



Mathematics

Intent of the Mathematics Curriculum

At Abbots Farm Junior School, our mathematics curriculum follows the Programme of Study and Aims of the National Curriculum.

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.

Aims

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.

Our vision for Mathematics

- To promote a positive attitude towards mathematics in all pupils
- To ensure all pupils are engaged in and are enjoying exploring Mathematics
- To enable all pupils to find links between mathematics and other areas of the curriculum, including Science
- To ensure all pupils progress in mathematics and are challenged appropriately through an in depth understanding
- To use a wide range of concrete, pictorial and abstract representations to develop all pupils' relational understanding of mathematics
- To ensure all pupils are confident using mathematical vocabulary when reasoning about mathematics
- To promote resilience in all pupils, particularly when Problem Solving

Roles and Responsibilities

The Maths leader is responsible for keeping up to date with the latest developments in Maths education, and to share these with staff and pupils when appropriate. They are responsible for implementing the whole school vision and advise and support staff with continuing professional development and support with planning. They also ensure that maths resources are kept well-stocked and are relevant to the planning. They monitor provision of maths and pupils' progress and contribute to the strategic development of learning in school.

Year group teams are responsible for ensuring maths units are taught in the order set out on the long-term plan and for ensuring that all National Curriculum objectives are taught in a carefully planned and progressive way. Staff are responsible for providing challenge and support to those that need it, based on prior knowledge of the children and regular formative assessment in lessons. They are also responsible to assessing pupils throughout lessons and end of term Summative Assessments.

The governors are responsible for discussing maths provision with the Curriculum Lead as part of the wider curriculum and allocating some governors to monitor the provision, its strengths and areas for development when required, and for reporting these to wider the governing body.

Cross-curricular links

Science

Science contributes to the teaching of mathematics in a number of ways. The children use weights and measures and learn to use and apply number. Through working on investigations, they learn to estimate and predict. They use numbers in many of their answers and conclusions. Statistics can be developed through creating graphs and analysing the data.

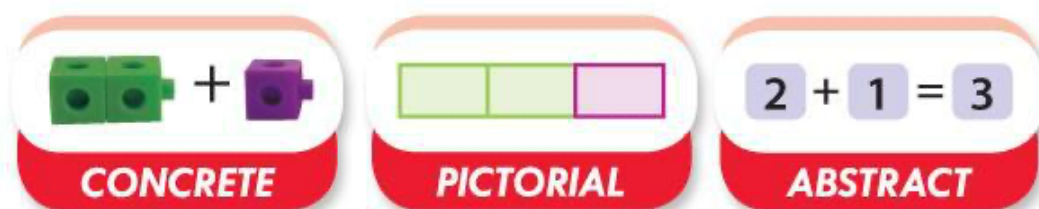
Computing

Children use ICT in maths lessons where appropriate. They use it to support their work in maths by learning how to find, select and analyse information on the internet. Children use ICT to record, present and interpret data and to review, modify and evaluate their work and improve its presentation.

Implementation of the Mathematics Curriculum

Teaching and Learning

The teaching and learning of mathematics at Abbots Farm Junior School Primary should, where appropriate, include aspects of the following strategies in lessons and/or over a series of lessons:



Concrete, pictorial, abstract (CPA) is a highly effective approach to teaching that develops a deep and sustainable understanding of maths.

CONCRETE

Concrete is the “doing” stage, using concrete objects to model problems. Instead of the traditional method of mathematics teaching, where a teacher demonstrates how to solve a problem, the CPA approach brings concepts to life by allowing pupils to experience and handle physical objects themselves. Every new abstract concept is learned first with a “concrete” or physical experience.

For example, if a problem is about adding up four baskets of fruit, the pupils might first handle actual fruit before progressing to handling counters or cubes which are used to represent the fruit.

PICTORIAL

Pictorial is the “seeing” stage, using representations of the objects to model problems. This stage encourages pupils to make a mental connection between the physical object and abstract levels of understanding by drawing or looking at pictures, circles, diagrams or models which represent the objects in the problem.

