Fen Rivers Mathematics Curriculum Y1-9 Overview

Structure

- The Fen Rivers (FR) KS1-3 mathematics curriculum is based on the Statutory 2014 National Curriculum (NC) (DfE).

- Each NC objective is ragged as either green, amber or red. The objectives ragged as green are the essential learning components that all children must be taught. These objectives provide the foundations for children to gain a secure understanding of mathematics and will allow them to progress to their next stage of learning. Amber and red objectives may also be covered, but are not essential.

- The FR curriculum has also mapped the DfE/NCETM Non-Statutory Mathematics Guidance Ready to Progress (RtP) statements (2020) for Years 1-6 (there are no RtP statements for KS3 currently). These statements are all ragged as green.

Guidance

- As teachers use the document, they are encouraged to add in notes to support the teaching of each objective, in the Teaching guidance section.

- In addition, the following resources should be used when planning:

  NRICH website and tasks: https://nrich.maths.org
  ECMG Spatial Reasoning Trajectory: https://earlymaths.org
  ATM The Power of Pattern book: https://www.atm.org.uk/shop/All-Books/The-Power-of-Pattern---Patterning-in-the-Early-Years/ACT133
  NNS framework for Y1-6 and Y7-9: http://www.satspapers.org/Resources/maths%20resources/oldstrategy/introduction.pdf
  NCETM PD materials (Spines 1-3): https://www.ncetm.org.uk/teaching-for-mastery/mastery-materials/
  MathsBeat Oxford University Press Teacher Guides: https://global.oup.com/education/content/primary/series/mathsbeat/?region=uk

Right of a mathematician

At Fen Rivers we have adopted Cath Gripton's The Rights of a Mathematician: https://blogs.nottingham.ac.uk/primaryeducationnetwork/2020/02/14/the-rights-of-the-mathematician/

1. The right to enjoy mathematics
2. The right to have interests and preferences
3. The right to make jottings, drawings and working out
4. The right to use our own methods and approaches
5. The right to use manipulatives and resources
6. The right to reason, to talk about maths and be listened to
7. The right to make mistakes
8. The right to estimate, to guess and to conjecture
9. The right to ponder and take time
10. The right to be playful

Assessment

The following assessments provide age-related assessments for all children:

- All RtP statements have an assessment task which children should complete
- Pattern baseline and pattern PITA should continue termly
- NCETM Y7 checkpoint tests
- Y6 National tests

Fen Rivers Year 6 Curriculum

Number – Number and place value

Aims of number and place value:

Children reason about how the position (place) of a digit in a numeral determines its value (worth). They solve problems involving estimating, counting and recording quantities, including translating word problems into pictorial representations. They develop fluency in counting multiples and reason about how this is linked to adding.

Key ideas in number and place value:

- The number tagged to the last object in a collection tells us the total quantity. It does not matter in which order we count the objects.
- When counting on, on a number track we count from the next square, not the one you are on. When counting on, on a number line, we count the jumps being made, not the marks on the line.
- Children will need plenty of experience of putting numerals on number tracks and number lines to understand that each counting number has a unique position on the line.
- Children need to be exposed to the idea that partitioning a number can be done in a variety of ways (e.g. 45 can be partitioned into 40 and 5, 30 and 15 or 10 and 32, and so on).
- Children appreciate that in a 2-digit number the tens digit is the ‘big picture’ and the ones digit is the ‘fine detail’.
- Children need to become familiar with two meanings of zero. First that zero is the answer when you count a group with no objects, and also that it can be used a place holder.
- Children need plenty of experience of estimating quantities before counting them to check, which helps to develop their number sense.

- Developing understanding of place value is based in practical experiences, not just labelling and manipulating symbols. Children need lots of experience of enumerating (establishing the total in) large collections by making groups of ten and then counting in tens (and other numbers).

Aims and key ideas inspired from MathsBeat Teacher Handbooks (OUP, 2019)

Number – Number and place value

NC/RtP	Statement	Teaching guidance
NC	Read, write, order and compare numbers up to 10,000,000 and determine the value of each digit	
NC	Round any whole number to a required degree of accuracy	
NC	Use negative numbers in context, and calculate intervals across 0	
NC	Solve number and practical problems that involve all of the above	
RtP 6NPV-1	Understand the relationship between powers of 10 from 1 hundredth to 10 million and use this to make a given number 10, 100, 1000, 1 tenth, 1 hundredth or 1 thousandth times the size (multiply and divide by 10, 100 and 1000)	RtP p. 13
RtP 6NPV-2	Recognise the place value of each digit in numbers up to 10 million, including decimal fractions, and compose and decompose numbers up to 10 million using standard and non-standard partitioning	RtP p. 17
RtP 6NPV-3	Reason about the location of any number up to 10 million, including decimal fractions, in the linear number system and round numbers, as appropriate, including in contexts	RtP p. 20
RtP 6NPV-4	Divide powers of 10, from 1 hundredth to 10 million, into 2,4,5 and 10 equal parts, and read scales/number lines with labelled intervals divided into 2,4,5 and 10 equal parts	RtP p. 25

