Teaching and Learning Handbook Maths

September 2021

Contents

Overview

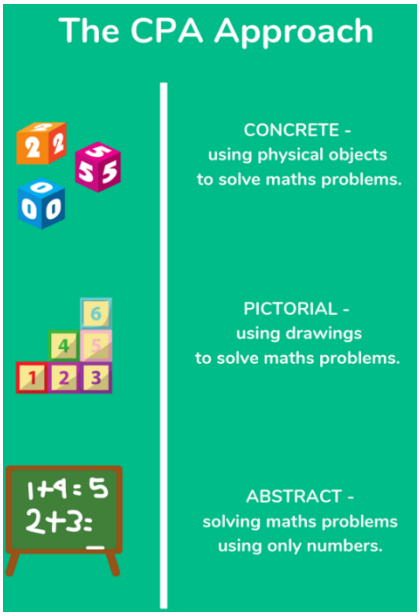
The national curriculum for mathematics aims to ensure that all pupils:

- ✓ 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

We believe:

All children can succeed in mathematics. We want every child to be ready to access the secondary curriculum by the time they leave Year 6. This means that they will be fluent in mathematics (have automaticity in key number facts); have good problem-solving and reasoning skills. They will achieve age-related expectations or greater depth where they are capable of achieving this.

The school's curriculum overview is based on the national curriculum and follows a mastery approach. This means that pupils should acquire a deep, long-term understanding of the maths that enables them to move onto more complex maths. Each learning journey encompasses previously learnt knowledge to highlight the relational nature of mathematics. We use White Rose as our core learning resource- using their teaching slides and questions to ensure consistency across the school. White Rose is structured into small steps that children need to master in order to progress onto more challenging lessons. Alongside this, we use Maths No Problem and NCETM resources to provide high-quality questions and materials to enable all children to access mathematical learning. Ready to Progress materials (RTP) materials are used with small groups to review, practise and consolidate learning.



Pupils are introduced to a new mathematical concept through the use of **concrete** resources (e.g. fruit, Dienes blocks, place value counters etc). When they are comfortable solving problems with physical aids, they are given problems with pictures – usually **pictorial representations** of the concrete objects they were using.

Then they are asked to solve problems where they only have the **abstract** i.e. numbers or other symbols.

Building these steps across lessons helps pupils better understand the relationship between numbers and the real world, and therefore helps secure their understanding of the mathematical concept they are learning.

Individual learning approaches are respected.

- ✓ Children will be provided with the necessary means to fully access appropriate learning as independently as possible.
- ✓ Students often develop efficient strategies of their own and will be encouraged to use these alongside the methods taught in school.

In developing key mathematical skills alongside fluency.

- ✓ Manipulating materials and drawing diagrams are essential mathematical skills and represent stages of learning which must be acquired before moving towards abstract written notation.
- ✓ Estimation is described by top mathematicians as the most important mathematical skill. Number flexibility and mental calculation strategies are essential for effective estimation and calculation (See Guided Maths Guidance).
- ✓ Other key skills are looking for patterns, making models, drawing pictures or diagrams, working with others, guessing, checking and improving, acting out the problem, producing lists and tables, working systematically, reasoning logically, trying simpler cases, working backwards…

PLANNING

LONG TERM PLANS

Long-term plans indicate when each topic is taught throughout the year, with core knowledge (Place Value and Number, Addition and Subtraction, Multiplication and Division, Fractions) given priority and revisited each year. The order of units is based on the White Rose yearly overviews.