Building or drawing a model makes it easier for pupils to grasp concepts they traditionally find more difficult, such as fractions, as it helps them visualise the problem and make it more accessible.

ABSTRACT

Abstract is the “symbolic” stage, where pupils are able to use abstract symbols to model problems. Only once a child has demonstrated that they have a solid understanding of the “concrete” and “pictorial” representations of the problem, can the teacher introduce the more “abstract” concept, such as mathematical symbols. Pupils are introduced to the concept at a symbolic level, using only numbers, notation, and mathematical symbols, for example $+$, $-$, \times , $/$ to indicate addition, subtraction, multiplication, or division.

What is Fluency?

Fluency comes from deep knowledge and practice. This is the first stage of pupil’s understanding.

Fluency includes: conceptual understanding, accuracy, rapid recall, retention and practice

Accuracy – Pupils carefully completing calculations with no or few careless errors.

Pace – Pupils are able to quickly recall the appropriate strategy to solve the calculation and progress through a number of questions at an age appropriate pace.

Retention – Pupils will be able to retain their knowledge and understanding on a separate occasion, away from the point of teaching from when the concept was first introduced. The key to fluency is deep knowledge and practice and making connections at the right time for a child.

What is Reasoning?

Verbal reasoning demonstrates that pupils understand the mathematics. Talk is an integral part of mastery as it encourages students to reason, justify and explain their thinking. This is tricky for many teachers who are not used to focusing on verbal reasoning in their mathematics lessons. You might, for example, get young learners to voice their thought processes. Older students could take part in class debates, giving them the space to challenge their peers using logical reasoning.

What is Problem Solving?

Mathematical problem solving is at the heart of the Mastery Approach. Pupils are encouraged to identify, understand and apply relevant mathematical principles and make connections between different ideas. This builds the skills needed to tackle new problems, rather than simply repeating routines without a secure understanding.

Number:

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

Planning should aim for all pupils to master the age group expectations of the National Curriculum by including rich, deep activities. Rapid graspers should not be accelerated through concepts, instead they should complete Challenge questions from NCETM, ISeeReasoning etc

Mathematical Talk

A maths classroom should never be a quiet classroom. The way pupils speak and write about mathematics transforms their learning. Abbots Farm Junior School approaches a carefully sequenced, structured approach to introduce and reinforce mathematical vocabulary and understanding.

To encourage talk in mathematics, teachers may introduce concepts by including sentence structures (stem sentences). Pupils should be able to say not just what the answer is, but how they know it's right and what method they used to find their answer. This is key to building mathematical language and reasoning skills. This gives pupils the confidence to communicate their ideas clearly, before writing them down.

Example Stem Sentences:

The denominator is 5 because the whole has been divided into 5 equal parts.

The numerator is 3 because 3 equal parts have been shaded/circled.

Teachers then maintain a high expectation upon pupils to repeat and use the correct mathematical vocabulary to explain their understanding verbally and in their reflection comments. By also displaying the vocabulary during the lesson, pupils will be able to use this independently.

When questioning and encouraging mathematical talk, teachers should provide regular, purposeful opportunities. For example:

- I do, we do, you do
- Show me how to complete the calculation
- Teach your friend how to complete the calculation
- How do you know which operation to use?
- Why have you chosen this method?
- How else can you represent this number?
- What have you learnt today?
- True or False
- Odd one out
- Sometimes, always, Never

Mathematical concepts are explored in a **variety** of representations and problem-solving contexts to give pupils a richer and deeper learning experience. Pupils combine different concepts to solve complex problems, and apply knowledge to real-life situations. Through problem solving, pupils are required to select their mathematical understanding and apply this to a new concept.

Teaching and Learning – Lesson Structure

‘The expectation is that the majority of pupils will move through the programmes of study at broadly the same pace. However, decisions about when to progress should always be based on the security of pupils’ understanding and their readiness to progress to the next stage.

