How Mathematics is Taught at Tudor

TUDOR PRIMARY SCHOOL

Summer 2022

Authored by: Alex Crowder

"Pure mathematics is, in its way, the poetry of logical ideas."

Albert Einstein

Mission Statement

Together we create a happy and caring community where all our children love to learn and want to achieve

Intention

This document sets out Tudor Primary's approach to the content and organisation of Mathematics in accordance with the 2014 curriculum and the school's mastery approach. At Tudor, we are committed to providing all pupils with high-quality opportunities to access all areas of the maths curriculum. We aim for pupils to become fluent in key mathematical concepts, applying these skills in problem solving and real life scenarios. They will be confident in using mathematical vocabulary and representations to show their thought processes and reasoning.

'Mathematics is a creative and highly inter-connected discipline that has been developed over centuries, providing the solution to some of history's most intriguing problems. It is essential to everyday life, critical to science, technology and engineering, and necessary for financial literacy and most forms of employment. A high-quality mathematics education therefore provides a foundation for understanding the world, the ability to reason mathematically, an appreciation of the beauty and power of mathematics, and a sense of enjoyment and curiosity about the subject.'

DfE 2014

Implementation

At Tudor, mathematics is taught through **a sequenced, mastery-based approach.** We aim to build upon a child's prior knowledge, providing them opportunities to utilise their new skills in different scenarios.

Learning sequences

Learning sequences are planned to test children's understanding in a variety of contexts, providing opportunity to solve problems once the necessary skills have been learned. Teachers use the **Herts ESSENTIALmaths sequence** to base units around, ensuring complete coverage and intelligent delivery of the curriculum. As such teachers identify the key learning for each class and plan to secure these. Learning sequences are developmental and, depending on the concept, a good proportion of time will be spent securing key learning. Teachers will use their judgement about when it is the right time to move on. As well as continuous formative assessment in-class, termly summative assessment is also carried out. Class teachers then use analysis of these summative assessments to identify gaps and inform subsequent units of teaching. The learning will often have links to the current topic, though never at the detriment of the mathematical skill being learned.

Steps within the Learning Sequence
Step 1: Finding complements of 1
Step 2: Adding fractions with the same denominator
Step 3: Subtracting fractions with the same denominator
Step 4: Applying the addition and subtraction of fractions with the same denominator

Vocabulary

Mathematical **vocabulary is key to our delivery of the curriculum**; with a strong grasp of the required vocabulary, our children are able to show their understanding and reasoning behind their answers. Adults share the appropriate language with the children and form their questioning around it. Pupils are encouraged to present their justifications, arguments and proofs both in written form and aloud. A list of vocabulary that is taught within each year group can be found here.

Assessment

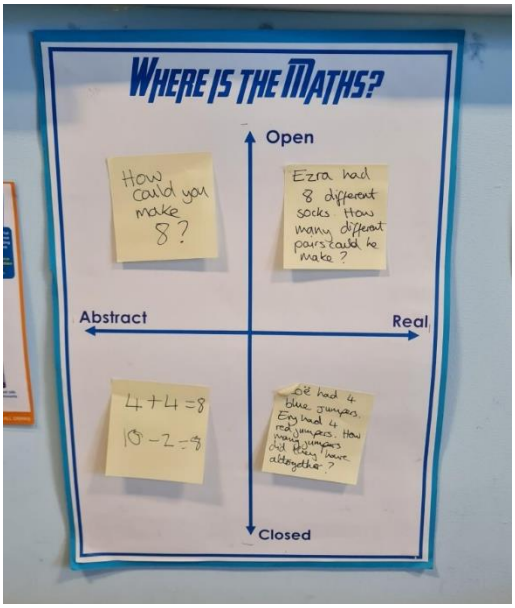
Pupil understanding is assessed during and after lessons. This formative assessment may take the form of completing tasks, conversations, destination questions, plenaries or self-assessment. Ongoing assessments are recorded on Tudor feedback grids, which are used to inform our new teaching. Feedback is often given verbally or through modelling in children's books; this feedback is provided either during a lesson or as part of the subsequent lesson, causing the greatest impact and addressing misconceptions early. Information on how we assess at Tudor can be found here.

