Red Hall Primary School Calculation Guidance Policy

Document History	
Originally Written	April 2017
Updated:	January 2020 January 2021
Reviewed:	June 2017 January 2022 October 2023
Re-written:	January 2020
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Next Review Date:	July 2023

This policy sets out the vision for the teaching of Maths Mastery at Red Hall Primary School.

It has been written by the School Council and the Maths Subject Leader.

Contents:

Maths Mastery at Red Hall

At Red Hall we aim to teach our children how to make sense of the world around them by developing their ability to calculate, reason and solve problems. We want our children to recognise and understand relationships and patterns in numbers in the world around them. We expect Mathematics to be utilised as a tool beyond the daily Mathematics lessons and beyond the classroom.

At Red Hall, we aim to provide our children with access to high quality teaching and learning in mathematics, which is both challenging and enjoyable! We use a Mastery approach to teaching, aiming for the deepest levels of understanding. Through mathematical talk, children will develop the ability to articulate, discuss and explain their thinking. We will provide the children with the necessary resources to allow all children to access the curriculum and encourage them to use this where appropriate to explain their logic and reasoning.

We want all pupils at Red Hall to recognise the importance of Mathematics within our daily lives, and therefore strive to be successful and resilient when they are faced with mathematical challenges. To emphasise the importance of Maths in our daily lives, we offer a broad and balanced curriculum, where Mathematical concepts are implemented within other, so that children can make rich connections not only between concepts in Maths lessons alone, but across the whole of the curriculum.

All pupils are given the same opportunities within this subject, and learning is tailored and adapted day-to-day to suit the needs of individual pupils, and support them in becoming resilient mathematicians.

What is Maths Mastery?

Mastering maths means pupils of all ages acquiring a deep, long-term, secure and adaptable understanding of the subject. The phrase 'teaching for mastery' describes the elements of classroom practice and school organisation that combine to give pupils the best chances of mastering maths. Achieving mastery means acquiring a solid enough understanding of the maths that's been taught to enable pupils to move on to more advanced material.

NCETM, 2022.

Aims of our Maths Curriculum:

To develop pupils who exhibit a high energy state in mathematics so that they can tackle problems with resilience and curiosity.

To have the highest of expectations for the pupils in our care. Teachers believe that ALL children in their class can achieve their age related expectation. The SLT set aspirational targets that will challenge both pupils and staff.

Lessons will begin with a 'Maths Wizard' session that is fast paced and fun. This session will include elements from all aspects of the learning so far that year. It is repetition based and intended to secure skills and consolidate learning. It is inspired by the best elements of maths teaching from Singapore and Shanghai.

Lessons will be in three main parts:

1. Pictorial – where the teacher will introduce an objective using visual representations. Teaching will begin at the stage below and then move up the age related expectation. This builds on prior learning.
2. Concrete – teaching now moves onto the use of apparatus to help consolidate learning.
3. Abstract – where learning will be expressed in a written form – perhaps in the form of a calculation.

The national curriculum for mathematics and this numeracy policy aims to ensure that all pupils:

- become **fluent** in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils have conceptual understanding and are able to recall and apply their knowledge rapidly and accurately to problems

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

- can **solve problems** by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions.

Teaching and Learning of Maths Mastery

Teachers will use the new 2014 Mathematics Curriculum as well as White Rose and Maths No Problem! resources to plan a series of lessons that will meet the needs of pupils and progress their learning in a Mastery approach.

Objectives and Stages

The objectives are grouped into years – so that there is an expectation that the vast majority of, for example, Year 5 pupils will be accessing the Year 5 assessment grid.

At Red Hall, these yearly expectations have been turned into 'stages', and children work towards targets which are appropriate for the stage they are working on.
The Assessment Grids give staff the opportunity to track the progress of children termly, and help to inform future planning and next steps in progression towards a deeper understanding of a concept.

Learning Journey

Teachers will plan using S Plan format (Appendix 1). The aim of an S Plan is to make explicit, the journey through a concept, breaking each concept into small steps which are achievable for all pupils. A differentiated sequence of learning will be created, based on the stages that the pupils in each class are currently working on. This plan will be evaluated as the children make their way through their journey of learning and appropriate intervention and support will be given to those children who need to secure some targets, having a 'keep-up' not 'catch-up' approach to intervention. Over the course of a term, teachers must ensure that a range of topics are covered, as set out in the long term planning.

Sequence of a Lesson

All Maths lessons will begin with a 'Maths Wizard' session, to meet the mental mathematic objectives explicit in the new curriculum and to review prior learning and to inform and scaffold new learning.