Pupils who grasp concepts rapidly should be challenged through being offered rich and sophisticated problems before any acceleration through new content. Those who are not sufficiently fluent with earlier material should consolidate their understanding, including through additional practice, before moving on.’ (National Curriculum)

Lesson Structure

All mathematics lessons at Abbots Farm Junior School follow the following structure:

- Opening Activity/flashback four – to promote fluency of arithmetic and the Non-negotiable concepts as well as previous learning a series of quick questions covering something from the previous lesson, last week and then topics from earlier in the year – maybe even last year!
- Introduce New Learning
- Reflective Plenary (Red Pen – KS2)

Starter Activity – to promote fluency of arithmetic

The purpose of this activity is to promote fluency of arithmetic and enable pupils to recap on the ‘Non-Negotiable’ aspects of mathematics.

Reflection time

At the end of each lesson, all pupils should have made progress by learning a new technique, gaining an improved understanding of a concept or being able to complete a new activity.

This new learning/progress should be evidenced by writing a purple pen comment (KS2 and Year 2) or by drawing a self-assessment image (Year 1).

NB: It is important, particularly at the start of the year, to model writing a reflective red pen edit/comment to ensure a consistent, detailed response which includes mathematical vocabulary.

Examples:

Today I have learned that percentages are always out of 100 and so I can create an equivalent fraction with 100 as the denominator.

I now know that when I multiply by 10 all of the digits move up one place value column and when multiplying a whole number, I need to introduce a place holder.

