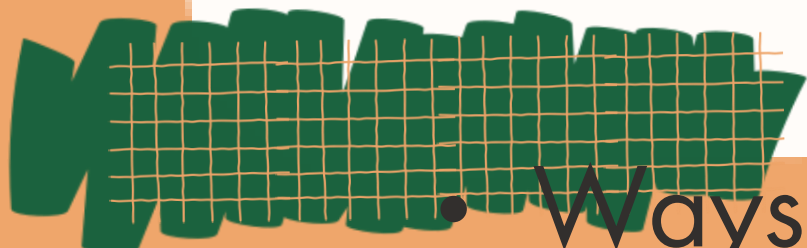# KS2 Maths workshop

Arbury Primary School

November 2024

Aims of the session

- What does Maths look like at Arbury Primary School?

- To understand what Mastery Maths is.

- To explain concrete, pictorial and abstract approaches in maths.

- The importance of secure times tables knowledge

- Ways to support at home.

Maths at Arbury Primary School

At Arbury, we follow the White Rose scheme which recognises that by nurturing positive attitudes and building confidence in mathematics, all children can achieve.

Concepts are built in small, logical steps and are explored through clear mathematical structures and representations.

Maths at Arbury Primary School

Children are taught together as a whole class and the focus is on depth - not acceleration - so that all children have a chance to embed learning.

Children complete regular arithmetic tests, use TT Rockstars and regularly revisit previous learning.
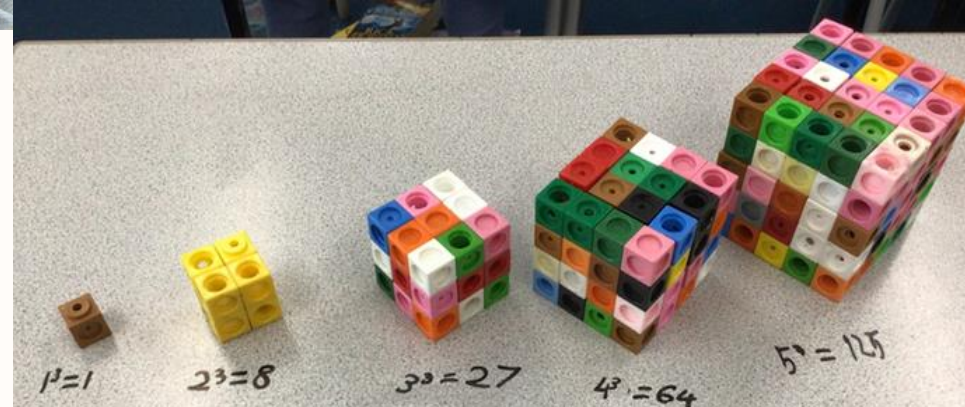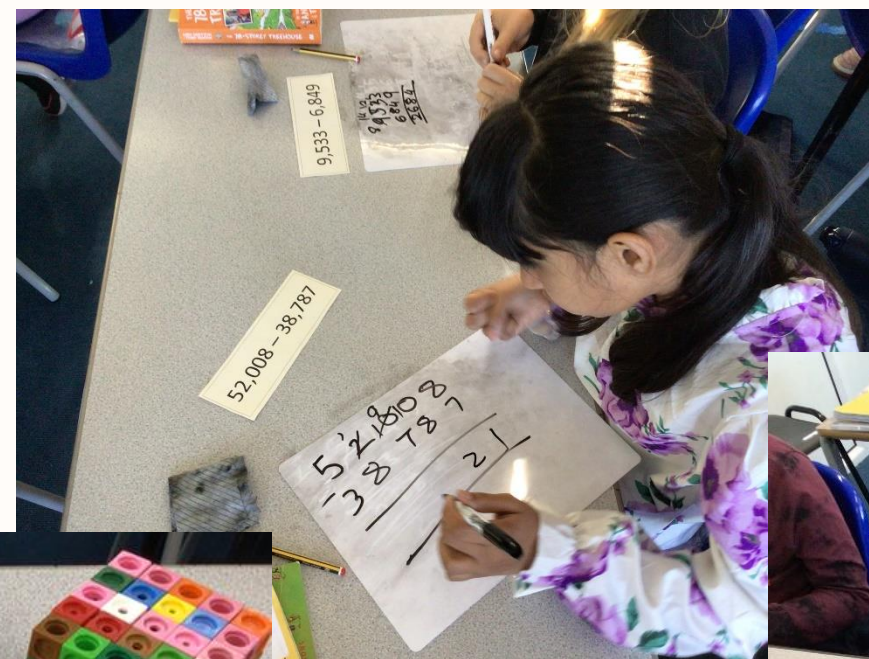
What is Maths Mastery?

