‘Sticky Knowledge’ Maths at Maybury

‘Practice does not make perfect, practice makes permanent’

We need to ensure that children leave us ready for the challenges of secondary school maths.

Making sure that pupils remember what we have taught them is important because maths is a hierarchical subject that needs firmly remembered foundations. However, it is also important for another reason. Pupils’ finite, precious working memory capacity needs to be reserved for the new knowledge and skills we are teaching. It should not be cluttered up processing things that should be remembered so well that recall of them is automatic.

These are the areas that we believe that children should be secure in by the time they leave Maybury:

- Secure recall of number bonds
- Times tables
- Algorithms for the 4 operations
- Multiply and divide by 10, 100 and 1000
- Knowing prime numbers and square numbers off by heart
- Tell the time
- Know the days of the week and months of the year
- Convert measures effortlessly

These are the areas of maths that must be taught in the ‘Sticky Knowledge’ section of the maths lesson. Each section below highlights where the direct teaching of each of the areas is taught through our maths curriculum. This information should be used to plan regular practise of these areas based upon what the children have already been taught.

Progress can entail learning something more securely, it does not always involve learning something new. Children need to practice until it is so embedded in the memory, they cannot get it wrong.

NCTEM Mastering Number

The school subscribes to the NCTEM Mastering Number and Mastering Number KS2 programs. Staff that deliver these sessions have received high quality CPD from NCTEM, which ensures these sessions are delivered to the highest standard.

Mastering Number:

The aim is to secure firm foundations in the development of good number sense for all children from Reception through to Year 1 and Year 2. The aim over time is that children will leave KS1 with fluency in calculation and a confidence and flexibility with number. Attention will be given to key knowledge and understanding needed in Reception classes, and progression through KS1 to support success in the future. This works alongside our own sticky knowledge ethos and helps to embed key knowledge into pupils long term memories.

What do pupils learn?

- They will develop and learn good number sense
- Pupils will develop fluency and calculation in number sense
- Children will use a range of manipulatives to help secure their understanding

Mastering Number KS2:

Children need to have a secure understanding of multiplication and division and its applications to ensure they can confidently access the KS2 curriculum and be successful in their secondary education. The aim is that pupils in Year 4 and 5 will develop their fluency in multiplication and division facts, and a confidence and flexibility with number that exemplifies good number sense.

What do pupils learn?

- Pupils will develop automaticity in multiplication and division facts through regular practice

1. Secure recall of number bonds:

Specific teaching of **Number Bonds** in the Long Term Plan:

	Autumn Term	Spring Term	Summer Term
Year 1	Numbers to 10: • Count and write numbers to 10 including objects, understand the concept of zero and order and compare numbers. Number bonds: Use part/whole models to explore different ways of making number bonds and using them to create number stories using pictorial representations Addition to 10: • Use part-whole diagrams to add up to 10, add by counting on and making addition stories. Subtraction within 10 • Subtract by crossing out, using number bonds and counting back within 10 and make subtraction number stories.	Numbers to 40: • Count to 40 in different ways, writing numbers to 40, comparing numbers and looking and looking at number patterns.	Numbers to 100: • Counting in 10's and 1's followed by using number bonds to partition numbers, comparing 2 digit numbers and find number patterns using a number chart.
Year 2	Numbers to 100: • Counting to 100 in 10's and 1's, place value, comparing numbers, number bonds and number patterns.		

In Year 1, number is specifically taught in the Autumn, Spring and Summer Term. In all other year groups, number only has a specific focus in the Autumn Term.

Number bonds are specifically taught in Year 1 and Year 2.

Children MUST have a secure recall of number bonds to 20. This needs to be practised in ALL year groups so that children have secure and automatic recall. We need to teach children to apply this knowledge to dealing with larger numbers:

Year 3 – number to 1,000
Year 4 – number to 10,000
Year 5 – number to 1,000,000
Year 6 – number to 10,000,000

2. Times Tables

Specific teaching of **Times Tables** in the Long Term Plan:

	Autumn Term	Spring Term	Summer Term
Year 1	Multiples of 10 Use a range of maths games, concrete resources and pictorial resources to learn the multiples of 10.	Multiples of 5: Use a range of maths games, concrete resources and pictorial resources to learn the multiples of 5.	Multiples of 2: Use a range of maths games, concrete resources and pictorial resources to learn the multiples of 2.
Year 2	Multiplies of 2,5 and 10: Using the CPA approach children explore the 2,5 and 10 times tables (including arrays). Multiplication and Division of 2,5 and 10: Sharing and grouping into 2, 5 or 10. Investigate the link between multiplication and division.		
Year 3	Multiplication/Division: Look at multiplication and division of 3,4 and 8, the relationship between multiplication and division and apply these to word problems.		
Year 4	Multiplication and division: Multiply and divide by 6, 7, 9, 11 and 12, calculate multiplication equations using known multiplication facts, divide with remainders and solve word problems.		