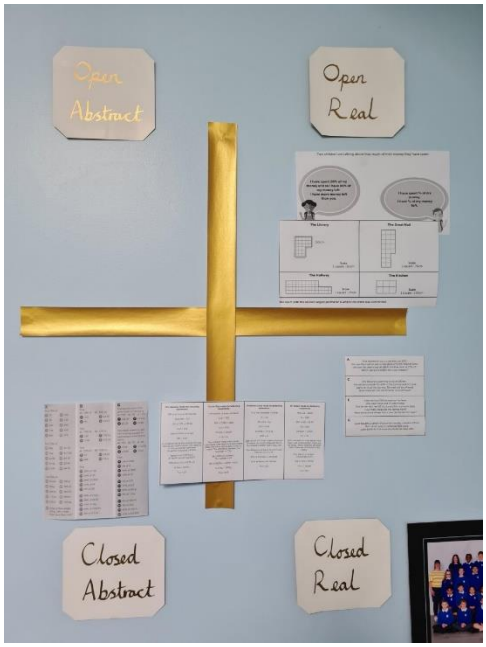
Coverage

In addition to the coverage ensured by using the ESSENTIALmaths sequences, teaching of the **curriculum is highlighted in the termly overview of each class**. The ESSENTIALmaths scheme is used by all classes from years R – 6, though our teachers are empowered to make adaptations when they see fit. The recommended allocation and sequence of units can be found **here**.

Question Quadrant

In order to ensure that our pupils enjoy a rich diet of challenge in their maths, the **Question Quadrant** is used to ensure a wide variety of questions being used; the consideration of open and closed tasks (plus the application of learning to more real scenarios) guide our teachers towards providing a greater depth of task for our learners. The quadrant enables children to think about more real life applications of their skills and the different strategies they could use to solve them. Children in Key Stage 1 will typically be guided by their adult as to how real or open an activity could be, while pupils in Upper Key Stage 2 will actively decide where learning goes on the quadrant, and therefore how their strategies may be adjusted



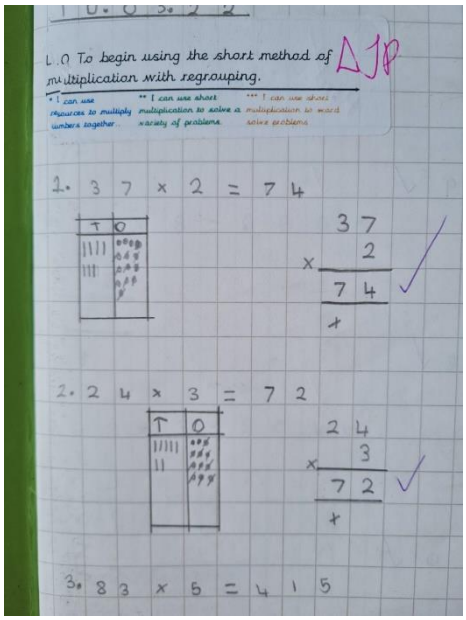


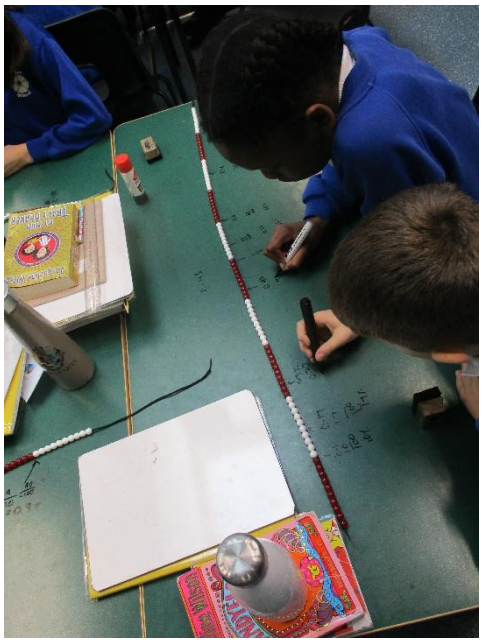
Thematic approach

In line with the National Curriculum 2014, children should be given **opportunities to use their mathematical skills in their wider learning.** Tudor's thematic approach to learning means that children often use their skills in other subjects, including Science, History, Geography, Art, French, PE and Design & Technology. Our full curriculum maps can be found here: KS1, LKS2 and UKS2.

