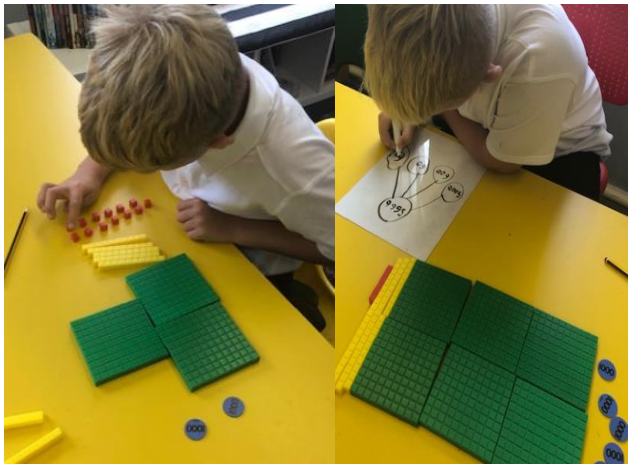
How can I help at home?

- When children give an answer, ask "How did you know?". "How did you work that out?" or "Can you prove it?"
- Deliberately make mistakes. Pupils need to understand mistakes are normal and everyone makes them e.g. saying 3 multiplied by 50 equals 200. Ask children to explain what you did wrong.
- Encourage children make up their own games and decide how to score points.
- Count in steps of 50 and 100 e.g. using coins
- Ask children to divide things into fractions – fractions of a whole such as pizza, fractions of amounts, such as sweets etc. Encourage mathematical thinking by deliberately making the fraction unequal and asking if it shows halves or quarters
- Talk about time. Ask time questions about how long until it's time for school, how long does the film last, how long was the football game etc. Look at time using digital and analogue clocks.
- Allow pupils to measure ingredients for baking using scales or measuring jugs. Talk about the scale on items for measuring, especially the ones that aren't numbered e.g.
  "*If that mark shows 100 and that one shows 200, what does this mark in between represent?*"
- Watch number videos; there are lots of songs for times tables, counting in steps and doubles on YouTube.
- Practise times tables in fun ways such as online games or by joining in with BBC Supermovers
  https://www.bbc.co.uk/sport/supermovers/42612496
  Times Table Rockstars is brilliant for practising tables facts. Don't forget to also practice the inverse e.g. how many 4s in 36?
- Talk about properties of shapes on the faces of 3D objects, e.g. circles on cylinders. Point out 3D shapes in real life, e.g. spheres (balls), cylinders (tin cans, vases, Amazon Echo), triangular prism (Toblerone box), cubes and cuboids (dice, boxes) cones or pyramids. Talk about how many faces, vertices and edges they have.
- Talk about months of the year and count days until special events, noting how many days on the month

Happy children aiming high

A Guide to Maths Mastery in Year 4



NEW HARTLEY FIRST SCHOOL

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Spotting Patterns and sequences

Pupils need to be taught to spot patterns in maths. This often does not come naturally and generally needs to be specifically taught:

- Using related facts to help with multiplication and division problems e.g. if 2 x 6 = 12 then 20 x 6 = 120
- Understanding that multiplication is commutative e.g. knowing that if 8 x 9 = 72 then 9 x 8 will also be 72
- Spotting patterns in multiplication tables such as knowing the link between the eight multiplication table and the four multiplication table.

Problem Solving

Problem solving in maths allows pupils to use their maths skills in lots of contexts and in situations that are new to them. It allows them to seek solutions, spot patterns and think about the best way to do things rather than blindly following maths procedures.

In Year 4, problem solving might include:

- Choosing different methods to find answers
- Proving statements correct/incorrect
- Problems that involve trial and error e.g. always, sometimes, never
- Working systematically to find all possible solutions
- Discussing 'what if?' problems and making generalisations
- Working backwards from known facts
- Finding the most efficient ways to work out answers from a range of known strategies

Fluency, reasoning and problem solving are not taught in isolation from each other. Lessons are carefully planned to interweave all three aspects in a cohesive teaching sequence to allow pupils to fully understand the concept being taught and to be able to make connections.