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Number – addition, subtraction, multiplication and division

Aims of addition, subtraction, multiplication and division:

Children solve, practically, different problem types. They solve problems of increasing complexity, particularly ones where the unknown in a problem is not always in an obvious place. They reason about how such problems involve part-whole relationships. They continue to develop fluency in knowing number bonds and number facts.

Key ideas in addition, subtraction, multiplication and division:

- Children need to understand and apply the commutative, associative and distributive laws.
- Children need to recognise connections and structure between addition, subtraction, multiplication and division.
- There are many different ways to solve a problem and children need to develop a toolkit of strategies from which to choose.
- Different problems use different structures, which children need to be able to identify and apply.

Number – addition, subtraction, multiplication and division

NC/RtP	Statement	Teaching guidance
NC	Multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication*	
NC	Divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division*, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context	
NC	Divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate*, interpreting remainders according to the context	
NC	Perform mental calculations, including with mixed operations and large numbers	
NC	Identify common factors, common multiples and prime numbers	
NC	Use their knowledge of the order of operations to carry out calculations involving the 4 operations	
NC	Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why	
NC	Solve problems involving addition, subtraction, multiplication and division	
NC	Use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy	
RtP 6AS/MD-1	Understand that 2 numbers can be related additively or multiplicatively and quantify additive and multiplicative relationships (multiplicative relationships restricted to multiplication by a whole number)	RtP p. 29

RtP 6AS/MD-2	Use a given additive or multiplicative calculation to derive or complete a related calculation, using arithmetic properties, inverse relationships, and place-value understanding	RtP p. 33
RtP 6AS/MD-3	Solve problems involving ratio relationships	RtP p. 36
RtP 6AS/MD-4	Solve problems with 2 unknowns	RtP p. 39

** please refer to the Fen River's calculation policy*

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Number – fractions

Aims of fractions:

Children develop their fluency when sharing in practical and concrete contexts. They begin by solve problems practically, with individual objects, countable groups and continuous quantities, and then abstract numbers and quantities (e.g. time). They continue to solve problems using a given fraction of a whole to find another fraction of the same whole and compare to fractional parts when wholes are equal and unequal. They reason about the similarities of the outcomes each time, despite the differences in the methods used. This leads to the introduction of formal language and fraction notation.

Key ideas in fractions:

- With fractions we must make equal parts. Sharing fairly might mean something different to children in real life.
- Parts need to be equivalent but they can appear different and/or be made up of smaller, separate parts.
- Children need to consider regularly both non-examples of fractions where the resulting parts are not equal, and also where the parts are exact but not obvious.
- Experiencing fractions in a concrete way prepares children for thinking about 'fractions of' as an abstract operation on numbers and the number line.

Aims and key ideas inspired from MathsBeat Teacher Handbooks (OUP, 2019)

Number – fractions

NC/RtP	Statement	Teaching guidance
NC	Use common factors to simplify fractions; use common multiples to express fractions in the same denomination	
NC	Compare and order fractions, including fractions >1	
NC	Add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions	
NC	Multiply simple pairs of proper fractions, writing the answer in its simplest form [for example, $\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$]	
NC	Divide proper fractions by whole numbers [for example, $\frac{1}{3} \div 2 = \frac{1}{6}$]	
NC	Associate a fraction with division and calculate decimal fraction equivalents [for example, 0.375] for a simple fraction [for example, $\frac{3}{8}$]	
NC	Identify the value of each digit in numbers given to 3 decimal places and multiply and divide numbers by 10, 100 and 1,000 giving answers up to 3 decimal places	
NC	Multiply one-digit numbers with up to 2 decimal places by whole numbers	
NC	Use written division methods in cases where the answer has up to 2 decimal places	
NC	Solve problems which require answers to be rounded to specified degrees of accuracy	

NC	Recall and use equivalences between simple fractions, decimals and percentages, including in different contexts	
RtP 6F-1	Recognise when fractions can be simplified, and use common factors to simplify fractions	RtP p. 43
RtP 6F-2	Express fractions in a common denomination and use this to compare fractions that are similar in value	RtP p. 47
RtP 6F-3	Compare fractions with different denominators, including fractions greater than 1, using reasoning, and choose between reasoning and common denomination as a comparison strategy	RtP p. 50

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Ratio and proportion

Aims of ratio and proportion:

Children develop their fluency when sharing in practical and concrete contexts. They continue to solve problems practically, with individual objects, countable groups and continuous quantities, and then abstract numbers and quantities (e.g. time). They continue to solve problems using a given fraction of a whole to find another fraction of the same whole and compare to fractional parts when wholes are equal and unequal. They reason about the similarities of the outcomes each time, despite the differences in the methods used, using formal language and fraction notation.