Based on evidence and research

Success for **all** pupils

Focus is on depth, not acceleration

Problem solving is at the heart

Focus on talk and reasoning about mathematics

Aligned with the national curriculum

Maths Mastery

Tubes of tennis balls come in packs of 2 and 5

Fay has 22 tennis balls.

How many of each pack could she have?
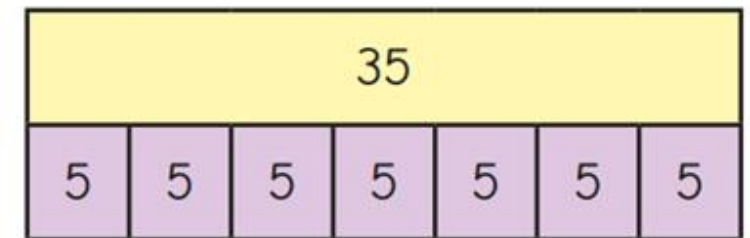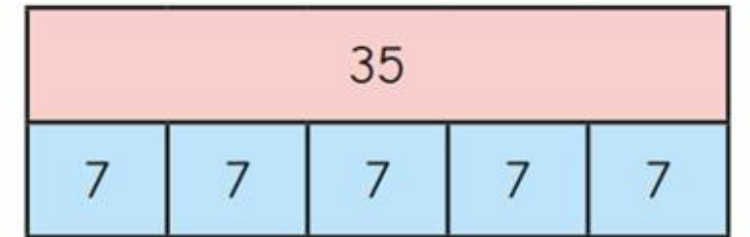
Compare answers with a partner.

Complete the number tracks.

50		40		30	

35					10

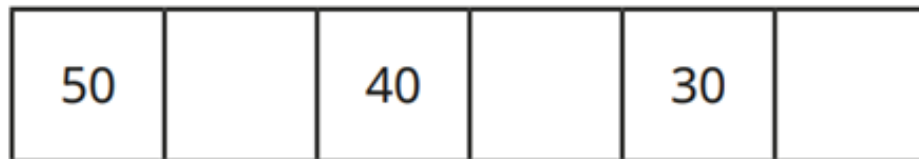**Problem Solving**

Reasoning

Applying learnt skills and concepts in a variety of different ways - word problems, multi-operational problems, graphically presented problems.

Fluency

Developing an understanding of mathematical concepts using concrete, pictorial and abstract representations. Understanding, knowing and recalling number facts, using and applying calculation strategies and skills in a variety of contexts.

Ben and Sam both draw bar models to show 7×5

Ben

35						
5	5	5	5	5	5	5

Sam

35				
7	7	7	7	7

What is the same and what is different about their bar models?

Concrete, pictorial and abstract resources

We teach maths using the concrete, pictorial, abstract approach (CPA).

Maths should be practical for all ages and the CPA approach, used at any time and with any age, supports understanding.

Concrete resources

Using physical objects to solve maths problems. Introducing real objects that can be manipulated to bring the problem to life. E.g. money, counters, fractions wall etc.
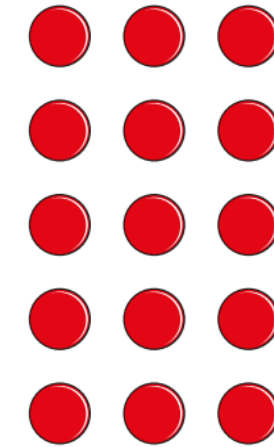
Pictorial resources

Using drawings to solve maths problems.
Once children are comfortable with solving problems with concrete materials, they are given problems with pictures – usually pictorial representations of the concrete objects they were using.

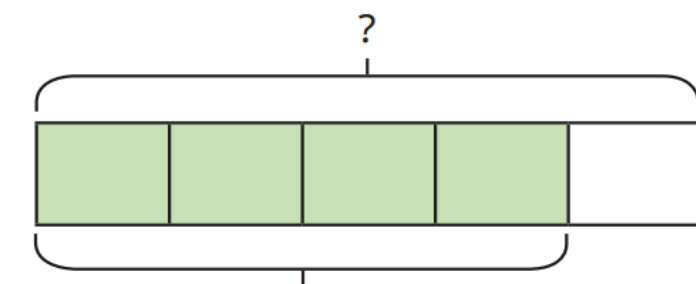Filip uses counters to show 5 equal groups of 3

a) Draw more counters to show 5 equal groups of 4

b) How many more counters did you draw?

