codes,** e.g. phone numbers, registration numbers on cars etc.
Counting on/back certain number of steps	In we define 'counting on/back a certain number of steps' as the process whereby you start at a number, are told how many to count on or back and then relate the answer e.g. start at 7, count on 4 8,9,10,11, the answer is 11
Counting to/from a number	In we define 'counting to/from a number' as the process whereby you are told the first and last number of the sequence and then count from the first to the last e.g. start at 7 and stop at 11: 7, 8,9,10,11. When pupils are confident with this process and can tap or grow fingers,

	they then track how many numbers were counted (start number to go into heads and not be said).
Counting up/down	In we define 'counting up/down' as the process of saying numbers in the regular counting sequence. This is not tracked with fingers or the number of numbers said recollected in any way.
Derive	Using known facts to work out others.
Expand	To split (partition) a number into component parts, e.g. the two digit number 38 can be partitioned into 30 + 8, 20 + 18, 10 + 28, 20 + 10 + 8, 10 + 10 + 10 + 8, etc.
Multiplying through powers of ten	In we define 'Multiplying through powers of ten ' as the process using known facts to establish new facts, based upon multiplying or dividing by multiples of ten (see picture on pg. 73 for an example).
Factor Bug	A method of recording factors, using a beetle's body, which enables pupils to identify the difference between prime numbers, square numbers and remaining factor pairs (see pg. 58)
Fact Family	A group of four related algorithms. These identified through having the same three numbers; there are two number sentences (algorithms) consisting of the same operation and two which have the inverse of that operation. For addition the inverse is subtraction, and for multiplication the inverse is division. In pupils are taught first how to establish the two related facts that use the same operation – Commutativity, before moving on to developing an understanding of inverses.
Finger tracking	Using fingers to track how many numbers forward or back one has counted. This requires that the child has instant recognition of how many fingers they are growing/holding up, as they will be ascribing different numbers to each finger, e.g. they say 7, 8, 9 when counting on three steps from 6, they need to know that they haven't counted 9 fingers, but that 9 is the result of 6 count on 3. This requires good manual dexterity and is very difficult for some pupils (see finger tapping below).
Finger tapping	A similar process as on previous page, but the child 'taps' their fingers on the table/their lap, rather than 'growing' their fingers. For some pupils this is the easiest method to manage.
Grouping	See 'Division Structures' (pg.82)
Generalisation	A section of the session, in which pupils are encouraged to use known facts to derive new facts (generalise). Pupils need to understand that this process cuts down the number of facts they need to commit to memory and speeds up calculation.
Increasing	See 'Addition structures' (pg. 81).

Inverse	A process of 'undoing' or 'reversing' the effect of the first operation (see fact families).
Inverse of addition structure	See 'Counting up to' in Subtraction structures (pg. 81).
Jigsaw numbers	See 'Complement of a number'.
Number Facts	A section within where pupils commit facts to memory. Pupils need to learn these facts so that they are as familiar with them as with their own name. They should be able to recall facts within 3 seconds.
Number track	A numbered track along which counters may be moved. The number in a region represents the number of single moves from the start. • Each number occupies a cell and is used to number the cell. • Numbers may have a matching illustration. • Supports learning to read numbers in numerals. • Supports locating ordered numbers. • The track should start at 1 and not 0, as number tracks set up a 1:1 correspondence between the objects placed on the track (or steps taken) and the number indicated.
Number of the Day (EYFS and KS1 where required) **I have removed Number sentence of the day**	A number is chosen each day to ensure that pupils have an opportunity to: read, write, draw, expand, partition a number, as well as finding one more/less, its complement to 100 and finding multiplication facts. This is a practice and consolidation activity intended to ensure that pupils gain a real 'sense or feel' for number. See 'Number of the day frame' in folder on server.
Partition	To separate a number into tens and ones. To split a number into subsets using tens and ones (see expand). To split a number into subsets e.g. 38 can be split into 19 + 19 etc.
Putting together	See 'Putting together' in 'Addition structures' (pg. 81).
Reducing	See 'Subtraction structures' (pg. 81).
Sharing	See 'Division structures (pg. 82).
Subitising	This is the process whereby we recognise the size of a set, its cardinality, from the pattern or structure without having to count the number of objects. For example, recognising there are five dots in this pattern.
Sum	The result of adding two or more numbers.
Commutativity	A term that is used for the commutative properties of addition and multiplication, e.g. 7 + 12 = 19, 12 + 7 = 19; 4 x 6 = 24, 6 x 4 = 24.
Bar Modelling	A term that is used for the commutative properties of addition and multiplication, e.g. 7 + 12 = 19, 12 + 7 = 19; 4 x 6 = 24, 6 x 4 = 24.

	A system of using bars (similar to Cuisenaire rods) as an abstract model of number.