The lesson will then progress through a series of activities which require children to demonstrate their fluency skills as well as problem solving and reasoning. Please see Appendix 2 for KS1 sequence of lessons and Appendix 3 for KS2 sequence of lessons.

Yearly Expectations

The national expectations are that a child will be accessing the objectives pertinent to their year group. Below are the expectations for each year group, linked to the new national curriculum and our assessment policy:

Year 1 – Stage 1 – National Standard
Year 2 – Stage 2 - National Standard
Year 3 – Stage 3 - National Standard
Year 4 – Stage 4 - National Standard
Year 5 – Stage 5 - National Standard
Year 6 – Stage 6 - National Standard

Children working at a 'Mastery' level are considered as having a deep level of understanding.

Please see our Assessment Policy for these assessment grids.

Non-Negotiables for the Teaching of Maths

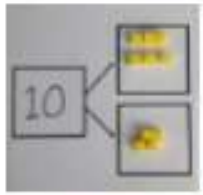
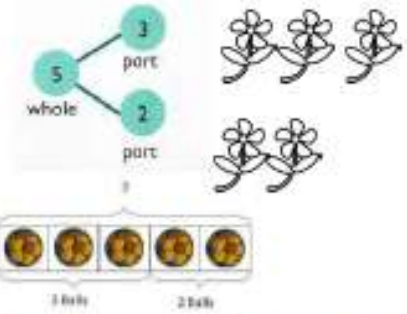
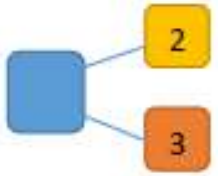
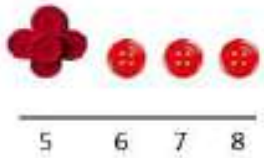
1. Children must work in pencil and use a ruler
2. Work must be presentable, with one number in each box
3. Short date always used, i.e. 1.1.2020
4. The short date must be underlined using a ruler
6. Children MUST self-assess their work at the end of every lesson, from Y2 to Y6
7. Opportunities for children to self-check their fluency work must be evident
8. Feedback given in blue pen linked to LO if necessary. No 'well done' but explaining how to improve (using cursive script handwriting) or challenging further
9. Green pen to be used for any misconception corrections or green pen challenges
10. Problem Solving and Reasoning work quality marked, with clear feedback to ensure misconceptions are addressed and more-able children are challenged further
11. Clear challenge given to more-able pupils, which is shown by appropriately differentiated work within fluency challenges
12. Assessment grids to be marked and kept up to date once each objective is covered and children are secure with that element of the concept

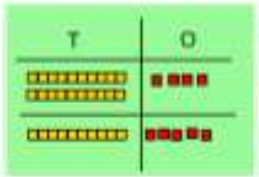
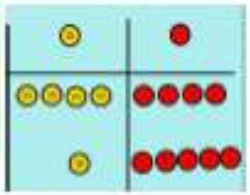
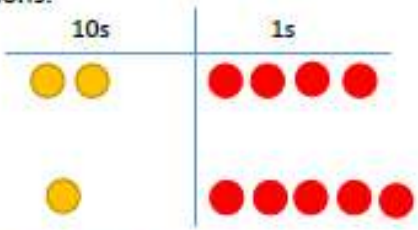
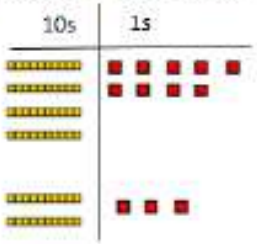
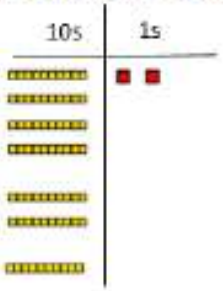
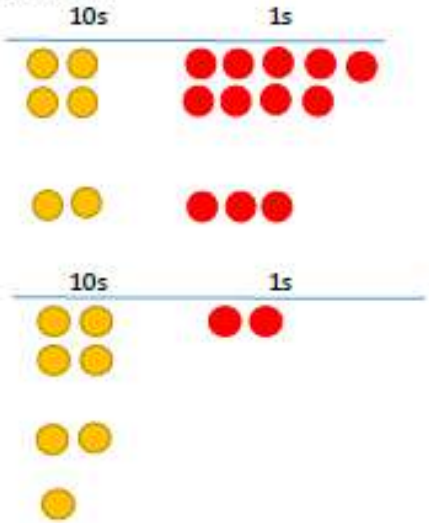
Termly scrutinies will monitor how each class is performing against these criteria.