Pupils also need to be able to link multiplication facts to other concepts, such as linking multiples of 50 and 100 to measuring length, weight, capacity or money.

By becoming fluent in maths facts, it allows our brain to concentrate on higher level skills, allowing maths to be done more efficiently and accurately.

Reasoning

Reasoning in maths helps pupils to be able to explain their thinking, therefore making it easier for them to understand what is happening in the maths they are doing and to make connections to new concepts. It helps them to think about how to solve a problem, explain how they solved it and to think about what they could do differently.

In Year 4, some examples of reasoning are:

- true and false statements e.g. if I add 10 to a number, only the tens column will change
- Spotting and explaining errors e.g.

$$\begin{array}{rr} & 263 \\ + & 28 \\ \hline & 281 \end{array}$$

- Always, Sometimes, Never statements e.g.
  "all of the multiples of 3 will also be multiples of 6"
- Explaining understanding e.g.
  "How do you know that your answer is correct? Can you use a different method to check?"
- Explaining how concepts connect: *"What is different? What is the same? What has changed? What do you notice? Which representation matches the question?"*

What is Teaching for Mastery?

Our Definition

At New Hartley First School, we see teaching for mastery in maths as allowing the pupils to gain a deep understanding of maths, allowing them to acquire a secure and long-term understanding of maths that allows them to make continual progress to move onto more complex topics.

Our Ethos

We believe that everyone can succeed maths and there's no such thing as a 'maths person'. Maths is a subject that everyone can and should be able to perform confidently and competently.

Teaching for Mastery

We choose to teach by breaking down maths objectives into the smallest steps, so that every pupil is secure in every new concept before moving on. We focus upon teaching to gain fluency with maths facts, reasoning about maths and problem solving.

National Curriculum in Year 4

This is what most pupils in Year 4 are expected to be able to do by the end of their school year.

Number - number and place value

- find 1000 more or less than a given number
- count backwards through zero to include negative numbers
- recognise the place value of each digit in a four-digit number (thousands, hundreds, tens, and ones)
- order and compare numbers beyond 1000
- identify, represent and estimate numbers using different representations
- round any number to the nearest 10, 100 or 1000
- solve number and practical problems that involve all of the above and with increasingly large positive numbers
- read Roman numerals to 100 (I to C) and know that over time, the numeral system changed to include the concept of zero and place value

Number - addition and subtraction

- add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate
- estimate and use inverse operations to check answers to a calculation
- solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why.

Number – multiplication and division

- recall multiplication and division facts for multiplication tables up to 12 × 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
- multiply two-digit and three-digit numbers by a one-digit number using formal written layout
- solve problems involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects.

pupils would spot that when adding or subtracting a ten that the ones digit would stay the same. In this case, the ones digit changes so pupils should already know that the calculation is incorrect. Furthermore, it would be expected that their understanding of place value would allow them to understand that 7 has been subtracted rather than 70.

Reasoning about numbers using facts they already know

Pupils reason about maths using facts they already know, such as recognising links between multiples eg

"I know 48 is a multiple of 8 so it must also be a multiple of 4 and of 2"

These links are often not immediately apparent to pupils and need to be specifically taught, using questioning such as 'What do you notice?' or 'What is the same? What is different? What has changed?"

Knowing and Understanding Times Tables

Having a good understanding of times tables is extremely useful in teaching for mastery. Problems are easier to solve if pupils don't have to interrupt their thinking to work out multiplication calculations.

A good knowledge of times tables also helps with spotting patterns, for example 164 ÷ 4 can quickly be calculated mentally if pupils know 16 is a multiple of 4 so therefore 160 is also a multiple of 4. Using this knowledge there is no need for a written calculation as:

"4 goes into 16 four times so 4 goes into 160 40 times. 4 goes into 4 once. 40 + 1 = 41."

