



DATE VALLEY SCHOOL

**A PARENTS GUIDE TO
MATHS MASTERY**

PROPS AROUND THE HOME

The National Curriculum 2014 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 develop conceptual understanding and the ability to recall and **apply knowledge** rapidly and accurately

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

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

- **A prominent clock**- digital and analogue is even better. Place it somewhere where you can talk about the time each day.
- **A traditional wall calendar**-Calendars help with counting days, spotting number patterns and
- **Board games that involve dice or spinners**-helps with counting and the idea of chance
- **A pack of playing cards**- Card games can be adapted in many ways to learn about number bonds, chance, adding and subtracting
- **A calculator**- A basic calculator will help with maths homework when required, there are also many calculator games you can play, too.
- **Measuring Jug**-Your child will use them in school, but seeing them used in real life is invaluable. Also useful for discussing converting from metric to imperial
- **Dried beans, Macaroni or Smarties**- for counting and estimating
- **A tape measure and a ruler**- Let your child help when measuring up for furniture, curtains etc
- **A large bar of chocolate** (one divided into chunks)- a great motivator for fractions work
- **Fridge magnets with numbers on**- can be used for a little practice of written methods
- **Indoor/outdoor Thermometer**- especially useful in winter for teaching negative numbers when the temperature drops below freezing
- **Unusual dice**- not all dice have faces 1-6, hexagonal dice, coloured dice, dice from board games all make talking about chance a little more interesting
- **A dartboard with velcro darts**- Helps with doubling, trebling, adding and subtracting.

Talk and think like a mathematician

Maths language often uses common words in a new context, for example table, right, difference, product.

Always encourage your child to *explain* how they have gone about solving a problem, and work with them to test, prove, explain, reflect and spot patterns. Questioning and prompts are powerful tools to boost your child's mathematical thinking; questions such as:

What do you think...?

Why?

What will happen if...?

What do you notice about ... ?

Can you see a pattern between... ?

What if we try...?

Communicating and discussing Maths problems in a way that others can understand demonstrates depth of understanding – another fundamental aspect of mastering maths.

Encourage the growth mindset – every one of us can master Mathematics, given the opportunity.

WHAT IS MASTERY?

What does it mean to *master* something?

'I know how to do it'

'I can do it without thinking (e.g. driving a car)'

'I'm really good at it (e.g. painting a room / picture)'

'I can show someone else how to do it'

What does it mean to *master* mathematics?

It's more than the above...

It is:

- Achievable for all
- The ability to build on something that has already been sufficiently mastered
- Involves **deep** and sustained learning
- The ability to reason about a concept and make connections
- Being fluent in concepts and procedures

LEVELS OF LEARNING

There are 3 levels of learning:

Shallow learning: surface, temporary, often lost

Deep learning: it sticks, can be recalled and used

Deepest learning: can be transferred and applied in different context

The deep and deepest levels are what we are aiming for by teaching maths using the Mastery approach.

A mathematical concept or skill has been *mastered* when a child can show it in multiple ways, using the mathematical language to explain their ideas, and can independently apply the concept to new problems in unfamiliar situations.

Mastery is a journey and long-term goal, achieved through exploration, clarification, practice and application over time. At each stage of learning, children should be able to demonstrate a deep, conceptual understanding of the topic and be able to build on this over time.

How can you help your child at home?

Maths learning can take place anywhere! Maths is all around us, so look for opportunities for you to do some problem solving together, making connections between what your child is learning at school and the world around them.

Follow a recipe: work together to find the quantities needed, then discuss how you would halve or double the recipe, which could lead to a discussion on ratio of ingredients.

Talk about the weather forecast: is the temperature today higher or lower than yesterday's? What do the numbers mean?

Shopping: discuss the cost of items and how the cost might change if you buy two items instead of one. Let your child count out the coins when paying and discuss the change you should get back. Coins can be used to explore addition, subtraction, multiplication and division.

Planning an outing: discuss how long it takes to get to the park. Work out what time you need to leave the house to reach there at a certain time. Discuss what shapes can be seen at the park.