What do you notice?

Ms Patel cycles $\frac{4}{5}$ of the way from her house to work.
She cycles 16 miles.

How far is it in total from Ms Patel's house to her work?

miles

Abstract resources

		Th	H	T	O	
		5	6	3	4	
	−	2	7	4	5	

Complete the additions.

a) $1\frac{2}{5} + 2\frac{3}{10} =$ ☐

b) $2\frac{2}{5} + 2\frac{3}{10} =$ ☐

Using numbers to solve maths problems.
The final stage is for children to understand abstract mathematical concepts, signs and notation. When a child demonstrates with concrete models and pictorial representations that they have grasped a concept, we can be confident that they are ready to explore the abstract.

# The importance of timestables

Times tables knowledge underpins much of the primary Maths curriculum.

Cognitive Load Theory states that learners have a limited capacity in their working memory and we must not over load this.

This means that if pupils are having to work hard to recall or calculate times tables facts, they will have less capacity available to absorb new and more complex information.
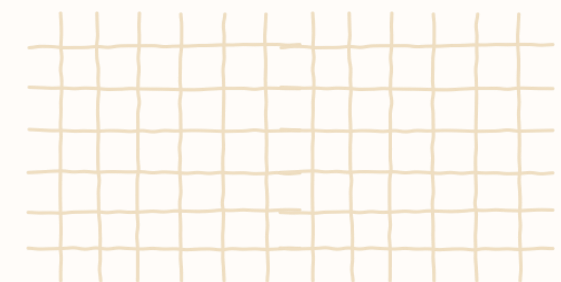
KS2 topics which require times tables knowledge

- Fractions
- Decimals
- Multiplication
- Division
- Area
- Perimeter
- Ratio
- Square and cube numbers
- Place value
- Prime numbers
- Common multiples
- Scaling
- Shape
- Algebra

Long multiplication – Years 5 & 6

		3	2	4	2
×				2	1
		3	2	4	2
	6	4	8	4	0

Long division – Year 6

		0	2	4	r	12
15	3	7	2			
	3	0	0			
		7	2			
		6	0			
		1	2			

Scaling – Year 3

The green ribbon is 6 cm long.

The red ribbon is 3 times as long as the green ribbon.

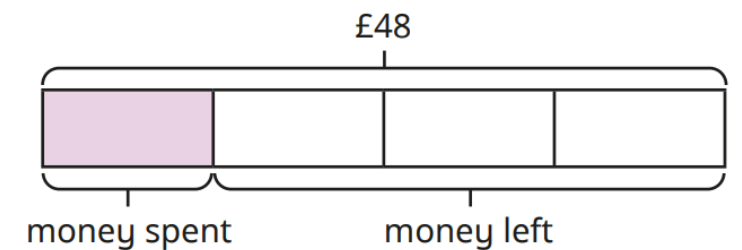6 cm

How long is the red ribbon?

Perimeter – Year 4

Work out the perimeter of each shape.

a)

5 cm

b)

4 m

Money – Year 4

Ron has £48

He spends one quarter of his money.

How much money does he have left?

Use the bar model to help you.

£48

money spent   money left
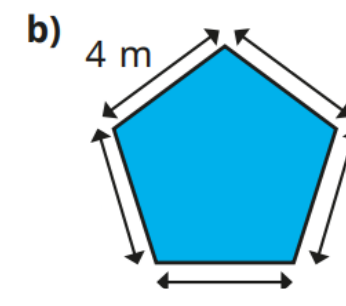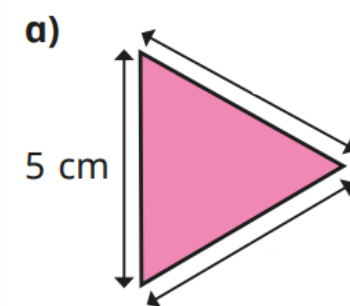
Area – Year 4

Shapes A and B are rectangles.

Shape C is a square.

Work out the area of each shape.