CPA

As part of Tudor's mastery approach and in line with the Essentials sequences, we teach new concepts using **Concrete, Picturial, Abstract (CPA)** progression. We believe that the use of manipulatives and visual models is vital to children being able to grasp more abstract concepts. Though children are taught more abstract concepts as they progress through the school, the presence of these concrete and pictorial materials are still available to support understanding. To quote Jerome Bruner: "*To learn any abstract concept, you must always begin with a concrete representation.*"





Fluency

Subitizing is a term that was coined by the theorist Piaget and defined the ability to instantaneously recognise the number of objects in a small group without the need to count them. It is important to note the philosophy of Bruner highlighted above so the value being looked at should be a concrete or visual representation rather than an abstract number. Both perceptual and conceptual subitizing are taught to the children. Perceptual subitizing relates to the ability to see the number ('it's 8') whilst conceptual subitizing is recognising values due to additional understanding ('it's 8 because there's 2 missing from 10'/' it's 3 and 5'). Subitizing activities take place regularly in the EYFS (and parents are given resources as soon as they start at Tudor) and

there is a focus on children being able to talk about values of numbers rather than simply counting and/ or giving an overall number.

The learning and recall of times tables has been taught through Flurish and TimesTable Rock Stars. Children have regular access to the TTRS app at school and are encouraged to access the app at home for daily practice. All pupils have access to the app in KS2, with Year 2 children beginning to use the platform when appropriate. The regular use of this software has allowed children to improve recall of their tables, translating to a reduced cognitive load during subsequent maths lessons and therefore allowing greater focus on the new concepts.

	10	2	5	3	4	8	6	7	9	11	12
10	10×10	10×2	10×5	10×3	10×4	10×8	10×6	10×7	10×9	10×11	10×12
2	2×10	2×2	2×5	2×3	2×4	2×8	2×6	2×7	2×9	2×11	2×12
5	5×10	5×2	5×5	5×3	5×4	5×8	5×6	5×7	5×9	5×11	5×12
3	3×10	3×2	3×5	3×3	3×4	3×8	3×6	3×7	3×9	3×11	3×12
4	4×10	4×2	4×5	4×3	4×4	4×8	4×6	4×7	4×9	4×11	4×12
8	8×10	8×2	8×5	8×3	8×4	8×8	8×6	8×7	8×9	8×11	8×12
6	6×10	6×2	6×5	6×3	6×4	6×8	6×6	6×7	6×9	6×11	6×12
7	7×10	7×2	7×5	7×3	7×4	7×8	7×6	7×7	7×9	7×11	7×12
9	9×10	9×2	9×5	9×3	9×4	9×8	9×6	9×7	9×9	9×11	9×12
11	11×10	11×2	11×5	11×3	11×4	11×8	11×6	11×7	11×9	11×11	11×12
12	12×10	12×2	12×5	12×3	12×4	12×8	12×6	12×7	12×9	12×11	12×12

Classroom environment

Working walls are used to reduce cognitive load for children, providing support through models and key vocabulary. Our children can use these during lessons to refer back to, empowering them to help themselves and reduce the need for direct adult support. Classrooms have supplies of concrete and supporting resources, in addition to the central store.

Adaptations and inclusion in our implementation

At Tudor we endeavour to ensure every child, no matter what their individual needs or barriers to learning are, has equal access to learning and the same opportunities to achieve. The curriculum is designed to be ambitious and meet the needs of all pupils. In Maths we ensure that children with additional needs are supported, and lessons are adapted to overcome possible barriers to learning in a variety of ways, including:

- Using multi-sensory approaches to teaching and learning, including the use of information and communications technology (ICT)
- Use of visual aids e.g. bar models, part whole models
- Pre teaching

- Over learning/fluency
- Additional adult support
- Resources to support individual physical needs
- Use of learning partners
- Having a variety of resources and materials accessible to all
- Tasks and activities being simplified/adjusted as required
- Alternative ways to record ideas e.g. Seesaw, photographs of whiteboard work, concrete resources
- Scaffolding of tasks e.g. partly completed calculations, multiple choice
- Resources to reduce cognitive load e.g. numberlines, tables grids
- Adapted reasoning opportunities
- Maths workshops
- Maths competitions for more able

More about inclusion at Tudor can be found here.

Progression in our Implementation

Mathematics in Early Years

In Early Years, the development of number sense is key. From the beginning, children use visual and physical representations of the numbers they encounter. There is a huge focus on the value of ten and how ten can be made in different ways. By the end of EYFS, children will have explored manipulating the numbers up to 10, including looking for patterns and counting beyond 20, in line with the Early Learning Goals.