Key ideas in ratio and proportion:

- There are four different meanings of the fraction notation: a part of a unit, a part of a set, a division, and a ratio
- Children need to understand the importance of equivalent fractions.
- Ratio is comparing one quantity to another (e.g. for every three squares there are eight circles).
- Children need multiple opportunities to use the words and language of ratio and proportional reasoning so the associated ideas and methods can be met, used and connected.

Ratio and proportion

NC/RtP	Statement	Teaching guidance
NC	Solve problems involving the relative sizes of 2 quantities where missing values can be found by using integer multiplication and division facts	
NC	Solve problems involving the calculation of percentages [for example, of measures and such as 15% of 360] and the use of percentages for comparison	
NC	Solve problems involving similar shapes where the scale factor is known or can be found	
NC	Solve problems involving unequal sharing and grouping using knowledge of fractions and multiples	

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Algebra

Aims of algebra:

Children extend their thinking and reasoning when they begin to develop their algebraic thinking. This is the idea that thinking starts in the exploration of number patterns, such as exploring odd and even numbers and understanding a statement such as ‘all numbers ending in 5 or 0 can be grouped into fives’.

Key ideas in algebra:

- Children should be introduced to the use of symbols and letters to represent variables and unknowns in mathematical situations that they already understand (e.g. formulae in mathematics and science).
- A letter represents a variable (i.e. a letter in algebra stands for whatever number is chosen; the ‘fruit-salad’ approach is unhelpful, as children develop the idea that a always stands for apples).
- There is a precedence of operations.
- Children should be able to specialise and generalise.
- The importance of understanding the equals sign as representing equivalence.

Algebra

NC/RtP	Statement	Teaching guidance
NC	Use simple formulae	
NC	Generate and describe linear number sequences	
NC	Express missing number problems algebraically	
NC	Find pairs of numbers that satisfy an equation with 2 unknowns	
NC	Enumerate possibilities of combinations of 2 variables	

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Measurement

Aims of measurement:

Children measure to solve problems comparing quantities that cannot be counted. They begin to develop fluency comparing lengths, masses and volumes using classrooms units (e.g. cubes and paper clips) and then start to do so using standard metric units. They become fluent with using conventional measuring devices, units and scales. They become familiar with coins and develop their knowledge of standard coins and notes and use this when reasoning about transactions, and then calculating and paying change. They fluently tell the time on both analogue and digital clocks and use this skill when solving problems.

Key ideas in measurement:

- Equivalence underpins measuring (e.g. how many cubes are equivalent to the length of the book?).
- Measuring is necessary when the quantities being compared are not physically close or adjacent, or they are being measured at different times.
- Estimating prior to measuring develops children's familiarity with the size of the standard units.
- Equivalence in money is not physical; one coin can be equivalent to several larger coins.
- Learning to tell the time does not develop children's sense of the passage and duration of time.
- Reading a scale is the same as reading a number line.
- Measuring naturally leads to using fractional language (e.g. half full, one third of my pocket money, quarter past 5).

Aims and key ideas inspired from MathsBeat Teacher Handbooks (OUP, 2019)

Measurement

NC/RtP	Statement	Teaching guidance
NC	Solve problems involving the calculation and conversion of units of measure, using decimal notation up to 3 decimal places where appropriate	
NC	Use, read, write and convert between standard units, converting measurements of length, mass, volume and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation to up to 3 decimal places	
NC	Convert between miles and kilometres	
NC	Recognise that shapes with the same areas can have different perimeters and vice versa	
NC	Recognise when it is possible to use formulae for area and volume of shapes	
NC	Calculate the area of parallelograms and triangles	
NC	Calculate, estimate and compare volume of cubes and cuboids using standard units, including cubic centimetres (cm^3) and cubic metres (m^3), and extending to other units [for example, mm^3 and km^3]	

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Geometry – properties and shapes

Aims of properties of shape:

Children develop fluency in recognising and naming 3D and 2D shapes. They become fluent using formal mathematical vocabulary, as they describe and reason about sorting shapes into categories. In doing so, they describe similarities and differences between properties of shapes, such as the number of edges and vertices shapes have, and the number and nature of the faces of 3D shapes. They solve problems that develop their understanding of line symmetry and construct symmetrical and non-symmetrical whole shapes from given parts.