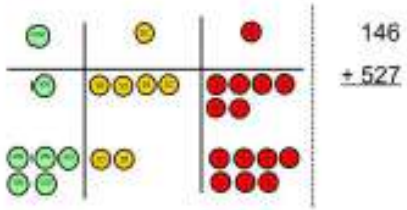
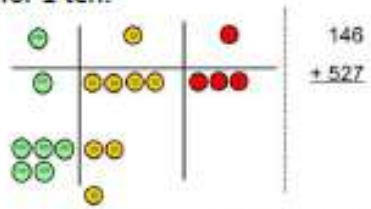
Calculation Guidance for the Four Operations

The following calculation guidance has been devised has been developed from the White Rose Calculation Policy: working document, which was written as a guide to indicate the progression through Addition, Subtraction, Multiplication and Division in Years 1 – 6. This guidance is our recommendation, in line with work completed by Maths Mastery / Sustaining Mastery / Mastering Number Maths Hub (NCETM: National Centre for Excellence in the Teaching of Maths) and White Rose Maths. Teachers can use any teaching resources that they wish to use and the policy does not recommend one set of resources over another, rather that, a variety of resources are used. For each of the four rules of number, different strategies are laid out, together with examples of what concrete materials can be used and how, along with suggested pictorial representations. The principle of the concrete-pictorial-abstract (CPA) approach [Make it, Draw it, Write it] is for children to have a true understanding of a mathematical concept, they need to master all three phases within a year group's scheme of work.

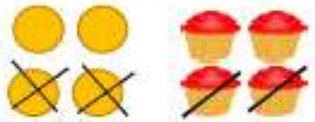
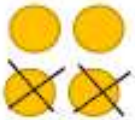
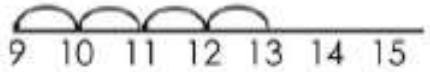
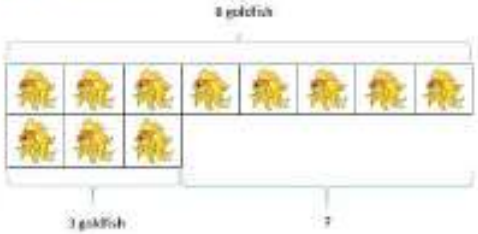
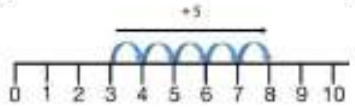
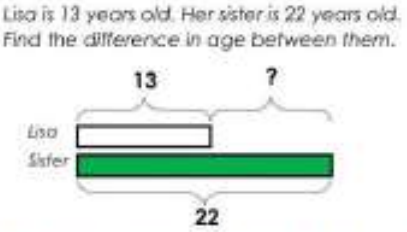
ADDITION

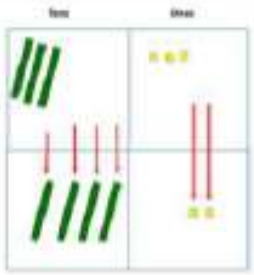
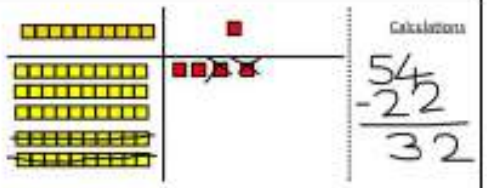
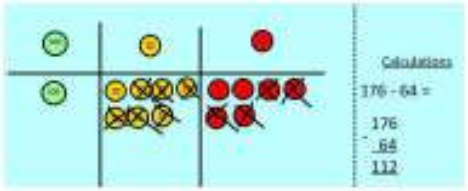
	Objective	Concrete	Pictorial	Abstract
Year 1	Number bonds of 5, 6, 7, 8, 9 and 10	   Use cubes to add two numbers together as a group or in a bar. 	 Use pictures to add two numbers together as a group or in a bar. 	2 + 3 = 5 3 + 2 = 5 5 = 3 + 2 5 = 2 + 3  Use the part-part-whole diagram as shown above to move into the abstract.
	Counting	 Start with the larger number on the bead string and then count on to the smaller number 1 by 1 to find the answer. 	Use a number line to count on in ones. 	5 + 3 = 8