YEAR 3 OVERVIEW

AUTUMN	Number: Place Value **3 weeks**	Number: Addition and subtraction **5 weeks**		Number: Multiplication and division **4 weeks**
SPRING	Number: Multiplication and division **3 weeks**	Measurement: Money **1 week**	Statistics **2 weeks**	Measurement: Length and perimeter **3 weeks**	Number: Fractions **2 weeks**
SUMMER	Number: Fractions **3 weeks**	Measurement: Time **3 weeks**	Geometry: Properties of shape **2 weeks**	Measurement: Mass and capacity **3 weeks**

YEAR 4 OVERVIEW

AUTUMN	Number: Place Value **4 weeks**	Number: Addition and subtraction **3 weeks**	Measurement: Length and perimeter **2 weeks**	Number: Multiplication and division **3 weeks**	
SPRING	Number: Multiplication and division **3 weeks**	Measurement: Area **1 week**	Number: Fractions **4 weeks**	Number: Decimals **3 weeks**	
SUMMER	Number: Decimals **2 weeks**	Measurement: Money **2 weeks**	Measurement: Time **2 weeks**	Statistics **1 week**	Geometry: Properties of shape **2 weeks**	Geometry: Position and direction **2 weeks**

YEAR 5 OVERVIEW

AUTUMN	Number: Place Value **3 weeks**	Number: Addition and subtraction **2 weeks**	Statistics **2 weeks**	Number: Multiplication and division **3 weeks**		Measurement: Perimeter and area **2 weeks**
SPRING	Number: Multiplication and division **3 weeks**	Number: Fractions **6 weeks**			Number: Decimals and percentages **2 weeks**	
SUMMER	Number: Decimals **3 weeks**	Geometry: Properties of shape **3 weeks**	Geometry: Position and direction **2 weeks**	Measurement: Converting units **2 weeks**	Measurement: Volume **1 week**	

YEAR 6 OVERVIEW

AUTUMN	Number: Place value **2 weeks**	Number: Addition and subtraction Multiplication and division **5 weeks**			Number: Fractions **4 weeks**		Geometry: Position and direction **1 week**
SPRING	Number: Decimals **2 weeks**	Number: Percentages **2 weeks**	Number: Algebra **2 weeks**	Measurement: Converting units **1 week**	Measurement: Perimeter, area and volume **2 weeks**	Number: Ratio **2 weeks**	
SUMMER	Statistics **2 weeks**	Geometry: Properties of shape **3 weeks**	SATs week	STEM projects Getting ready for secondary maths Transition units (topics to be confirmed)			

PLANNING

The majority of maths planning will be stored on Staffshare/2021-2022/Year Group/Maths. Each year group should also have a 'working' folder to hold any paper documents related to maths.

Each Staffshare year group folder should contain:

- ✓ The yearly overview (from White Rose)

YEAR 5 OVERVIEW

AUTUMN	Number: Place Value **3 weeks**	Number: Addition and subtraction **2 weeks**	Statistics **2 weeks**	Number: Multiplication and division **3 weeks**	Measurement: Perimeter and area **2 weeks**	
SPRING	Number: Multiplication and division **3 weeks**	Number: Fractions **6 weeks**		Number: Decimals and percentages **2 weeks**		
SUMMER	Number: Decimals **3 weeks**	Geometry: Properties of shape **3 weeks**	Geometry: Position and direction **2 weeks**	Measurement: Converting units **2 weeks**	Measurement: Volume **1 week**	

Planning Folder

There should be a separate folder for each unit taught which is subdivided so that there is also a separate folder for each lesson.

For each unit taught:

- ✓ The unit overview (this can be snipped from White Rose)

Year 5 - Autumn Block 2 - Addition & Subtraction

Recap Add two 4-digit numbers - one exchange
Recap Add two 4-digit numbers - more than one exchange
Add whole numbers with more than 4 digits (column method)
Recap Subtract two 4-digit numbers - one exchange
Recap Subtract two 4-digit numbers - more than one exchange
Subtract whole numbers with more than 4 digits (column method)
Round to estimate and approximate
Inverse operations (addition and subtraction)
Multi-step addition and subtraction problems

- ✓ The Scheme of learning should also be saved in the unit planning folder.

This is a really useful document, as it contains notes and guidance for each lesson and examples of questions to develop mathematical talk during class input.
See example below.

Notes and Guidance

Building on their experiences in Year 3, children use their knowledge of subtracting using the formal column method to subtract two 4-digit numbers.