In the EYFS setting, maths is visible at all times, giving children the opportunity practise and hone their learning. This extends to the outdoor area where are extensive opportunities to explore maths in different ways; there are numerous 'self-service' stations when the children can initiate their own maths-based activities. This supports an understanding of maths in the real world and beyond the classroom.

In Nursery, weekly problems are presented to the children predominantly in the 'Maths Area' with the manipulatives required to solve them. Open questions allow the learning to be extended and discussed verbally with the children. Next steps are specifically targeted at those children who require extension.

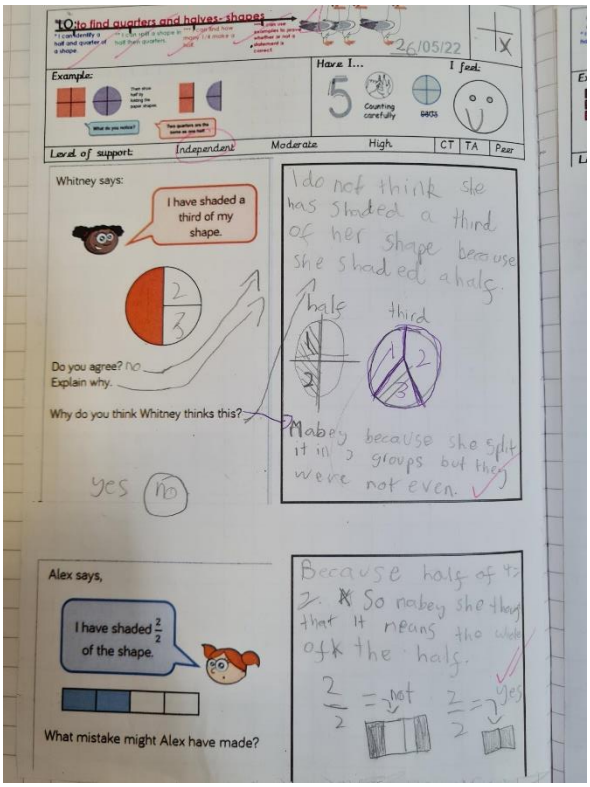
In Reception, we use Essentials sequences to deliver the spiral curriculum; this means that key concepts are regularly revisited and built upon. Adults lead whole class activities where children take a highly active role in their learning. The use of 'multisensory delivery' gives children the opportunity to rehearse their understanding before moving to more independent activities. For three days a week, maths lessons are adult led. For the remaining two days, the

classroom is set up in an exciting game-focused way called 'Maths explorers', where different activities are available for all children to practise their new learning or rehearse prior learning. At different points in the week, selected groups will work with adults as part of an extension 'mastery group', where their understanding can be challenged and deepened. Interventions are delivered from White Rose to support different groups that need to revisit prior learning or overlearn a concept.

Mathematics in KS1

In Years 1 and 2, children continue to use concrete materials to support their learning and number sense. The use of subitizing is built upon from Early years, increasing mental fluency and allowing children to more efficiently and deeply recognize the value of numbers. Numbers, problems and strategies are visualized in a variety of ways including part/whole models, cherry models and numberlines.

In KS1, addition and subtraction progresses from using concrete materials, to visualising numbers using drawings of base 10, to beginning to use a basic and expanded formal method.

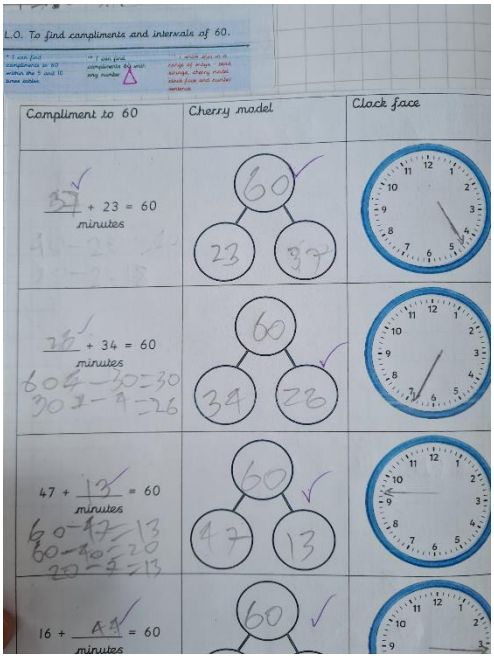


Division begins to be explored as sharing and grouping, including finding fractions of quantities and shapes. Multiplication is visualized as repeated addition and arranging sequences of arrays. Children are taught their 2, 5 and 10 times tables by the time they leave KS1, with many beginning to use Times Table Rockstars in practicing recall.