In Year 1, children are taught to count in multiples of 2, 5 and 10 across the Autumn, Spring and Summer Terms.

Times tables are only specifically taught in the Autumn Term of Year 2, 3 and 4.

Children MUST have secure knowledge of the times tables. These must be revisited and practised in ALL year groups so that children have secure and automatic recall up to 12 x 12. We need to teach children to apply this knowledge.

3. Algorithms for the 4 operations

Specific teaching of the **4 Operations** in the Long Term Plan:

	Autumn Term	Spring Term	Summer Term
Year 1	Addition to 10: Use part-whole diagrams to add up to 10, add by counting on and making addition stories. Subtraction within 10: Subtract by crossing out, using numbers bond and counting back within 10 and make subtraction number stories. Addition and Subtraction within 20: Adding by counting on, by making 10 first and subtract by counting back, subtracting from 10 and looking at addition and subtraction facts.	Addition and Subtraction word problems: Consolidation of addition and subtraction, simple word problems that introduce the concept of bar modelling.	
Year 2	Addition and Subtraction: Adding 2 digit numbers including renaming and subtracting 2 digit numbers including renaming, addition of 3 numbers up to 2 digits. Multiplication and Division of 2,5 and 10: Sharing and grouping into 2, 5 or 10. Investigate the link between multiplication and division.		Word Problems: Addition and subtraction multi-step word problems using bar models. Make the decision whether to add or subtract.
Year 3	Addition/Subtraction: Look at addition and subtraction facts, adding and subtracting of 3 digit numbers including regrouping and answering word problems using bar models. Multiplication/Division: Look at multiplication and division of 3,4 and 8, the relationship between multiplication and division and apply these to word problems. Further multiplication/Division: Multiply by a 2 digit number (including regrouping), divide by 2 digit numbers (including regrouping).	Money: Name and show amounts of money, add and subtract money, calculate change and solve word problems.	
Year 4	Addition and subtraction within 10000: Add and subtract numbers up to 10000 including renaming, using mental methods to add and subtract, apply these methods to word problems and visualise the problems using bar modelling.	Further Multiplication and Division: Divide and multiply by 0 and 1, understand the law of commutativity, multiplying 3 numbers together using prior knowledge, use tables and place value to multiply by 10, multiply 2/3 digit numbers using short multiplication, use	

	Multiplication and division: Multiply and divide by 6, 7,9, 11 and 12, calculate multiplication equations using known multiplication facts, divide with remainders and solve word problems.	knowledge of multiplying by 10 when multiplying by 100, divide 2 digit numbers using 2 methods (including remainders), solve multiplication and division problems using bar models to visualise.	
Year 5	Addition and Subtraction of whole numbers Counting on and back to add and subtract numbers to 1,000,000, use column method and number bonds to add and subtract numbers. Multiplication and Division of whole numbers: Find multiples and factors of numbers including common factors, prime numbers, square and cube numbers, multiplying by 10, 100 and 1000, formal written methods up tip 4 digit numbers for both multiplication and division, divide with remainders. Word Problems: Solving problems involving a variety of steps and operations and represent the problems using bar modelling, complex problems using advanced bar models.		
Year 6	Four operations on whole numbers: Creating and solving expressions involving; brackets, exponents and the four operations, multiply 3 and 4 digit numbers by 2 digit numbers, estimate the product of multiplication sentences, divide 3 and 4 digit numbers by 2 digit numbers, solving word problems, finding common multiples and factors and prime numbers.	Word Problems: Applying bar models to solving word problems with increased complexity.	

The majority of direct teaching of the 4 operations takes place in the Autumn Term each year.

Methods for addition, subtraction, multiplication and division MUST be practised. Although children do need to understand how and why these algorithms work, it is important that the steps in each procedure are automatic and do not need to be actively remembered.

4. Multiplying and Dividing by 10, 100 and 1000

	Autumn Term	Spring Term	Summer Term
Year 2	Multiplication and Division of 2,5 and **10**: Sharing and grouping into 2, 5 or **10**. Investigate the link between multiplication and division.		
Year 5	Multiplication and Division of whole numbers: Find multiples and factors of numbers including common factors, prime numbers, square and cube numbers, **multiplying and dividing by 10, 100 and 1000**, formal written methods up tip 4 digit numbers for both multiplication and division, divide with remainders		
Year 6	Decimals • **Identify the value of each digit in numbers given to three decimal places and multiply and divide numbers by 10, 100 and 1000**		

This MUST be practised throughout Year 5 and Year 6 so that children learn this to automaticity.