Key ideas in properties of shape:

- Children should explore 3D shapes first because 3D shapes actually exist in their world, whereas 2D shapes are an abstraction. Even models of 2D shapes will always have some depth, and so in reality they are examples of 3D shapes.
- The orientation of a shape does not change the type of shape that it is.
- Non-examples help children use language with increased precision: knowing what it is not sharpens knowledge of what it is.
- Children should reason about shapes and their properties in general. Shapes are a context which support children's developing use of rule-making and generalisation (e.g. all pentagons have 5 edges and 5 vertices).
- Asking children to find, create and draw shapes is worthwhile because it is more challenging than recognising and describing shapes that are presented to them.
- Shapes also have important non-numerical properties (e.g. a cone, a sphere and a cylinder all roll, but they each do so in a different way).

Aims and key ideas inspired from MathsBeat Teacher Handbooks (OUP, 2019)

Geometry – properties and shapes

NC/RtP	Statement	Teaching guidance
NC	Draw 2-D shapes using given dimensions and angles	
NC	Recognise, describe and build simple 3-D shapes, including making nets	
NC	Compare and classify geometric shapes based on their properties and sizes and find unknown angles in any triangles, quadrilaterals, and regular polygons	
NC	Illustrate and name parts of circles, including radius, diameter and circumference and know that the diameter is twice the radius	
NC	Recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles	
RtP 6G-1	Draw, compose, and decompose shapes according to given properties, including dimensions, angles and area, and solve and related problems	RtP p. 53

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Geometry – position and direction

Aims of position and direction:

Children develop fluency with the language conventionally used when describing position, direction and movement. They use this language to give their reasoning when solving problems about position and direction and apply it as they explore patterns. They solve problems about direction in practical contexts, such as navigating a partner through an obstacle course.

Key ideas in position and direction:

- Children need to act out the language of position, direction and movement to develop their spatial awareness and reasoning.
- Shared language and agreed conventions enable one person to describe the position, direction and movement of objects to another person, even when the objects are not visible to that person.
- Sometimes knowing the comparative position of one object tells us the position of another (e.g. if the bird is above the tree and below the aeroplane we know the aeroplane must be above the tree) but sometimes it does not (e.g. the car can be outside the shop and the dog can be outside the car, but the dog might not be outside the shop).
- Different children will see different patterns in the same sequence. Patterns can be classified by their structure (e.g. red, blue, AB). Identifying the underlying pattern of a sequence helps children predict the sections that come before or after the visible portion and justify their reasoning.
- Children should make connections with fractions (e.g. quarter and half turns) and measurement (clockwise and anti-clockwise turns).

Aims and key ideas inspired from MathsBeat Teacher Handbooks (OUP, 2019)

Geometry – position and direction

NC/RtP	Statement	Teaching guidance
NC	Describe positions on the full coordinate grid (all 4 quadrants)	
NC	Draw and translate simple shapes on the coordinate plane, and reflect them in the axes	

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Statistics

Aims of statistics:

Children solve problems that require them to gather information from and about people, such as finding out what sandwiches to make for a class picnic through a survey of each child's filling. They reason about, and draw inferences from, the data they collect. They become fluent with making predictions and posing hypotheses; carrying our surveys; displaying relevant data using tally charts, data tables, pictograms, block diagrams and so on; interpreting the representations and drawing conclusions that relate to the original problem. These conclusions might be qualitative (e.g. lots more children chose cheese than jam), or multiplicative (e.g. twice as many children chose cheese as jam).

Key ideas in statistics:

- Children can sometimes forget the source of the data (e.g. forgetting that each cube in a block graph records and actual response, and hence making conclusions about the numbers of blocks not the numbers of people).

- All the information in a data visual conveys meaning including the title, key and labels.

- The data that are gathered can restrict the scope of the conclusions that can be drawn from them. Survey questions and data collection methods need to be carefully designed so that justifiable conclusions can be drawn.

Aims and key ideas inspired from MathsBeat Teacher Handbooks (OUP, 2019)

Statistics

NC/RtP	Statement	Teaching guidance
NC	Interpret and construct pie charts and line graphs and use these to solve problems	
NC	Calculate and interpret the mean as an average	

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Summary

- 61 statements in total (NC and RtP)
- 38 green (62%)
- 23 Amber (38%)
- 0 red (0%)