The core number skills learned are used to explore real world maths through a variety of measures including time, money and statistics. Children use key vocabulary to discuss and sort shapes.

Mathematics in lower KS2

In LKS2, children become more efficient and fluent in calculations using the 4 main operations. More recognizable, expanded, formal methods begin to be



used with the aim of empowering children to confidently use these as part of their problem solving strategies. These expanded routines are reduced to more efficient, short methods. Numbers, problems and strategies continue to be visualized in a variety of ways including part/whole models, cherry models and numberlines.

Through the continued use of CPA, the formal column methods for adding and subtracting numbers are taught and secured. These are then used in scenarios involving greater numbers, making connections between number and a variety of real world measures.

Division and multiplication are taught through CPA, leading to securing formal methods of multiplying/dividing 3-digit numbers by 1-digit numbers; this lays the foundation for progressing to calculating the larger numbers seen in UKS2. Multiplication practice increases both in school and at home to achieve fluency in all tables by the end of year 4. We have used Flurish and TTRS to achieve this.

Shape, time, money, fractions and statistics continue to be explored, using the core skills learned. Reasoning around these areas are demonstrated through real life scenarios where appropriate.

Mathematics in upper KS2

In KS2, larger integers are used in calculations involving all four operations. Children are actively involved in choosing an appropriate strategy, whether mental or written. Models for visualization are built upon to support solving highly abstract concepts and algebraic language is used when appropriate. Formal methods are shortened for greater efficiency. Manipulatives continue to be available to support children in making links to previous learning, particularly when introducing new methods or concepts.

The formal column methods for addition and subtraction are used to answer arithmetic and reasoning questions involving large numbers, working alongside appropriate models to aid problem solving.

Column multiplication is used to multiply up to 6 digit numbers by 2 digit numbers. Fluent and secure times table knowledge is rehearsed through continued practice on Flurish and TTRS. Division progresses from the short 'bus stop' method to long division with 2 digit divisors in Year 6.

Children are taught to recognize and calculate equivalent fractions, decimals and percentages, including calculating these of set amounts. Teaching in geometry, statistics and measures consolidates and extends understanding of core strategies in a wide variety of contexts.

Outside maths workshops are arranged when available, in which all our students take an active role. Annually, a select group of high-attainers from year 5 take part in a county wide competition; this gives them an opportunity to test their problem solving abilities and experience a high degree of challenge.

Impact

Teachers deliver **whole class direct teaching with clear and progressive modelling of concepts and procedures**, with sequences of varied examples. The consistent use of core manipulatives and representations supports ability to access learning and to deepen children's understanding, based on the prior learning.

Regular rehearsal of core facts and strategies through the development of frequent 'intelligent rehearsal', including practice of times tables through TTRS and Flurrish.

Rich mathematical talk is given high status and supported by the learning environment and teachers' questioning. Children are actively encouraged to explain their thinking using key mathematical vocabulary.

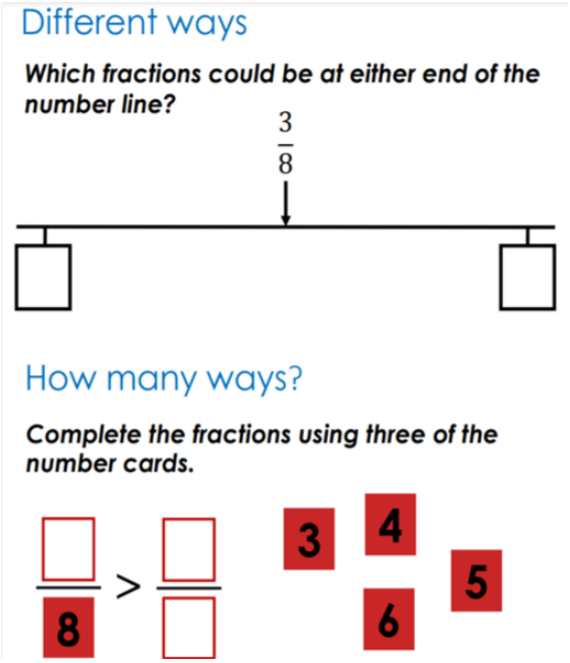
Emphasis placed on **'learning' through reasoning,** developing multiple strategies and concepts towards understanding. Our pupils are challenged so that they 'grapple' with learning mathematical concepts. Challenge for those pupils that grasp concepts quickly is provided through **depth and breadth of experience**; open questions and challenges mean that high-attainers are given the chance to demonstrate their understanding.