Children explore subtractions where there is one exchange. They use place value counters to model the exchange and match this with the written column method.

Mathematical Talk

When do we need to exchange in a subtraction?
How do we indicate the exchange on the written method?

How many bars are you going to use in your bar model?
Can you find out how many tokens Mo has?
Can you find out how many tokens they have altogether?

Can you create your own scenario for a friend to represent?

- ✓ Teaching slides are the planning for each lesson. These PowerPoints should be saved for each lesson in the planning folder for that unit and annotated where necessary.

TA GUIDANCE SHEET

- ✓ TAs should have a copy of the lesson plan in advance, as well as the following guidance sheet that will indicate their role and focus children for that lesson. A copy can be found on Staffshare in Maths 21 folder.

Children are learning to							**Focus children**
Most effective working strategies as applicable.							
Resource	**Model**	**Method**	**Problem-solving strategy**				
Cubes	Number line	Informal	Act out the problem				
Counters	Bar model		Draw or build the problem				
Base 10	Whole-part model		Look for patterns and relationships				
Numicon	Proportion squares		Work backwards				
Cuisenaire rods	Percentages model	Formal	Draw pictures, graphs, tables				
			Estimation and check				
			Try an easier example				
			Eliminate unneeded information				
Redirect child to red task if							
Prioritise feedback on							
Resources used	Model used	Choice of method	Problem-solving strategy suggestion	Planning	Checking	Evaluating	

Working Planning folder

Included in your 'paper' folder should be:

- Yearly overview
- The unit overview
- The scheme of learning which should be annotated as necessary, with key points to remember (such as anything that was done differently or if more time was needed, reasons why slides/calculations were done in a particular order etc.), focus children identified for pre-teaching or support in a lesson
- TA guidance sheets for each lesson

INDEPENDENT WORK

The White Rose worksheet for each lesson will form the BLUE task questions that are aimed at those working at age-related expectations.

YELLOW task questions will come from the 'reasoning and problem-solving' document for that unit, and from the reasoning and problem-solving section of the Scheme of Learning

Questions should be snipped from the appropriate documents and included in the planning folder for that unit of work.

LEARNING OBJECTIVES

These should be provided for each small step (lesson) and provide any information or models that pupils need to be successful with the new learning in the lesson.

They should include (as below):

- ✓ learning objective in child friendly language
- ✓ date
- ✓ unit that is being taught
- ✓ information needed for the lesson; which can take the form of:
  - prior knowledge that should have been remembered, REMEMBER ….
  - top tips for new learning (also things to remember, such as lining up digits)
  - vocabulary definitions where appropriate
  - CHOOSE FROM…. different strategies/models for calculations
  - WAGOLL – example of how to solve a particular type of problem

The LO may contain one or more of these.

See the example below.

FRACTION 3a 18/01/21

LO: convert improper fractions to mixed numbers

REMEMBER that there are 3 types fractions.

$\frac{5}{3}$ is an **improper fraction** because the fraction is greater than 1 and the numerator is <u>greater than or equal to the denominator.</u>

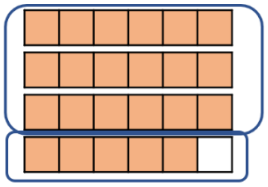
$\frac{5}{3}$ can also be written as $\mathbf{1\frac{2}{3}}$ which is a **mixed number** – it is made up from a whole number and a fraction.

WAGOLL: ***Convert the improper fraction to a mixed number.***

$\frac{23}{6}$ *is the same as* $23 \div 6$

23 ÷ 6 = 3 r 5 We can make 3 wholes and there are 5 parts left over and each part is equal to $\frac{1}{6}$.

So $\frac{23}{6} = 3\frac{5}{6}$



$\frac{23}{6} = \boxed{3\frac{5}{6}}$

STRUCTURE OF LEARNING

Questioning

Questioning throughout the lessons is used to challenge and deepen the understanding of the mathematics being taught.