5. Knowing Prime Numbers and Square numbers off by heart

Specific teaching of the **Prime Numbers and Square Numbers** in the Long Term Plan:

	Autumn Term	Spring Term	Summer Term
Year 5	Multiplication and Division of whole numbers: Find multiples and factors of numbers including common factors, **prime numbers, square** and cube **numbers**		

This is introduced in Year 5. However, children can be introduced to square numbers as they learn their times tables e.g. 2x2, 5x5, 10x10 etc.

Prime numbers and square numbers need to be practised and learned throughout Year 5 and Year 6 so that children understand what these numbers are and are able to identify them automatically or work them out with ease.

6. Tell the Time

Specific teaching to **Tell the Time** in the Long Term Plan:

	Autumn Term	Spring Term	Summer Term
Year 1			Time: Telling the time to the hour and half hour, using terms such as next, before and after, estimating durations of time and comparing time.
Year 2			Time: Recognising time to 5 minutes, finding the duration of time and finding the ending and starting times and comparing times.
Year 3		Time: Tell the time using am and pm, telling the time to the minute, use analogue and digital time, 24 clocks and Roman Numerals, measure and compare time in seconds, hours and minutes, covert units of time and find the number of days.	
Year 4		Measurement: Time: How to use the 12hr and 24hr clock, convert between units of time (such as minutes and seconds and hours and minutes), solving time problems and calculate durations of time in relation to word problems.	
Year 5			Measurements: Covert units of length mm to cm and cm to m, convert m to km, convert imperial to metric, convert mass in g to kg, **convert units of time**, temperature.
Year 6		Measurements: Converting units of length and distance, exploring mass, volume and **time**.	

In our digital world, many of our children cannot not tell the time, particularly using an analogue clock. Time is only taught once a term in each year group. This is not enough to ensure that children become fluent in the reading of the time. Time should be planned for and taught in regular sessions in the 'Sticky Knowledge' section of the maths lesson. In addition to this, teachers should plan to give children opportunities to practise reading the clock to tell the time across the school day so that this becomes automatic.

Children also need to be fluent in converting between seconds, minutes, hours, days, weeks, months and years.

7. Know the Days of the Week and the Months of the Year

Specific teaching of **Days of the Week** and the **Months of the Year** in the Long Term Plan:

	Autumn Term	Spring Term	Summer Term
Year 1			Time: Telling the time to the hour and half hour, using terms such as next, before and after, estimating durations of time and comparing time; **days of the week, weeks, months and years**

This needs to continue to be taught from Year 2 to Year 6.

All children must learn and understand the rhyme:

Thirty days has September,
April, June, and November;
All the rest have thirty-one,
Excepting February alone,
And that has twenty-eight days clear
And twenty-nine in each leap year

Children need to know and practise key dates:

- Their own birthday in word form and digits (include full date of birth when able)
- New Year's Day – 1st January
- Valentine's Day – 14th February
- Halloween – 31st October
- Bonfire Night – 5th November
- Christmas Day – 25th December
- Boxing Day – 26th December
- Any other significant date e.g. cultural or from their learning.

Children also need to be fluent in converting between days, weeks, months and years.

8. Convert measures effortlessly

Specific teaching relating to **Converting Measures** (excluding time) in the Long Term Plan:

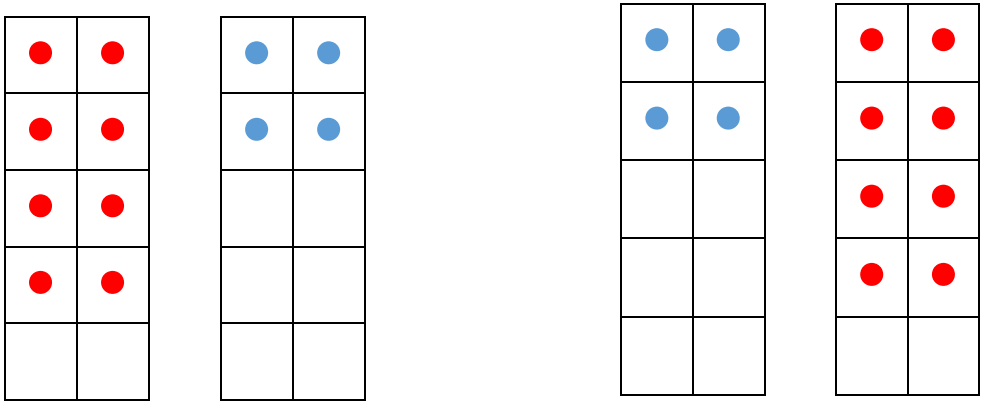
	Autumn Term	Spring Term	Summer Term
Year 1		Length and Height: Compare lengths and measure using items and a ruler	Volume and Capacity: Comparing volume and capacity using more than and less than, finding volume and capacity using non-standard units and describing volume using the terms halves and quarter. Money: Identify the different coins and notes. Mass: Use terms heavy, heavier, light and lighter and finding mass using non-standard units.
Year 2	Length: Measuring objects in centimetres and metres using metre sticks and rulers, compare lengths and apply this to word problems	Mass: Read scales using kilograms and grams, compare masses of objects and answer word problems. Temperature: Learn about Celsius, how to read a thermometer and look at different types of temperatures that can be measured. Money : Recognising amounts of money, counting amounts of money up to £100, comparing amounts of money, calculating change and solving word problems using bar modelling.	Volume: Compare volume, measure in litres and millilitres and solve problems.
Year 3		Length: Learn to measure in centimetres, metres and kilometres, compare lengths and then apply this knowledge to word problems. Mass: Measure different masses using scales (grams and kilograms), children will then apply this knowledge to word problems Volume: Measure volumes in millilitres and litres, write in millilitres and litres and apply this knowledge to word problems. Money: Name and show amounts of money, add and subtract money, calculate change and solve word problems.	Perimeter of figures: Using grid paper to calculate the length around a shape, calculating the perimeter of rectangles and finding missing lengths in rectangles.

Year 4			Money: Count and record in £s and p, make links between tenths and hundredths and decimal notation for money, compare amounts of money and round to the nearest £ and solve problems. Measurement: Money, Mass, Volume, Length Estimate and measure mass, volume and length, learn how to convert units of measure from larger to smaller and vice versa, measure perimeter into cm and mm and solve problems.
Year 5			Measurements: Covert units of length mm to cm and cm to m, convert m to km, convert imperial to metric, convert mass in g to kg, convert units of time, temperature. Area and Perimeter: Perimeter of a polygon constructed from other polygons, construct shapes with different areas but the same perimeter, and explore scale diagrams to determine the perimeter of shapes, area on a square grid and estimate area. Volume: Volume of solids and use cubes to determine volume, differentiate between volume and capacity, convert between different metric units and imperial and metric units and apply to word problems.
Year 6		Measurements: Converting units of length and distance, exploring mass, volume and time. Area and Perimeter: Finding the area and perimeter of rectangles, parallelograms and triangles, finding the area of a parallelogram using the triangle method.	Volume: Find the volume of cubes and cuboids and solve problems involving volume related to multiplication and division.

The units of length, mass, money and temperature should be practised so that children know these automatically and can convert between smaller and larger units of each.

Key Tools for Mastery Maths

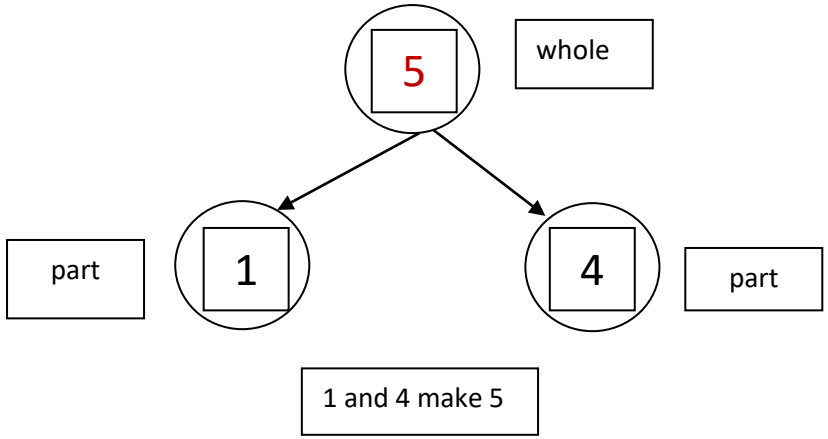
Key Tool 1: The 10 Frame



8 + 4 4 + 8

Is 8 + 4 the same as 4 + 8?

Key Tools 2: The Number Bond Diagram



Key Tools 3: Bar Modelling