Without a good knowledge of times tables, this pattern wouldn't be recognised as quickly and would need to be calculated by a written method. Teaching for mastery aims to improve accuracy and efficiency and pausing to use a written calculation ca sometimes detract from the initial problem.

Knowing and understanding times tables is not necessarily the same as memorisation of times tables. Rote memorisation of tables without understanding may not allow pupils to make connections. Pupils need to be able to notice connections such as the connections between 2x, 4x and 8x tables, connections between multiples of 50 and 100 and about the commutivity of tables, so for example 4 x 8 = 32 so 8 x 4 = 32.

We can also know the opposite (inverse), for example 7-2=5 and 7-5=2, so 70-20=50 and 70-50=20. However, these connections often do not come naturally to pupils and need to be shown to them in many ways.

+	0	1	2	3	4	5	6	7	8	9	10
0	0+0	0+1	0+2	0+3	0+4	0+5	0+6	0+7	0+8	0+9	0+10
1	1+0	1+1	1+2	1+3	1+4	1+5	1+6	1+7	1+8	1+9	1+10
2	2+0	2+1	2+2	2+3	2+4	2+5	2+6	2+7	2+8	2+9	2+10
3	3+0	3+1	3+2	3+3	3+4	3+5	3+6	3+7	3+8	3+9	3+10
4	4+0	4+1	4+2	4+3	4+4	4+5	4+6	4+7	4+8	4+9	4+10
5	5+0	5+1	5+2	5+3	5+4	5+5	5+6	5+7	5+8	5+9	5+10
6	6+0	6+1	6+2	6+3	6+4	6+5	6+6	6+7	6+8	6+9	6+10
7	7+0	7+1	7+2	7+3	7+4	7+5	7+6	7+7	7+8	7+9	7+10
8	8+0	8+1	8+2	8+3	8+4	8+5	8+6	8+7	8+8	8+9	8+10
9	9+0	9+1	9+2	9+3	9+4	9+5	9+6	9+7	9+8	9+9	9+10
10	10+0	10+1	10+2	10+3	10+4	10+5	10+6	10+7	10+8	10+9	10+10

The above number bonds should all be known fluently by the end of Year 2 so pupils in Year 3 and 4 should now be using these known facts to generalise about numbers and to work out related facts.

Having a good knowledge of number bonds also helps with mental calculations when crossing the tens boundary, for example, adding

347 + 8

Having a fast recollection of number bonds allows pupils to partition the 8 and to quickly work out the calculation using

347 + 3 + 5

"I know I need three more to make 350 then there are 5 left out of the 8 so 350 plus 5 equals 355"

Equally, it allows for fast calculations when adding tens or hundreds to a four digit number as pupils can apply their knowledge of single digit number bonds to add tens or hundreds mentally.

Spotting connections and patterns

Pupils need to be taught to spot connections and patterns to improve their fluency. If they understand how numbers connect they often will not need to do a calculation to solve a problem, for example:

True or False: 389-70 is equal to 382

It would be expected that instead of performing the calculation,

Number - fractions

- recognise and show, using diagrams, families of common equivalent fractions
- count up and down in hundredths; recognise that hundredths arise when dividing an object by one hundred and dividing tenths by ten.
- solve problems involving increasingly harder fractions to calculate quantities, and fractions to divide quantities, including non-unit fractions where the answer is a whole number
- add and subtract fractions with the same denominator
- recognise and write decimal equivalents of any number of tenths or hundredths
- recognise and write decimal equivalents to $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$
- find the effect of dividing a one- or two-digit number by 10 and 100, identifying the value of the digits in the answer as ones, tenths and hundredths
- round decimals with one decimal place to the nearest whole number
- compare numbers with the same number of decimal places up to two decimal places
- solve simple measure and money problems involving fractions and decimals to two decimal places.

