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 explain what you did?"
- Deliberately make mistakes. Pupils need to understand mistakes are normal and everyone makes them eg 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 eg 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 eg
  "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 another good online game for practsing tables facts. Don't forget to also practice the inverse eg how many 4s in 36?
- Talk about properties of shapes on the faces of 3D objects, eg circles on cylinders. Point out 3D shapes in real life, eg 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 3

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

- Spotting repeated addition or subtraction patterns
  eg if 10 x 8 is 80 then 9 x 8 will be 8 less, therefore 72
- Linking calculations to their inverse operations eg 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 3, problem solving might include:

- Choosing different ways to find answers
- Solving 'puzzles'
- Problems that involve trial and error
- 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 3, some examples of reasoning are:

- true and false statements eg *if I add a multiple of ten to a three digit number, it will change the number in the ones column*
- Spotting and explaining errors eg

$$\begin{array}{r} 2\ 6\ 3 \\ +\quad 2\ 8 \\ \hline 2\ 8\ 1 \end{array}$$

- Always, Sometimes, Never statements eg
  "Multiples of 4 are always multiples of 8"
  "Multiples of 8 are always multiples of 4"
- Explaining understanding eg
  "How would you check your answer is correct in another way? How would that help?"
- 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 do 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 3

This is what most pupils in Year 3 are expected to be able to do by the end of their school year.

Number - number and place value

- count from 0 in multiples of 4, 8, 50 and 100; find 10 or 100 more or less than a given number
- recognise the place value of each digit in a 3-digit number (100s, 10s, 1s)
- compare and order numbers up to 1,000
- identify, represent and estimate numbers using different representations
- read and write numbers up to 1,000 in numerals and in words
- solve number problems and practical problems involving these ideas

Number - addition and subtraction

- Pupils should be taught to:
- add and subtract numbers mentally, including:
- a three-digit number and 1s
- a three-digit number and 10s
- a three-digit number and 100s
- add and subtract numbers with up to 3 digits, using formal written method of columnar addition and subtraction
- estimate the answer to a calculation and use inverse operations to check answers
- solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction

Number – multiplication and division

- recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables
- write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods
- solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems in which 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 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 three 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

Pupils should be taught to:

- count up and down in tenths; recognise that tenths arise from dividing an object into 10 equal parts and in dividing one-digit numbers or quantities by 10
- recognise, find and write fractions of a discrete set of objects: unit fractions and non-unit fractions with small denominators
- recognise and use fractions as numbers: unit fractions and non-unit fractions with small denominators
- recognise and show, using diagrams, equivalent fractions with small denominators
- add and subtract fractions with the same denominator within one whole [for example, $\frac{5}{7} + \frac{1}{7} = \frac{6}{7}$]
- compare and order unit fractions, and fractions with the same denominators
- solve problems that involve all of the above

Measurement

- measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)
- measure the perimeter of simple 2-D shapes
- add and subtract amounts of money to give change, using both £ and p in practical contexts
- tell and write the time from an analogue clock, including using Roman numerals from I to XII, and 12-hour and 24-hour clocks
- estimate and read time with increasing accuracy to the nearest minute; record and compare time in terms of seconds, minutes and hours; use vocabulary such as o'clock, am/pm, morning, afternoon, noon and midnight
- know the number of seconds in a minute and the number of days in each month, year and leap year
- compare durations of events [for example, to calculate the time taken by particular events or tasks]

Geometry – properties of shapes

- draw 2-D shapes and make 3-D shapes using modelling materials; recognise 3-D shapes in different orientations and describe them
- recognise angles as a property of shape or a description of a turn

- identify right angles, recognise that 2 right angles make a half-turn, 3 make three-quarters of a turn and 4 a complete turn; identify whether angles are greater than or less than a right angle
- identify horizontal and vertical lines and pairs of perpendicular and parallel lines

Statistics

- interpret and present data using bar charts, pictograms and tables
- solve one-step and two-step questions [for example 'How many more?' and 'How many fewer?'] using information presented in scaled bar charts and pictograms and tables

How do we teach for Mastery in Year 3?

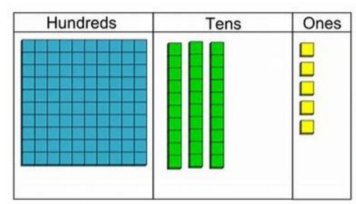
Fluency

In Year 3, we aim to teach so that pupils have a deep understanding of number.

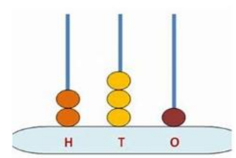
Representing Numbers

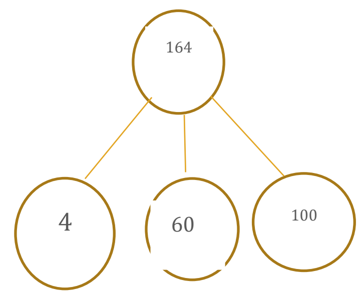
We want to develop pupils's number sense so that they understand the number rather than just recognising the numeral. Pupils need to understand that numbers can be represented in many ways, not just as a written numeral. We use many different objects and pictures to show that numbers can be represented in lots of ways.

Some ways to represent 3 digit numbers



196		
100	90	6





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