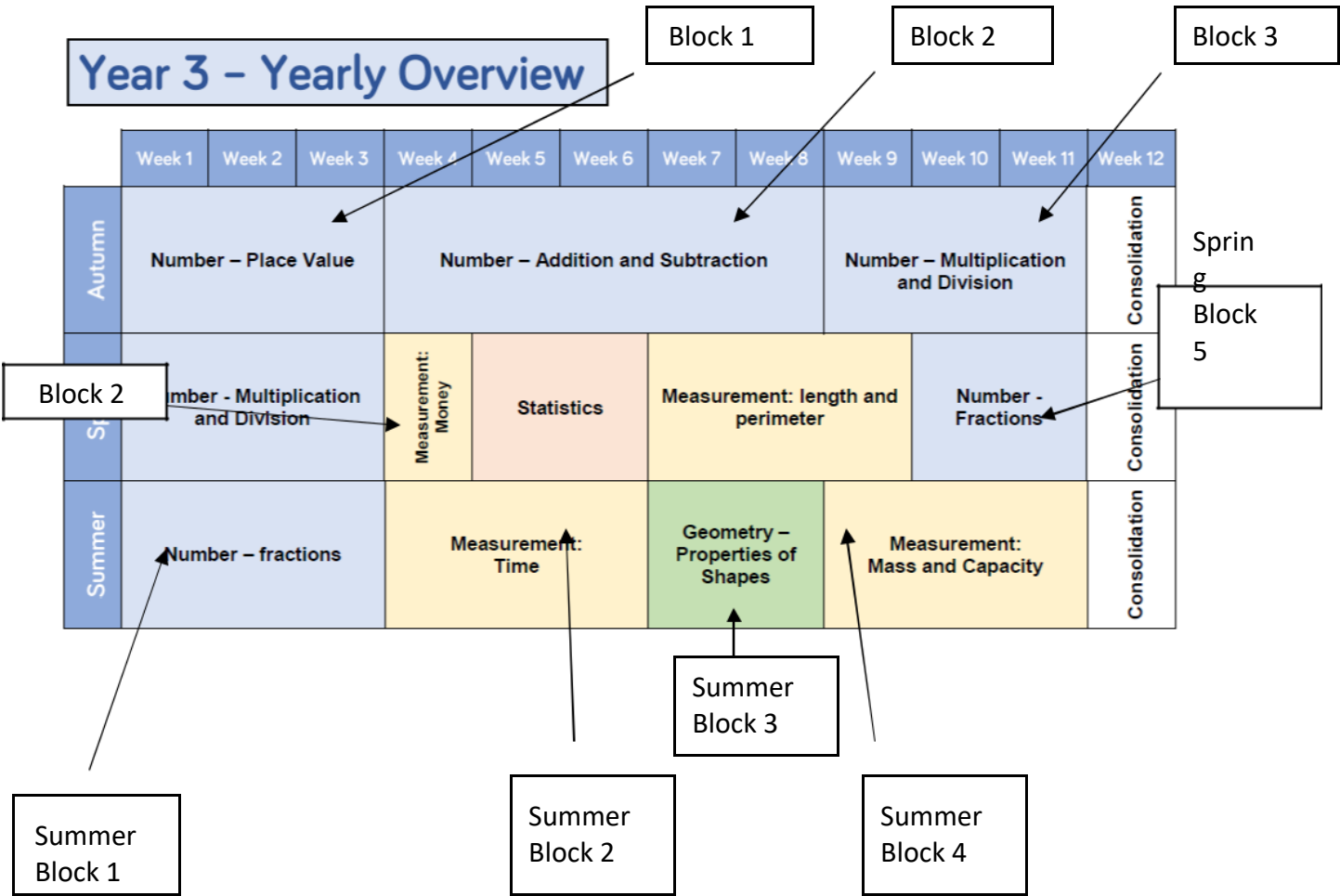
Planning

At Abbots Farm Junior School, Teachers follow the White Rose Planning. This provides the yearly overview and Medium Term planning for each year group. For calculation, Abbots Farm Junior School’s calculation Policy, which follows the Whiterose Calculation Policy. Alongside planning and to develop

understanding and vary the type of questions and representations, teachers use resources from other mathematical websites. Such as:

- Classroom secrets
- NRich
- NCETM
- Grammarsaurus
- Deepening Understanding

The **yearly overview** provides a Long Term Plan and is arranged into ‘**Blocks**’



Each term, the Learning Objectives are listed and are time related to ensure coverage and pace

Year 3 – Spring Term

Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
<u>Number – multiplication and division</u> 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 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 objectives.			<u>Measurement – money</u> Add and subtract amounts of money to give change, using both £ and p in practical contexts.	<u>Statistics</u> 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.		<u>Measurement – length and perimeter</u> <u>Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml).</u> Measure the perimeter of simple 2D shapes.			<u>Number – fractions</u> 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 and use fractions as numbers: unit fractions and non-unit fractions with small denominators. Recognise, find and write fractions of a discrete set of objects: unit fractions and non-unit fractions with small denominators. Solve problems that involve all of the above.		
Consolidation											

Within the planning documents, there are notes and guidance, Mathematical Talk (including Stem Sentences) and examples of how to show Varied Fluency, Reasoning and Problem Solving.

Comparing Statements

Notes and Guidance

Children use their knowledge of multiplication and division facts to compare statements using inequality symbols.

It is important that children are exposed to a variety of representations of multiplication and division, including arrays and repeated addition.

Mathematical Talk

What other number sentences does the array show?

If you know $4 \times$, how can you use this to work out your $8 \times$?

What's the same and what's different about 8×3 and 7×4 ?

Varied Fluency

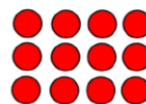
1 Use the array to complete the number sentences:

$3 \times 4 = \square$

$4 \times 3 = \square$

$\square \div 3 = \square$

$\square \div 4 = \square$



2 Use $<$ $>$ or $=$



$\square \times \square = \square$

$\square \times \square = \square$

8×3

7×4

$36 \div 6$

$36 \div 4$

3 Complete the number sentences:

$5 \times 1 < \square \times \square$

$4 \times 3 = \square \div 3$

Comparing Statements

Reasoning and Problem Solving

Shadya says,



8×8 is greater than 4×8 twice

Do you agree?

Can you prove your answer?

Possible answer: She is wrong because they are equal.



True or false

- $6 \times 7 < 6 + 6 + 6 + 6 + 6 + 6 + 6$
- $7 \times 6 = 7 \times 3 + 7 \times 3$
- $2 \times 3 + 3 > 5 \times 3$

- False
- True
- False

Can you find three different ways to complete each number sentence?