There are **regular opportunities to reason and problem solve** either independently, as a small group or as a class. Discussion and challenge is encouraged.

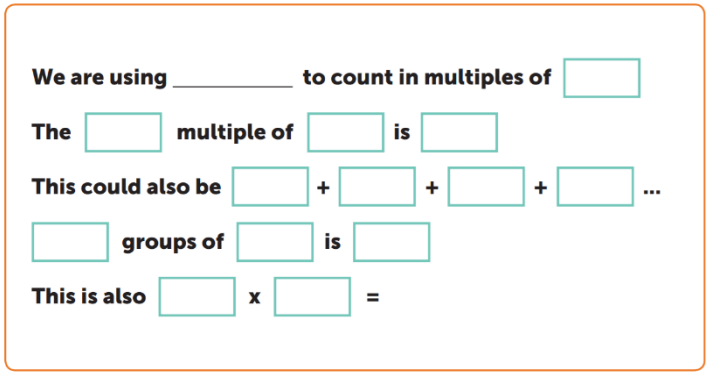
Resources

We employ a variety of resources to aid the delivery of our maths curriculum, whilst remaining true to the Essentials sequences that form the spine of our planning. These ensure that teachers have the ability to 'cherry pick' and provide bespoke, high-quality learning opportunities for our children in a variety of contexts and formats. These include:

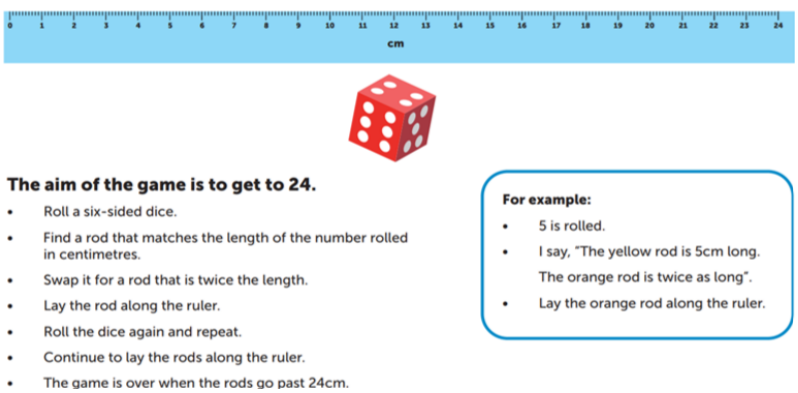
Iseemaths – open questions



ESSENTIALmaths – typical speaking frame

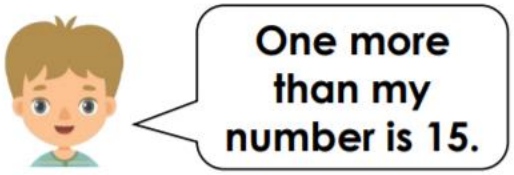


ESSENTIALSmaths – open/real game



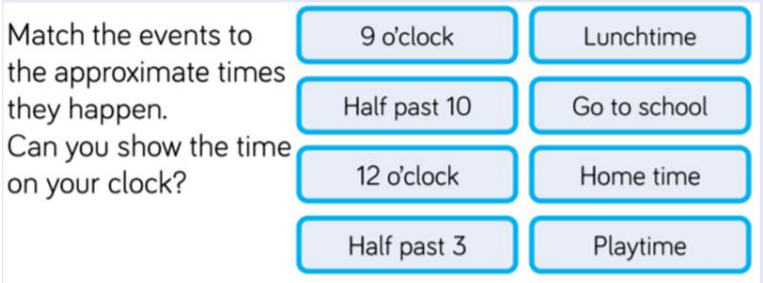
ClassroomSecrets – example reasoning question

6b. Dan is thinking of a number.



What is Dan's number? Explain your answer.

White Rose – Real question



<u>Other resources used:</u>

- CGP
- Twinkl
- Flurrish/Timestables Rockstars (see above)
- GCP targeted question books used for homework tasks