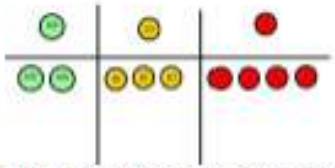
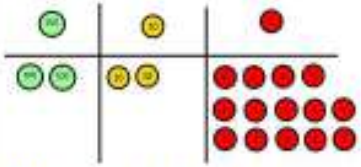
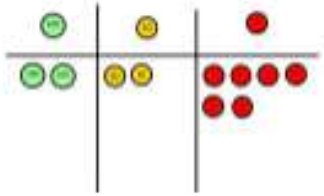
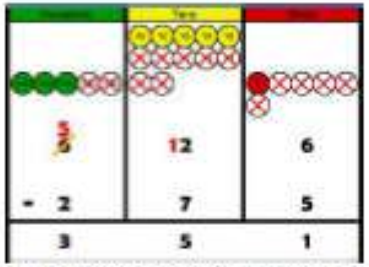
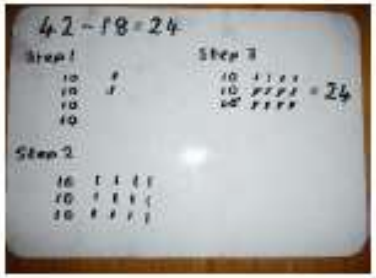
	Objective	Concrete	Pictorial	Abstract
Year 2	Column method without regrouping	Add together the ones first, then add the tens. Use the Base 10 blocks first before moving onto place value counters. 24 + 15 =  44 + 15 = 	After physically using the base 10 blocks and place value counters, children can draw the counters to help them to solve additions.  	24 + 15 = 39 24 + 15 39
	Column method with regrouping	Make both numbers on a place value grid.  Add up the units and exchange 10 ones for 1 ten.  	Using place value counters, children can draw the counters to help them to solve additions.  	40 + 9 20 + 3 60 + 12 = 72

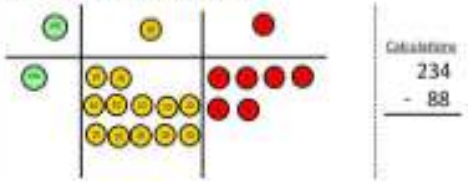
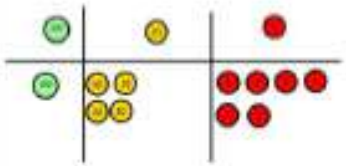
	Objective	Concrete	Pictorial	Abstract
Year 3/4	Column method with regrouping	Make both numbers on a place value grid.  Add up the units and exchange 10 ones for 1 ten.  As children move on to decimals, money and decimal place value counters can be used to support learning. NB By Year 4 children will progress on to adding four digit numbers.	 Children can draw a pictoral representation of the columns and place value counters to further support their learning and understanding. NB Addition of money needs to have £ and p added separately.	100 + 40 + 6 500 + 20 + 7 600 + 70 + 3 = 673 As the children progress, they will move from the expanded to the compacted method. 146 + 527 673 1 As the children move on, introduce decimals with the same number of decimal places and different. Money can be used here.
Year 5/6	Column method with regrouping	Consolidate understanding using numbers with more than 4 digits and extend by adding numbers with up to 3 decimal places.		

SUBTRACTION

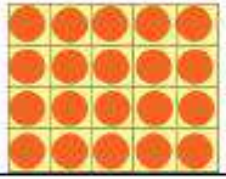
	Objective	Concrete	Pictorial	Abstract
Year 1	Taking away ones	Use physical objects, counters, cubes etc. to show how objects can be taken away. 4 – 2 = 2 	Cross out drawn objects to show what has been taken away. 4 – 2 = 2 	4 – 2 = 2
	Counting back	Make the larger number in your subtraction. Move the beads along your bead string as you count backwards in ones.  13 – 4 = 9	Count back on a number line or number track  Start at the bigger number and count back the smaller number, showing the jumps on the number line.	Put 13 in your head, count back 4. What number are you at? Use your fingers to help.
	Find the difference	Compare amounts and objects to find the difference.  Use cubes to build towers or make bars to find the difference. Use basic bar models with items to find the difference.	 Count on to find the difference.  Draw bars to find the difference between 2 numbers.	Hannah has 8 goldfish. Helen has 3 goldfish. Find the difference between the number of goldfish the girls have.

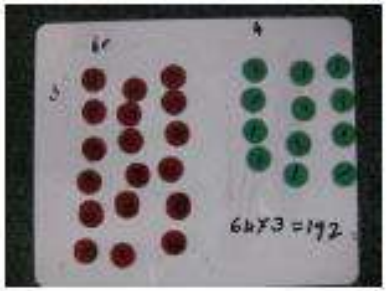
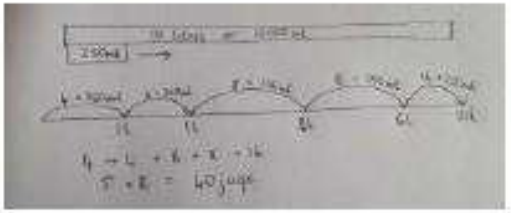
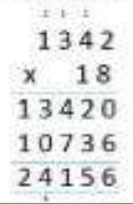
	Objective	Concrete	Pictorial	Abstract
Year 2	Column method without regrouping	75 – 42 = 33  Use Base 10 to make the bigger number then take the smaller number away. Show how you partition numbers to subtract. Again make the larger number first. 	 Draw the Base 10 or place value counters alongside the written calculation to help to show working. 	47 – 24 = 23 40 + 7 – 20 + 4 20 + 3 This will lead to a clear written column subtraction. 