$\square \times 3 + \square \times 3 < \square \div 3$

$\square \div 4 < \square \times 4 < \square \times 4$

$\square \times 8 > \square \div 8 > \square \times 8$

Possible answers:

- $1 \times 3 + 1 \times 3 < 21 \div 3$
- $1 \times 3 + 1 \times 3 < 24 \div 3$
- $1 \times 3 + 1 \times 3 < 27 \div 3$
- $1 \times 3 + 2 \times 3 < 30 \div 3$
- $24 \div 4 < 8 \times 4 < 12 \times 4$
- $16 \div 4 < 5 \times 4 < 7 \times 4$
- $8 \div 4 < 3 \times 4 < 4 \times 4$
- $4 \times 8 > 88 \div 8 > 1 \times 8$
- $2 \times 8 > 80 \div 8 > 1 \times 8$
- $6 \times 8 > 96 \div 8 > 1 \times 8$

A range of these questions should be completed by pupils as appropriate and evident in the pupils' mathematics books – 'Snipping Tool' is an excellent program on the school computers to help teachers to create this resource for all pupils.

Calculation Policy

Abbots Farm Junior School's Calculation Policy is on the school website.

The policy should be followed when teaching written methods. The policy demonstrates our approach and shows progression through each operation for each stage of learning.

Times Tables

Times Tables are a mathematics 'Non-negotiable' and must be **taught** and then **practised**. TT Rockstars is available for the practice of times tables.

We teach times tables using the following progression:

Year 3 - Be able to recall 2, 3, 4, 5, 8 and 10 multiplication and division facts

Year 4 - Be able to recall 6, 7 and 9 multiplication and division facts

Year 5/6 - application of multiplication and division facts to problem solving

NB: All times tables to be learnt up to 12 x 12

From 2019/2020 Year 4 pupils will take an online Times Table test which will be a timed assessment testing their speed of recall for multiplication

TT Rockstars

TT Rockstars is an initiative for all pupils. It is a fun way to practise times tables.

*The 'Sound Check' programme on TT Rockstars follows the exact structure of the 2020 Year 4 Times Table Test.

Resources

When resourcing and planning using the White Rose Planning, teachers to also choose resources which complement it and follow the Whiterose planning. Teachers have the flexibility to choose resources they feel are most effective to support the needs of all learners (differentiation) and ensure they achieve the aims of fluency, reasoning and problem solving.

Resources are kept online, in classrooms and in the mathematics cupboard

- A range of 'Concrete' manipulates e.g. fraction walls, counting beads, place value counters etc.
- White Rose planning materials, lesson slides and resources
- A range of mathematical websites such as: Classroom secrets, Testbase, NRich, NCETM, Grammarsaurus, Deepening Understanding

Impact of the Mathematics Curriculum

Feedback

Immediate Intervention is essential. A pupil should leave each lesson feeling successful and any misconceptions or concerns to be addressed immediately. All teachers to follow the Assessment and Feedback Policy. On occasion and where appropriate, pupils should have the opportunity to self and peer assess their work.

Assessment and Recording

We assess children's work in maths by making formative assessments from the probing question put to a child as they think something through; quick recap questions at the opening of a lesson; observations and scrutiny of the work of children; right through to formal test questions. Summative assessments are completed termly using White Rose Assessment.

- There are no official grade boundaries for the White Rose Assessments. However, in line with the KS2 SATs, the following is a guideline:
A consistent score of approximately 55% (28/50) would indicate 'Expected' and 86% (43/50) would indicate 'Greater Depth'. These tests should be used to inform teacher assessment.

At the end of each term, all teachers attend a Pupil Progress meeting to share data and to discuss pupils who are 'off target'.

Ready – To - Progress

To ensure pupils are 'ready' for the next year group's curriculum. Teachers should ensure all pupils can complete the Ready – To – Progress documents concepts. This is not at the expense of the rest of the curriculum but are the fundamental requirements to enable a child to progress.

Monitoring and Review

The maths leader creates an action plan for the development of the subject and provide a review of the subject to the headteacher and Governors termly. They review the curriculum through work trawls, learning walks, lesson drop-ins and pupil interviews to determine knowledge acquisition and development of working mathematical skills.