Appendix 11 – Long Term Maps

Nursery

Overview

Term	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn	Getting to know you (Transition & Baselines)			Number Songs	Matching and Sorting		Representations of 1,2 and 3		Compare size	Compare mass and capacity	Simple patterns	Number Songs
Spring	Number 1 and Number 2			Compare amounts up to 3	Pattern	Positional language	Number 3 and Number 4			Length	Height	Weight
Summer	Number 5		1 more and 1 less		Shape		Compare Size	Mass and Capacity	Everyday language- time	Consolidate numbers 1-5		

Subject: Maths

Year: Reception

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn term	Getting to know you		Match, sort and compare FREE TRIAL VIEW		Talk about measure and patterns VIEW		It's me 1, 2, 3 VIEW		Circles and triangles VIEW	1, 2, 3, 4, 5 VIEW		Shapes with 4 sides VIEW
Spring term	Alive in 5 VIEW		Mass and capacity VIEW	Growing 6, 7, 8 VIEW		Length, height and time VIEW		Building 9 and 10 VIEW			Explore 3-D shapes VIEW	
Summer term	To 20 and beyond VIEW		How many now? VIEW	Manipulate, compose and decompose VIEW		Sharing and grouping VIEW		Visualise, build and map VIEW			Make connections VIEW	Consolidation

Subject: Maths

Year: Year 1 (v3)

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn term	Number **Place value** (within 10) FREE TRIAL VIEW					Number **Addition and subtraction** (within 10) VIEW					Geometry **Shape** VIEW	Consolidation
Spring term	Number **Place value** (within 20) VIEW			Number **Addition and subtraction** (within 20) VIEW		Number **Place value** (within 50) VIEW			Measurement **Length and height** VIEW		Measurement **Mass and volume** VIEW	
Summer term	Number **Multiplication and division** VIEW			Number **Fractions** VIEW		Geometry **Position and direction** VIEW	Number **Place value** (within 100) VIEW		Measurement **Money** VIEW	Measurement **Time** VIEW		Consolidation

Year 2

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn	Number: Place Value			Number: Addition and Subtraction					Measurement: Money		Number: Multiplication and Division	Consolidation
Spring	Number: Multiplication and Division				Statistics		Geometry: Properties of Shape			Number: Fractions		
Summer	Measurement: Length and Height		Geometry: Position and Direction		Consolidation and problem solving		Measurement: Time		Measurement: Mass, Capacity and Temperature			Consolidation

Year 3

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn	Number: Place Value			Number: Addition and Subtraction					Number: Multiplication and Division			
Spring	Number: Multiplication and Division			Measurement: Money	Statistics		Measurement: Length and Perimeter			Number: Fractions		Consolidation
Summer	Number: Fractions			Measurement: Time			Geometry: Properties of Shape		Measurement: Mass and Capacity			Consolidation


Year 4
Week 1
Week 2
Week 3
Week 4
Week 5
Week 6
Week 7
Week 8
Week 9
Week 10
Week 11
Week 12
Autumn
Number: Place Value
Number: Addition and Subtraction
Measurement: Length and Perimeter
Number: Multiplication and Division
Spring
Number: Multiplication and Division
Measurement: Area
Number: Fractions
Number: Decimals
Consolidation
Summer
Number: Decimals
Measurement: Money
Measurement: Time
Statistics
Geometry: Properties of Shape
Geometry: Position and Direction
Consolidation

Subject: Maths

Year: Year 5 (v3)

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn term	Number **Place value** FREE TRIAL VIEW			Number **Addition and subtraction** VIEW		Number **Multiplication and division A** VIEW			Number **Fractions A** VIEW			
Spring term	Number **Multiplication and division B** VIEW			Number **Fractions B** VIEW		Number **Decimals and percentages** VIEW			Measurement **Perimeter and area** VIEW		Statistics VIEW	
Summer term	Geometry **Shape** VIEW			Geometry **Position and direction** VIEW		Number **Decimals** VIEW			Number **Negative numbers** VIEW	Measurement **Converting units** VIEW		Measurement **Volume** VIEW

Subject: Maths

Year: Year 6 (v3)

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn term	Number **Place value** FREE TRIAL VIEW		Number **Addition, subtraction, multiplication and division** VIEW					Number **Fractions A** VIEW		Number **Fractions B** VIEW		Measurement **Converting units** VIEW
Spring term	Number **Ratio** VIEW		Number **Algebra** VIEW		Number **Decimals** VIEW		Number **Fractions, decimals and percentages** VIEW	Measurement **Area, perimeter and volume** VIEW		Statistics VIEW		
Summer term	Geometry **Shape** VIEW		Geometry **Position and direction** VIEW		Themed projects, consolidation and problem solving VIEW							