	Objective	Concrete	Pictorial	Abstract
Year 3 onwards	Column method with regrouping	Use Base 10 to start with before moving on to place value counters. Start with one exchange before moving onto subtractions with 2 exchanges. Make the larger number with the place value counters  Calculations 234 - 88 Start with the ones, can I take away 8 from 4 easily? I need to exchange 1 of my tens for 10 ones.  Calculations 234 - 88 Now I can subtract my ones.  Calculations 234 - 88	 Draw the counters onto a place value grid and show what you have taken away by crossing the counters out as well as clearly showing the exchanges you make. When confident, children can find their own way to record the exchange/regrouping. Just writing the numbers as shown here shows that the child understands the method and knows when to exchange/regroup.  	 Children can start their formal written method by partitioning the number into clear place value columns.  Moving forward the children use a more compact method. This will lead to an understanding of subtracting any number including decimals. 5 12 1 2 6 3 . 0 - 2 6 . 5 2 3 6 . 5

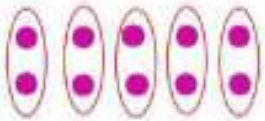
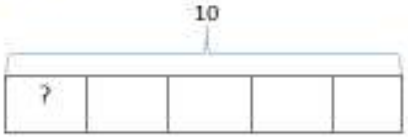
	Objective	Concrete	Pictorial	Abstract
Year 3 up	Column method with regrouping	Now look at the tens, can I take away 8 tens easily? I need to exchange 1 hundred for 10 tens.  Now I can take away 8 tens and complete my subtraction.   Show children how the concrete method links to the written method alongside your working. Cross out the numbers when exchanging and show where we write our new amount.		

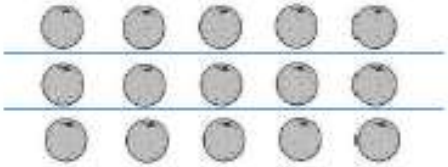
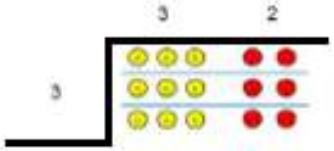
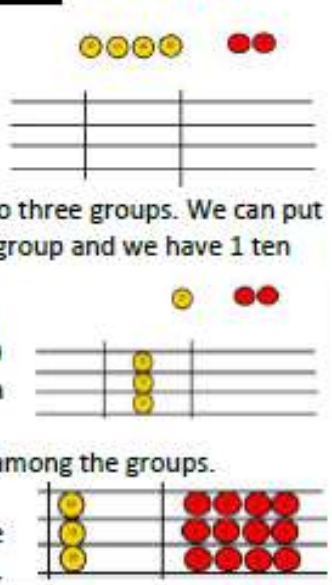
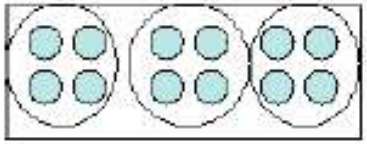
MULTIPLICATION

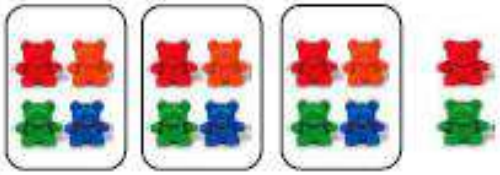
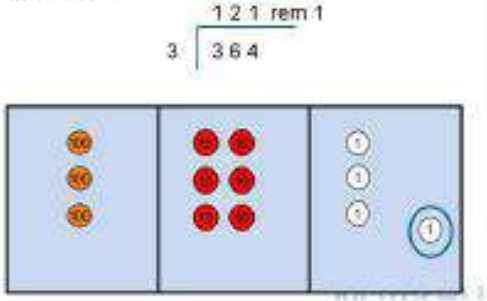
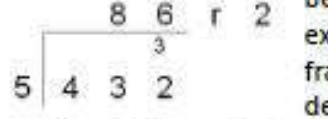
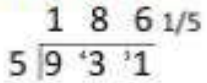
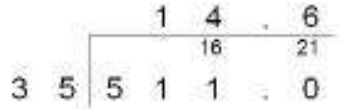
	Objective	Concrete	Pictorial	Abstract
Year 1/2	Repeated addition	   Use different objects to add equal groups.	There are 3 plates. Each plate has 2 star biscuits on. How many biscuits are there?  2 + 2 + 2 = 6  5 + 5 + 5 = 15	Write addition sentences to describe objects and pictures.  2 + 2 + 2 = 6
	Arrays- showing commutative multiplication	Create arrays using counters/cubes to show multiplication sentences.  	Draw arrays in different rotations to find commutative multiplication sentences.  4 × 2 = 8 2 × 4 = 8  2 × 4 = 8 4 × 2 = 8 Link arrays to area of rectangles. 	Use an array to write multiplication sentences and reinforce repeated addition.  5 + 5 + 5 = 15 3 + 3 + 3 + 3 + 3 = 15 5 x 3 = 15 3 x 5 = 15