Measurement

- Convert between different units of measure [for example, kilometre to metre; hour to minute]
- measure and calculate the perimeter of a rectilinear figure (including squares) in centimetres and metres
- find the area of rectilinear shapes by counting squares
- estimate, compare and calculate different measures, including money in pounds and pence
- read, write and convert time between analogue and digital 12- and 24-hour clocks
- solve problems involving converting from hours to minutes; minutes to seconds; years to months; weeks to days.

Geometry – properties of shapes

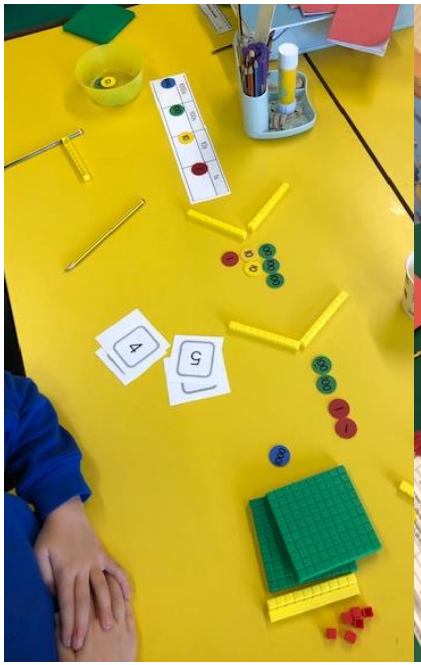
- compare and classify geometric shapes, including quadrilaterals and triangles, based on their properties and sizes
- identify acute and obtuse angles and compare and order angles up to two right angles by size
- identify lines of symmetry in 2-D shapes presented in different orientations
- complete a simple symmetric figure with respect to a specific line of symmetry.

Geometry – position and direction

- describe positions on a 2-D grid as coordinates in the first quadrant
- describe movements between positions as translations of a given unit to the left/right and up/down
- plot specified points and draw sides to complete a given polygon.

Statistics

- interpret and present discrete and continuous data using appropriate graphical methods, including bar charts and time graphs.
- solve comparison, sum and difference problems using information presented in bar charts, pictograms, tables and other graphs.



How do we teach for Mastery in Year 4?

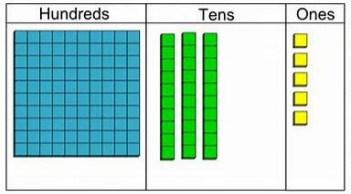
Fluency

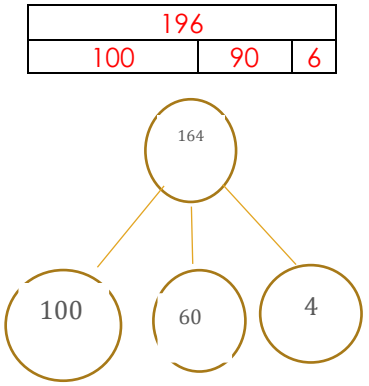
In Year 4, we aim to teach so that pupils have a deep understanding of number and become fluent in the basic skills which will aid their understanding at greater depth.

Representing Numbers

We want to develop pupils' number sense so that they understand the number rather than just recognising the numeral. It is important that children build on their learning right back from the Early Years, making connections between numerals and quantities. Pupils need to understand that numbers can be represented in many ways, not just as a written numeral. We use many different objects and pictures to show that numbers can be represented in lots of ways.

Some ways to represent 3 digit numbers





Pupils sometimes need lots of practise to recognise numbers in different forms. Seeing numbers in different contexts helps them to make connections and to generalise about concepts.

Number Bonds

Learning number bonds is of high importance in understanding maths. Number bonds are pairs of numbers that go together to make another number. Once number bonds are learned they form the basis of many other calculations, for example if we know 5 + 2 = 7, we also know 50+20=70, 500+200=700 and we know 15 +2 =17, 25+2=27 etc