A   12 m

7 m

10 mm

B   3 mm

C   5 cm
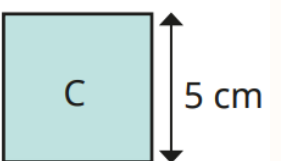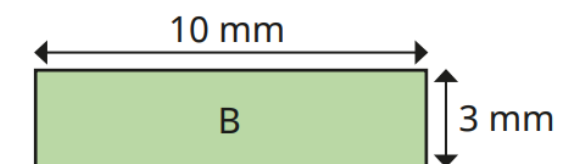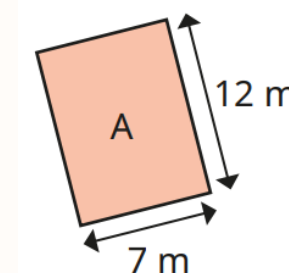
National expectations

Year group	Expectations
1	Count in multiples of **2, 5 and 10**. Recall and use all **doubles to 10** and corresponding halves.
2	Recall and use multiplication and division facts for the **2, 5 and 10** times tables including recognising odd and even numbers.
3	Recall and use multiplication and division facts for the **3, 4 and 8** times tables.
4	Recall and use multiplication and division facts for the **6, 7, 9, 11 and 12** times tables. Recall and use multiplication and division facts for tables up to **12 x 12**.
5	Revision of all times tables and division facts up to **12 x 12**.
6	Revision of all times tables and division facts up to **12 x 12**.

Place value
- read, write, order and compare numbers to at least 1,000,000 and determine the value of each digit
- count forwards or backwards in steps of powers of 10 for any given number up to 1,000,000
- interpret negative numbers in context, count forwards and backwards with positive and negative whole numbers, including through 0
- round any number up to 1,000,000 to the nearest 10, 100, 1,000, 10,000 and 100,000
- solve number problems and practical problems that involve all of the above
- read Roman numerals to 1,000 (M) and recognise years written in Roman numerals

Measurement
- convert between different units of metric measure [for example, kilometre and metre; centimetre and metre; centimetre and millimetre; gram and kilogram; litre and millilitre]
- understand and use approximate equivalences between metric units and common imperial units such as inches, pounds and pints
- measure and calculate the perimeter of composite rectilinear shapes in centimetres and metres
- calculate and compare the area of rectangles (including squares), including using standard units, square centimetres (cm^2) and square metres (m^2), and estimate the area of irregular shapes
- estimate volume [for example, using 1 cm^3 blocks to build cuboids (including cubes)] and capacity [for example, using water]
- solve problems involving converting between units of time
- use all four operations to solve problems involving measure using decimal notation, including scaling

Geometry – properties of shapes
- identify 3-D shapes, including cubes and other cuboids, from 2-D representations
- know angles are measured in degrees: estimate and compare acute, obtuse and reflex angles
- draw given angles, and measure them in degrees (°)
- identify:
  - angles at a point and 1 whole turn (total 360°)
  - angles at a point on a straight line and half a turn (total 180°)
  - other multiples of 90°
- use the properties of rectangles to deduce related facts and find missing lengths and angles
- distinguish between regular and irregular polygons based on reasoning about equal sides and angles

Addition and subtraction
- add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)
- add and subtract numbers mentally with increasingly large numbers
- use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy
- solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why

Year 5 Curriculum
57% of skills taught need secure times table knowledge

Geometry – position and direction
- identify, describe and represent the position of a shape following a reflection or translation, using the appropriate language, and know that the shape has not changed

Statistics
- solve comparison, sum and difference problems using information presented in a line graph
- complete, read and interpret information in tables, including timetables

Multiplication and Division
- identify multiples and factors, including finding all factor pairs of a number, and common factors of 2 numbers
- know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers
- establish whether a number up to 100 is prime and recall prime numbers up to 19
- multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers
- multiply and divide numbers mentally, drawing upon known facts
- divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context
- multiply and divide whole numbers and those involving decimals by 10, 100 and 1,000
- recognise and use square numbers and cube numbers, and the notation for squared (^{2}) and cubed (^{3})
- solve problems involving multiplication and division, including using their knowledge of factors and multiples, squares and cubes
- solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign
- solve problems involving multiplication and division, including scaling by simple fractions and problems involving simple rates