	Objective	Concrete	Pictorial	Abstract
Year 5/6	Compact method	Children can continue to be supported by place value counters at the stage of multiplication.  It is important at this stage that they always multiply the ones first and note down their answer followed by the tens which they note below.	Bar modelling and number lines can support learners when solving problems with multiplication alongside the formal written methods.  	Start with long multiplication, reminding the children about lining up their numbers clearly in columns. If it helps, children can write out what they are solving next to their answer.  This moves to the more compact method. 

DIVISION

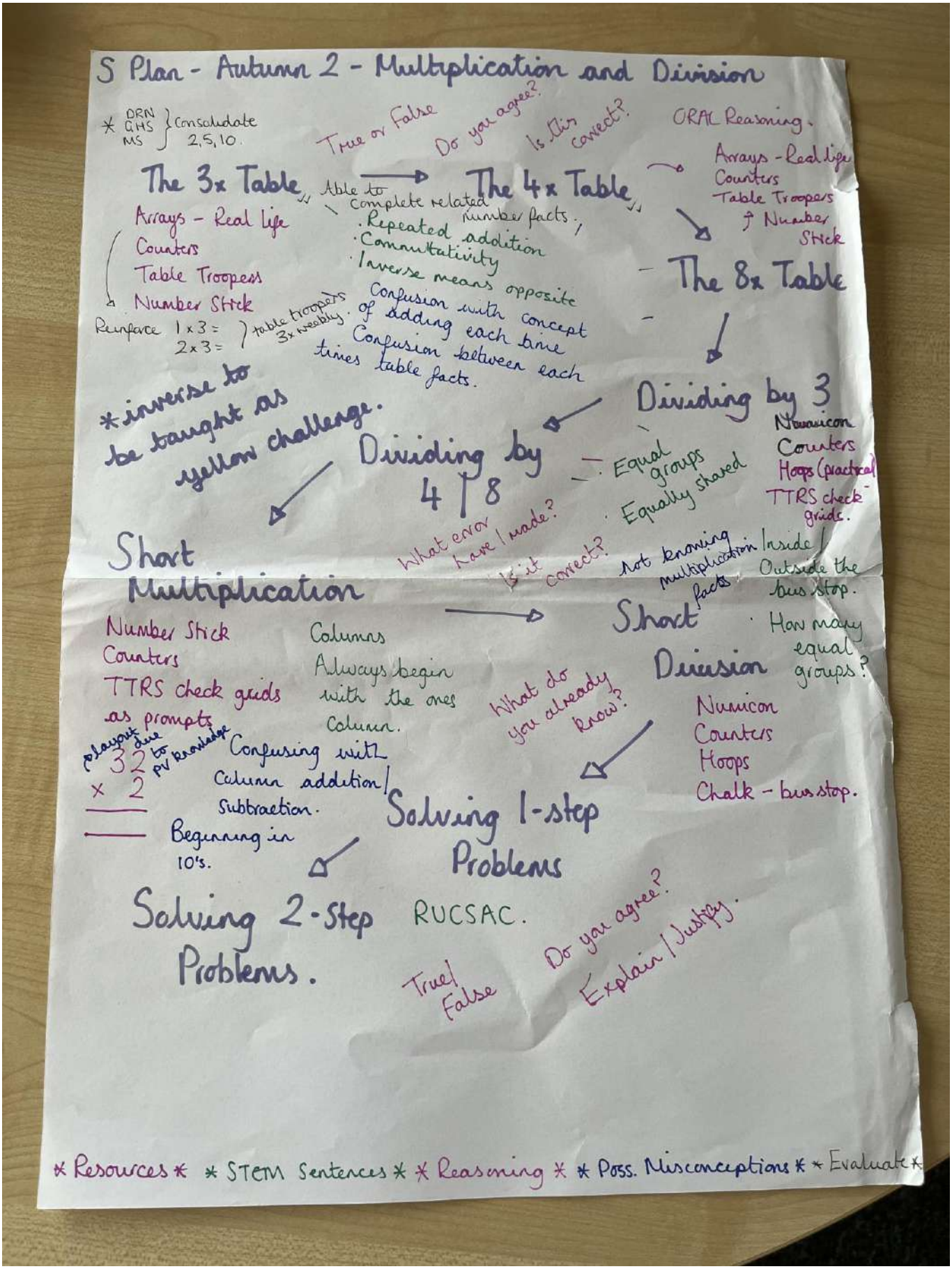
	Objective	Concrete	Pictorial	Abstract
Year 1/2	Sharing	I have 8 cubes, can you share them equally between two people?	Children use pictures or shapes to share quantities.  8 ÷ 2 = 4	Share 8 buns between two people. 8 ÷ 2 = 4 
	Grouping	Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.  	Use a number line to show jumps in groups. The number of jumps equals the number of groups.  Think of the bar as a whole. Split it into the number of groups you are dividing by and work out how many would be within each group.  10 ÷ 5 = ? 5 x ? = 10	10 ÷ 5 = 2 Divide 10 into 5 groups. How many are in each group?