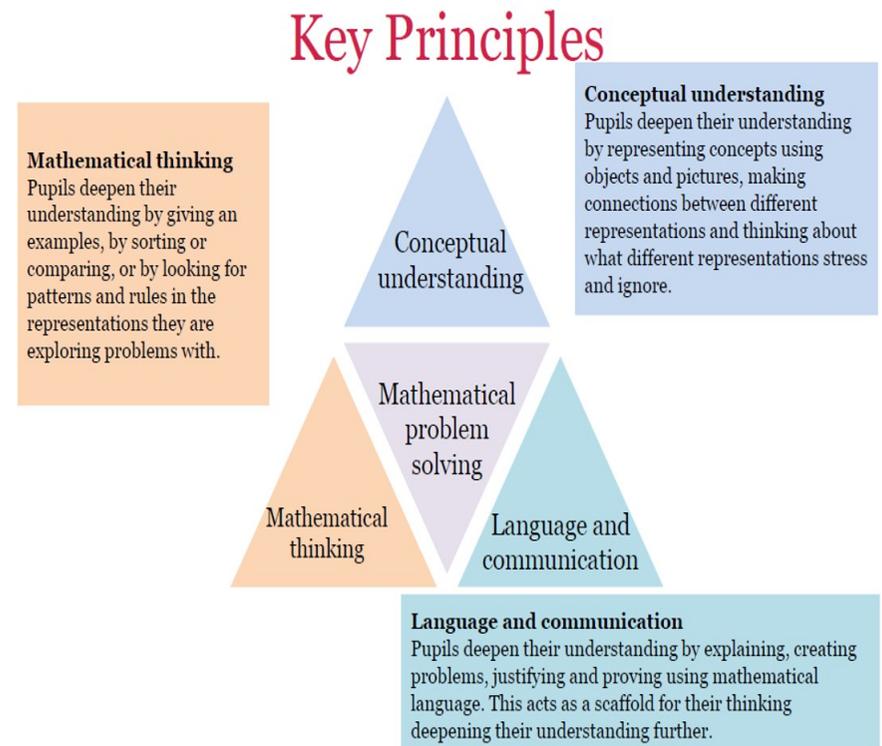
Growth Mindset is very closely linked with Mastery and fosters:

- a belief that effort creates success
- a belief that skill and ability can be increased over time
- mistakes are viewed as an opportunity to learn and develop
- builds resilience – don't give up easily
- think about **how** they learn, not just what

Traditionally, Maths has been taught by memorising key facts and procedures, which tends to lead to superficial understanding that can easily be forgotten. Children should be able to select which mathematical approach is most effective in different scenarios.

All pupils can achieve in mathematics! There is no such thing as a 'Maths person', that is the belief that some pupils can do maths and others cannot.

Teaching for Mastery involves:



Teaching for Mastery involves:

- High expectations for all children
- Fewer topics covered in greater depth over a longer time
- Number sense and place value come first
- Problem solving is central, ensuring an understanding of why it works so that children understand what they are doing rather than just learning to repeat routines without grasping what is happening
- Challenge is provided through greater depth, rather than accelerated content (moving into next year's concepts) – this allows children to deepen their knowledge and improve their reasoning skills rather than accelerating on to new curriculum content.

Fluency	Reasoning	Problem Solving																																												
<ul style="list-style-type: none"> • Complete the grid: <table border="1" style="margin-left: 20px;"> <tr> <td></td> <td>x100</td> <td>+1000</td> <td>x10</td> </tr> <tr> <td>365</td> <td></td> <td></td> <td></td> </tr> <tr> <td>2669</td> <td></td> <td></td> <td></td> </tr> <tr> <td>12</td> <td></td> <td></td> <td></td> </tr> </table> • Fill in the boxes: <div style="margin-left: 20px;"> $\boxed{} \times 100 = 38$ $56 \boxed{} = 5.6$ $0.8 \times 1000 = \boxed{}$ </div> • Some facts have been cut up. Work with a partner to put them back together. e.g. $74 \div 10 = 7.4$ <div style="margin-left: 20px;"> <table style="display: inline-table; border: none; vertical-align: middle;"> <tr><td style="border: 1px solid black; padding: 2px;">100</td></tr> <tr><td style="border: 1px solid black; padding: 2px;">31</td></tr> <tr><td style="border: 1px solid black; padding: 2px;">3100</td></tr> <tr><td style="border: 1px solid black; padding: 2px;">÷100</td></tr> <tr><td style="border: 1px solid black; padding: 2px;">÷1000</td></tr> <tr><td style="border: 1px solid black; padding: 2px;">=0.031</td></tr> <tr><td style="border: 1px solid black; padding: 2px;">31</td></tr> <tr><td style="border: 1px solid black; padding: 2px;">= 1</td></tr> </table> </div> 		x100	+1000	x10	365				2669				12				100	31	3100	÷100	÷1000	=0.031	31	= 1	<ul style="list-style-type: none"> • True or false? When you multiply whole and decimal numbers by 10, 100 or 1000, you just add noughts on to the end. <ul style="list-style-type: none"> • If $5 \times 4 = 20$ • Explain why these facts are true without working them out: <div style="margin-left: 20px;"> $0.5 \times 4 = 2$ $200 \div 4 = 50$ $0.4 \times 0.5 = 0.2$ </div> 	<ul style="list-style-type: none"> • Put these calculations in order from smallest to biggest: <div style="margin-left: 20px;"> <table style="border-collapse: collapse; text-align: center;"> <tr><td style="border: 2px solid black; padding: 10px;">100 x 540</td></tr> <tr><td style="border: 2px solid black; padding: 10px;">5.4 x 1000</td></tr> <tr><td style="border: 2px solid black; padding: 10px;">5400 ÷ 10</td></tr> <tr><td style="border: 2px solid black; padding: 10px;">5400 ÷ 1000</td></tr> <tr><td style="border: 2px solid black; padding: 10px;">540 ÷ 10</td></tr> </table> </div> • Using a number from column A, an operation from B and a number from C, how many ways can you find to make 70? (There are more than 4 ways!) <table border="1" style="margin-left: 20px; width: 100%; text-align: center;"> <thead> <tr style="background-color: #d9ead3;"> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr><td>7</td><td>X</td><td>1</td></tr> <tr><td>70</td><td></td><td>10</td></tr> <tr><td>700</td><td>+</td><td>100</td></tr> <tr><td>7000</td><td></td><td>1000</td></tr> </tbody> </table> 	100 x 540	5.4 x 1000	5400 ÷ 10	5400 ÷ 1000	540 ÷ 10	A	B	C	7	X	1	70		10	700	+	100	7000		1000
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EFFECTIVE QUESTIONING