Fractions (including decimals and percentages
- compare and order fractions whose denominators are all multiples of the same number
- identify, name and write equivalent fractions of a given fraction, represented visually, including tenths and hundredths
- recognise mixed numbers and improper fractions and convert from one form to the other and write mathematical statements
- add and subtract fractions with the same denominator, and denominators that are multiples of the same number
- multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams
- read and write decimal numbers as fractions recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents
- round decimals with 2 decimal places to the nearest whole number and to 1 decimal place
- read, write, order and compare numbers with up to 3 decimal places
- solve problems involving number up to 3 decimal places
- recognise the per cent symbol (%) and understand that per cent relates to 'number of parts per 100', and write percentages as a fraction with denominator 100, and as a decimal fraction
- solve problems which require knowing percentage and decimal equivalents

Place value

- read, write, order and compare numbers up to 10,000,000 and determine the value of each digit
- round any whole number to a required degree of accuracy
- use negative numbers in context, and calculate intervals across 0
- solve number and practical problems that involve all of the above

Addition, subtraction, multiplication and division

- multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication
- divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context
- divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context
- perform mental calculations, including with mixed operations and large numbers
- identify common factors, common multiples and prime numbers
- use their knowledge of the order of operations to carry out calculations involving the 4 operations
- solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why
- solve problems involving addition, subtraction, multiplication and division
- use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree ÷ accuracy

Geometry – properties of shapes

- draw 2-D shapes using given dimensions and angles
- recognise, describe and build simple 3-D shapes, including making nets
- compare and classify geometric shapes based on their properties and sizes and find unknown angles in any triangles, quadrilaterals, and regular polygons
- illustrate and name parts of circles, including radius, diameter and circumference and know that the diameter is twice the radius
- recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles

Measurement

- solve problems involving the calculation and conversion of units of measure, using decimal notation up to 3 decimal places where appropriate
- use, read, write and convert between standard units, converting measurements of length, mass, volume and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation to up to 3 decimal places
- convert between miles and kilometres
- recognise that shapes with the same areas can have different perimeters and vice versa
- recognise when it is possible to use formulae for area and volume of shapes
- calculate the area of parallelograms and triangles
- calculate, estimate and compare volume of cubes and cuboids using standard units, including cubic centimetres (cm^3) and cubic metres (m^3), and extending to other units [for example, mm^3 and km^3]

Year 6 Curriculum
80% of skills taught need secure times table knowledge

Algebra

- use simple formulae
- generate and describe linear number sequences
- express missing number problems algebraically
- find pairs of numbers that satisfy an equation with 2 unknowns
- enumerate possibilities of combinations of 2 variables

Statistics

- interpret and construct pie charts and line graphs and use these to solve problems
- calculate and interpret the mean as an average

Geometry – position and direction

- describe positions on the full coordinate grid (all 4 quadrants)
- draw and translate simple shapes on the coordinate plane, and reflect them in the axes

Ratio

- solve problems involving the relative sizes of 2 quantities where missing values can be found by using integer multiplication and division facts
- solve problems involving the calculation of percentages [for example, of measures and such as 15% of 360] and the use of percentages for comparison
- solve problems involving similar shapes where the scale factor is known or can be found
- solve problems involving unequal sharing and grouping using knowledge of fractions and multiples

Fractions (including decimals and percentages)

- use common factors to simplify fractions; use common multiples to express fractions in the same denomination
- compare and order fractions, including fractions >1
- add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions
- multiply simple pairs of proper fractions, writing the answer in its simplest form [for example, $1/4 \times 1/2 = 1/8$]
- divide proper fractions by whole numbers [for example, $1/3 ÷ 2 = 1/6$]
- associate a fraction with division and calculate decimal fraction equivalents [for example, 0.375] for a simple fraction [for example, 3/8]
- identify the value of each digit in numbers given to 3 decimal places and multiply and divide numbers by 10, 100 and 1,000 giving answers up to 3 decimal places
- multiply one-digit numbers with up to 2 decimal places by whole numbers
- use written division methods in cases where the answer has up to 2 decimal places
- solve problems which require answers to be rounded to specified degrees of accuracy
- recall and use equivalences between simple fractions, decimals and percentages, including in different contexts

How can you help?

- Daily practice – little and often.

- Regular use of TTRS

- Display a times tables grid

- Make it part of your day rather than explicit learning.

- Make it competitive if your child responds well to competition – can they beat their score? Your score? A siblings? etc.

- Times tables songs (YouTube)

- Use of other online resources – BBC Bitesize, Hit the Button, Timestables.co.uk etc.