	Objective	Concrete	Pictorial	Abstract
Year 3/4	Division with arrays	Link division to multiplication by creating an array and thinking about the number sentences that can be created. Eg 15 ÷ 3 = 5 5 x 3 = 15 15 ÷ 5 = 3 3 x 5 = 15 	 Draw an array and use lines to split the array into groups to make multiplication and division sentences.	Find the inverse of multiplication and division sentences by creating four linking number sentences. 5 x 3 = 15 3 x 5 = 15 15 ÷ 5 = 3 15 ÷ 3 = 5
	Short division	Use place value counters to divide using the short division method alongside. 96 ÷ 3  42 ÷ 3 Start with the biggest place value. We are sharing 40 into three groups. We can put 1 ten in each group and we have 1 ten left over. We exchange this ten for 10 ones and then share the ones equally among the groups. We look at how many are in each group. 	Students can continue to use drawn diagrams with dots or circles to help them divide numbers into equal groups.  Encourage them to move towards counting in multiples to divide more efficiently.	Begin with divisions that divide equally with no remainder. 2 1 8 3 4 8 7 2

	Objective	Concrete	Pictorial	Abstract
Year 5/6	Division with remainders	14 ÷ 3 = Divide objects between groups and see how much is left over 	Jump forward in equal jumps on a number line then see how many more you need to jump to find a remainder.  Draw dots and group them to divide an amount and clearly show a remainder. 	Complete written divisions and show the remainder using r. 
	Short division with remainders	364 ÷ 3 = 		Move onto divisions with a remainder. Once children understand remainders, begin to express as a fraction or decimal according to the context.   

	Objective	Concrete	Pictorial	Abstract
Year 6	Long division			Children will use long division to divide numbers with up to 4 digits by 2 digit numbers. 015 32 ⟌ 487 -0 48 -32 167 -160 7 17 r 19 31 ⟌ 546 31↓ 236 217 19

APPENDIX 1
S Plan Example


S Plan - Autumn 2 - Multiplication and Division
* DRN GHS MS } Consolidate 2,5,10.
True or False
Do you agree?
Is this correct?
ORAL Reasoning.
The 3x Table
Arrays - Real life
Counters
Table Troopers
Number Stick
Reinforce 1x3= 2x3= } table troopers 3x weekly.
Able to complete related number facts.
· Repeated addition
· Commutativity
· Inverse means opposite
Confusion with concept of adding each time
Confusion between each times table facts.
The 4x Table
Arrays - Real life
Counters
Table Troopers
Number Stick
The 8x Table
*inverse to be taught as yellow challenge.
Dividing by 4 | 8
Dividing by 3
Numicon
Counters
Hoops (practical)
TTRS check grids.
· Equal groups
· Equally shared
What error have I made?
Is it correct?
Not knowing multiplication facts
Inside | Outside the bus stop.
· How many equal groups?
Short Multiplication
Number Stick
Counters
TTRS check grids as prompts
Columns
Always begin with the ones Column.
Layout due to PV knowledge
32 x 2
Confusing with Column addition/ Subtraction.
Beginning in 10's.
Short Division
Numicon
Counters
Hoops
Chalk - bus stop.
What do you already know?
Solving 1-step Problems
Solving 2-step Problems.
RUCSAC.
True/ False
Do you agree?
Explain / Justify.
* Resources * * STEM Sentences * * Reasoning * * Poss. Misconceptions * * Evaluate *