Teachers promote reasoning through carefully chosen questions, such as:

- _____ thinks that..... . Do you agree? Explain your answer
- Is it always, sometimes or never true that _____?
- Can you spot the mistake? Explain how you know they are wrong.
- True or false?
- Spot the odd one out. Why?

Teachers will ensure fluency skills are secure and then facilitate deeper learning by using reasoning and problem solving. For example, if the learning intention is to multiply and divide whole numbers by 10, 100 and 1000 (Year 5), the lesson may have the format as shown on the next page :

A typical Maths lesson will provide the opportunity for all children, regardless of their ability, to work through Fluency, Reasoning AND Problem Solving activities.

Multiple representations for all

Concrete, pictorial, abstract

Objects, pictures, words, numbers and symbols are everywhere. The mastery approach incorporates all of these to help children explore and demonstrate mathematical ideas, enrich their learning experience and deepen understanding. Together, these elements help cement knowledge so pupils truly understand what they've learnt.

All pupils, when introduced to a key new concept, should have the opportunity to build competency in this topic by taking this approach. Pupils are encouraged to physically represent mathematical concepts. Objects and pictures are used to demonstrate and visualise abstract ideas, alongside numbers and symbols.

Concrete – children have the opportunity to use concrete objects and manipulatives to help them understand and explain what they are doing.

Pictorial – children then build on this concrete approach by using pictorial representations, which can then be used to reason and solve problems.

Abstract – With the foundations firmly laid, children can move to an abstract approach using numbers and key concepts with confidence.

Number at the heart

A large proportion of time is spent reinforcing number to build competency and fluency. Number is at the heart of Mastery, with more time devoted to this than other areas of mathematics. It is important that pupils secure these key foundations of maths before being introduced to more difficult concepts.

This increased focus on number will allow pupils to explore the concepts in more detail and secure a deeper understanding. Key number skills are fed through the rest of the scheme so that students become increasingly fluent.

Focus on depth

Deepen understanding before accelerating content coverage

All pupils benefit from deepening their conceptual understanding of mathematics, regardless of whether they've previously struggled or excelled. Pupils must be given time to fully understand, explore and apply ideas, rather than accelerate through new topics. This approach enables children to truly grasp a concept, and the challenge comes from investigating it in new, alternative and more complex ways.

Fluency

Involves

- Quick recall of facts and procedures
- The flexibility and fluidity to move between different contexts and representations of mathematics.
- The ability to recognise relationships and make connections in mathematics

Fluency (arithmetic) often gets confused for just memorisation – it is far more than this. Children need to be able to *apply* their fluency of facts and procedures into new contexts and representations, recognise relationships and make connections in mathematics. This should help pupils develop a deep conceptual understanding of the subject.

Reasoning

The way pupils speak and write about mathematics transforms their learning. Teaching for Mastery involves carefully designed questions to enable pupils to explain the mathematics in full sentences with the correct vocabulary. They should be able to say not just what the answer is, but *how* they know it is correct. This is key to building mathematical language and reasoning skills.

Problem solving

Mathematical problem solving is at the heart of the Mastery approach. Pupils apply their skills of fluency to solve complex problems and real-life situations.