Key questions used are:

- ✓ What is the same? What is different?
- ✓ Give me an example of … and another … and another.
- ✓ Give me an example of … which is also an example of …
- ✓ What if I change …?
- ✓ If I know … what else do I know?
- ✓ If I know … what else can I work out?

Variable grouping

Lesson inputs are structured using the small step PowerPoints from the White Rose resources and adapted to suit the needs of the learners.

Each teacher sets adaptive tasks suited to children working within the age-related standards (blue task) and at greater depth (yellow task). The learning is further broken down for those children who need more structure and scaffolding to move onto the expected level (red for blue task).

Red for blue	**Blue**	**Yellow**
Children who require support or scaffolding to answer the question and work towards working independently on the blue questions. ⬇ This is a **teacher-led session** that starts at the point the learning is secure and uses scaffolding and concrete resources to be able to independently start the blue questions.. *The pre-assessment should help identify those children and the gaps and where necessary, pre-teaching to address this happens before the start of the unit; and sometimes consolidated with some adult support during the lesson. This can include clear explanation of the learning using a carefully selected range of concrete and pictorial models and links to previous learning in the unit made explicit.*	Children who can solve the problem, but who need to become more efficient or explore the conceptual structure further. ⬇ These children will be part of the lesson input and will start on question 1 of the **blue questions** which will include opportunities for fluency, problem-solving and reasoning. *The expectation is that children will complete all the blue questions in a lesson.* .	Children who have shown that they understand the concept being taught and so do not need to be part of the whole class input. ⬇ These children will start immediately after the warm-up on the **blue questions, moving onto the yellow questions** when completed and corrected if necessary. *Answers are provided to allow self-marking and no disruption of the input. Answers should not show all working, it is good practice for the children to find and correct their own errors.*

Role of the teacher

During the lesson, the teacher provides feedback at the point of learning.
Student's work is used to draw out key ideas, misconceptions and discussion is used to build links in their understanding.
Discussions should:

- provide opportunity for children to discuss the key ideas and links they need to correct their work and move on.
- support to model problems clearly, understand the vocabulary and use more efficient calculation methods, reasoning and start to draw out generalisations by looking for patterns.
- challenge children to make clear links between the expected learning and their task using generalisations (where appropriate), justifying their ideas mathematically using models and symbol notations as well as the correct mathematical vocabulary.

FEEDBACK

Point of learning feedback is the most effective method of improving outcomes for children.
Effective on-the-spot marking comments:

- Explain why you think this
- Find and fix error(s)
- Add more detail
- Prove that you are correct

Children need time to act upon feedback. Allow students to discuss feedback with others; ask the teacher / a peer for clarification or write notes on what they need to do next.

REPRESENTATIONS AND MODELS

Representations are examples or images of mathematics in real contexts; for example, measurements and money represent decimal numbers. Children should work with concrete and pictorial representations before using visual models.

Models are visual representations of mathematical structure. It can be built using practical materials or drawn. Students should be able to implement this in their independent work. A good model represents key mathematical concepts in multiple contexts. ALL children should be encouraged to use and draw models as part of their reasoning and explanations.

Key drawn models are:

- ✓ Number line – Blank to use with post-its and numbered
- ✓ Whole-part bar model - additive and multiplicative relationships
- ✓ Ratio / comparison bar model
- ✓ Multiplicative relationship 4-squares (including proportion and fractions)
- ✓ Percentage model (Years 5 & 6)
- ✓ Gattegno place value chart (Year 5 & 6)
- ✓ Place value grid
- ✓ Arrays then rectangles for multiplicative relationships
- ✓ Fraction wall

Useful modelling materials, which should be readily available in the classroom, are:

- Numicon
- Cuisenaire rods
- Cubes
- Counters
- Dienes
- Bead strings
- Unstructured (blank) number lines

Other materials that can be made available according to the learning journey include:

- Dice
- Money
- Shapes
- Measuring equipment for length, mass and volume
- Clocks
- Digit cards
- Place value cards
- Sorting circles

WORKING WALLS

The working wall always shows:

- ✓ the unit theme and learning journey
- ✓ relevant vocabulary and definitions for the learning journey
- ✓ representations and models relevant to the lesson / unit
- ✓ a place value grid which are always displayed, and in year 3, a hundred square as well
- ✓ WAGOLL – an example of the sort of question they should be able to answer by the end of the unit.
- ✓ WAGOLL – an example of excellent student work both mathematically and in terms of the quality of presentation from the unit

ASSESSMENT

Pre-unit assessments

Pre-unit assessments are used to diagnose individual and class areas for development before a unit begins.

- Printed on green paper.
- They should be completed at least a week before the start of the unit so that pre-teaching can take place to ensure that foundational knowledge is secure.
- There should be a maximum of 5 questions for the assessment.
  Questions could be found from:
  - ✓ White Rose- the end of block assessment from the previous year for that unit.
  - ✓ RTP document
  - ✓ Baseline assessment for that unit on Twinkl
- Pupils are given 20 minutes to complete the assessment. The assessment is stuck into pupils' books on a new page to indicate the start of the unit.
- Pre-assessments should be discussed with the Maths lead before giving to children.

Post-unit assessments

The post-unit assessment uses the same format but is a check of the learning from the unit as opposed to foundational knowledge. It is printed on yellow paper. The assessment is stuck into pupils' books on a new page to indicate the end of the unit.

Pupils are given an opportunity to correct their work and demonstrate their understanding after the post-unit assessment has been completed. Corrections should be completed in purple pen.

Formative Assessment

Good formative assessment takes place at the point of learning and during a lesson; it is evident in the path each learner takes, neither too easy nor too hard, and the progression of learning within and from step to step.

- Start from where the learner is, allowing time to incorporate new ideas into existing understanding, taking all student questions and responses seriously, talking through inconsistencies and challenges.
- Students must be actively learning; make sure you have time to observe.
- Students need to talk about their ideas as a whole class and in peer groups, so they can construct their understanding of the language of mathematics.
- Students must understand the learning objective (what they are learning and how it links to the previous lesson and prior knowledge). A WAGOLL models the expected quality of work and thinking but will not ensure progress alone. Students need to actively discuss and judge the quality of their own and their peers' work. Together this will enable students to take responsibility for their own learning.
- Feedback should tell pupils how to improve: comment on the work, not the student. Highlight strengths and weaknesses in a piece of work and show how to improve it. This way students will learn from their mistakes.

Recording AfL

At the end of each lesson, the learning objective is highlighted in pink if it has been achieved and in green if it has not. Sometimes it is necessary to only highlight part of the objective as achieved.

This should be used to inform the starting points for learners at the start of the next lesson.

Summative Assessment

The tests are marked and scores submitted as percentages across all 3 papers. This test score is then compared with the teacher assessment.

Summative assessment data takes two forms, both of which are recorded on OTrack:

- Percentage score from summative test.
- Progress arrows and teacher assessment of attainment.

An evidence-based assessment is then used to indicate each child's position in relation to the end of year expectations.

Rising Stars arithmetic tests are taken fortnightly by each year group as part of low-stakes testing opportunities. From this, the children edit their Target 30 target sheet. Their score identifies how many more marks the child needs in the following test when working towards their overall score (this is around 75% of the total number of marks for the paper).

STUDENTS WITH ADDITIONAL NEEDS

Beyond the adaptations put in place for individual needs, there are several keys to success for students with additional needs.

- ✓ Clear, consistent use of practical and visual models.
- ✓ Precise vocabulary used consistently.
- ✓ Making explicit when mathematical and general definitions of the same word do not align. The word 'difference' is the most common source of problems.
- ✓ Opportunities to talk with their peers and share ideas.

Targets for maths are written so that they fit with the learning and are taken from the KPIs in the relevant Programme of Study that the child is currently working at.