APPENDIX 2
Sequence of Lessons - KS1

Monday	Fluency Using equipment / visual aids to develop understanding where possible. Begin lesson with a problem solving question / reasoning question to give a context / purpose for learning	I would expect that on Monday, all children are provided with the same opportunity, so that assumptions aren't made of their abilities, unless they are working significantly below the expected standard for that point in the year. On Tuesday, you may challenge more-able, based on learning from prior day. I.e this could be through giving them numbers with more digits for the four operations. *This means looking at differentiating work!* If you need help or suggestions, please ask! Provide the children with the answers for fluency tasks in a small box beside the questions! This way, they can mark off when they have the answer right an if it is not in the grid, they need to have another go with a green pen! This makes marking much easier for you too, and gives you time to quality mark problem solving and reasoning tasks as these are key evidence that a child has secured a skill! Please remember what is meant by varied fluency: procedural or conceptual variation. Conceptual means visual representations to help, procedural means applying learning. Example of procedural could be: • when looking at multiplication facts: if we know 5 x 6 = 30, what would this be: 50 x 6 = ? • When looking at addition and subtraction: 12,343 + ? = 54,709 Using the inverse to write the answer or finding links and connections between sums: 122-92 119-89 If you need assistance with this, please ask me! Please note: not all children will progress to problem solving / reasoning activities at the same time. You need to make a professional, teacher assessment as to who can move on and who does not. These activities may likely need to be differentiated from now on too, depending on abilities to use and apply skills. There should be a range of problem solving, not use word problems. Use true/false, missing number problems, complete the sentence. **Remember, these should be quality marked too,** providing clear feedback for misconceptions and clear challenge for more-able pupils to progress. I understand you may spend more than one week per concept, which is absolutely fine. Just please stick to this sequencing once a new concept has been introduced (so you may spend 4 days on fluency or you may spend more than two days on reasoning / problem solving etc).
Tuesday	Fluency Visual Fluency Try to encourage only SEND / children at risk of underachieving targets to use resources to support learning. Begin lesson with a problem solving question / reasoning question to give a context / purpose for learning	
Wednesday	Fluency Visual Fluency Try to encourage only SEND / children at risk of underachieving targets to use resources to support learning. Begin lesson with a problem solving question / reasoning question to give a context / purpose for learning	
Thursday	Fluency Varied Fluency Begin lesson with a problem solving question / reasoning question to give a context / purpose for learning	
Friday	Problem Solving / Reasoning Applying skills taught Developing reasoning skills to demonstrate a deeper understanding of concepts	

APPENDIX 3
Sequence of Lessons – KS2

Monday	Fluency Using equipment / visual aids to develop understanding where possible. Begin lesson with a problem solving question / reasoning question to give a context / purpose for learning	I would expect that on Monday, all children are provided with the same opportunity, so that assumptions aren't made of their abilities, unless they are working significantly below the expected standard for that point in the year. On Tuesday, you may challenge more-able, based on learning from prior day. I.e this could be through giving them numbers with more digits for the four operations. *This means looking at differentiating work!* If you need help or suggestions, please ask! Provide the children with the answers for fluency tasks in a small box beside the questions! This way, they can mark off when they have the answer right an if it is not in the grid, they need to have another go with a green pen! This makes marking much easier for you too, and gives you time to quality mark problem solving and reasoning tasks as these are key evidence that a child has secured a skill! Please remember what is meant by varied fluency: procedural or conceptual variation. Conceptual means visual representations to help, procedural means applying learning. Example of procedural could be: • when looking at multiplication facts: if we know 5 x 6 = 30, what would this be: 50 x 6 = ? • When looking at addition and subtraction: 12,343 + ? = 54,709 Using the inverse to write the answer or finding links and connections between sums: 122-92 119-89 If you need assistance with this, please ask me! Please note: not all children will progress to problem solving / reasoning activities at the same time. You need to make a professional, teacher assessment as to who can move on and who does not. These activities may likely need to be differentiated from now on too, depending on abilities to use and apply skills. There should be a range of problem solving, not use word problems. Use true/false, missing number problems, complete the sentence. **Remember, these should be quality marked too**, providing clear feedback for misconceptions and clear challenge for more-able pupils to progress. I understand you may spend more than one week per concept, which is absolutely fine. Just please stick to this sequencing once a new concept has been introduced (so you may spend 4 days on fluency or you may spend more than two days on reasoning / problem solving etc).
Tuesday	Fluency Moving to abstract. Try to encourage only SEND / children at risk of underachieving targets to use resources to support learning. Begin lesson with a problem solving question / reasoning question to give a context / purpose for learning	
Wednesday	Fluency Varied Fluency Begin lesson with a problem solving question / reasoning question to give a context / purpose for learning	
Thursday	Problem Solving / Reasoning Applying skills taught Developing reasoning skills to demonstrate a deeper understanding of concepts	
Friday	Problem Solving / Reasoning Applying skills taught Developing reasoning skills to demonstrate a deeper understanding of concepts	

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