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 2 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	Count in steps of 2, 3, and 5 from 0, and in tens from any number, forward and backward	
NC	Recognise the place value of each digit in a two-digit number (tens, ones)	
NC	Identify, represent and estimate numbers using different representations, including the number line	
NC	Compare and order numbers from 0 up to 100; use <, > and = signs	
NC	Read and write numbers to at least 100 in numerals and in words	
NC	Use place value and number facts to solve problems	
RtP 2NPV-1	Recognise the place value of each digit in two-digit numbers, and compose and decompose two-digit numbers using standard and non-standard partitioning	RtP p. 12
RtP 2NPV-2	Reason about the location of any two-digit number in the linear number system, including identifying the previous and next multiple of 10	RtP p. 14

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Number – addition and subtraction

Aims of addition and subtraction:

Children solve, practically, different problem types – for example, change, collection and comparison. 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 develop fluency in knowing number bonds.

Key ideas in addition and subtraction:

- There are three core experiences underpinning all addition and subtraction problems: change increase or decrease, collection and comparison. Children need to learn how to identify each type of problem.
- Children develop a more secure understanding of addition and subtraction by working on both concepts together and talking about part-whole relationships and describing the relationship between addition and subtraction.
- Making explicit the part-whole relationship in a problem helps children reason about different ways to do the calculation.
- Children need to relate numbers to each other to become confident with number bonds.
- Becoming fluent in number bonds builds on using strategies, for example, partitioning, bridging and using near doubles.

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

Number – addition and subtraction

NC/RtP	Statement	Teaching guidance
NC	Solve problems with addition and subtraction: using concrete objects and pictorial representations, including those involving numbers, quantities and measures	
NC	Solve problems with addition and subtraction: applying their increasing knowledge of mental and written methods	
NC	Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100	
NC	Add and subtract numbers using concrete objects, pictorial representations, and mentally, including: a two-digit number and ones	
NC	Add and subtract numbers using concrete objects, pictorial representations, and mentally, including: a two-digit number and tens	
NC	Add and subtract numbers using concrete objects, pictorial representations, and mentally, including: two two-digit numbers	
NC	Add and subtract numbers using concrete objects, pictorial representations, and mentally, including: adding three one-digit numbers	
NC	Show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot	
NC	Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems	
RtP 2NF-1	Secure fluency in addition and subtraction facts within 10, through continued practice	RtP p. 16

RtP 2AS-1	Add and subtract across 10	RtP p. 18
RtP 2AS-2	Recognise the subtraction structure of ‘difference’ and answer questions of the form, “How many more…?”	RtP p. 20
RtP 2AS-3	Add and subtract within 100 by applying related one-digit addition and subtraction facts: add and subtract only ones or only tens to/from a two-digit number	RtP p. 23
RtP 2AS-4	Add and subtract within 100 by applying related one-digit addition and subtraction facts: add and subtract any 2-digit numbers	RtP p. 27

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Number – multiplication and division

Aims of multiplication and division:

Children solve, practically, multiplication problems involving the core idea of creating equal groups. They solve, practically, division problems that involve grouping or equal sharing. They reason, in practical and visual situations, about multiplication being commutative, but division not being commutative. By finding the total number in terms of arrays, they begin to become fluent in counting in multiples (unitising).

Key ideas in multiplication and division:

- A big step from addition to multiplication is the idea of unitising; moving from using one to represent a single object to one representing one group.
- Multiplication problems are either simple rate problems (e.g. there are five plates on a table, and three biscuits on each plate. The word 'each' in a problem flags that is it a simple rate) or scaling problem (e.g. a baby eel is 3cm long and its mother is 5 times as long. How long is the mother?).
- Solving division problems involves either equal sharing or equal grouping. Each type of problem involves different actions and children need plenty of experience with each.
- Exploring arrays and talking about different ways to describe them and find the total provides an informal introduction to the idea that multiplication is commutative.
- The convention that children work with is that (e.g.) 4 x 5 is 4 multiplied by 5, or 5 groups of 4.

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

Number – multiplication and division

NC/RtP	Statement	Teaching guidance
NC	Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers	
NC	Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs	
NC	Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot	
NC	Solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts	
RtP 2MD-1	Recognise repeated addition contexts, representing them with multiplication equations and calculating the product, within the 2, 5 and 10 multiplication tables	RtP p. 30
RtP 2MD-2	Relate grouping problems where the number of groups is unknown to multiplication equations with a missing factor, and to division equations (quotative division)	RtP p. 33

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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	Recognise, find, name and write fractions 1/3, 1/4, 2/4 and 3/4 of a length, shape, set of objects or quantity	
NC	Write simple fractions for example, 1/2 of 6 = 3 and recognise the equivalence of 2/4 and ½	

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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	Choose and use appropriate standard units to estimate and measure length/height in any direction (m/cm); mass (kg/g); temperature (°C); capacity (litres/ml) to the nearest appropriate unit, using rulers, scales, thermometers and measuring vessels	
NC	Compare and order lengths, mass, volume/capacity and record the results using >, < and =	
NC	Recognise and use symbols for pounds (£) and pence (p); combine amounts to make a particular value	
NC	Find different combinations of coins that equal the same amounts of money	
NC	Solve simple problems in a practical context involving addition and subtraction of money of the same unit, including giving change.	
NC	Compare and sequence intervals of time	
NC	Tell and write the time to five minutes, including quarter past/to the hour and draw the hands on a clock face to show these times	
NC	Know the number of minutes in an hour and the number of hours in a day	

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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	Identify and describe the properties of 2-D shapes, including the number of sides and line symmetry in a vertical line	
NC	Identify and describe the properties of 3-D shapes, including the number of edges, vertices and faces	
NC	Identify 2-D shapes on the surface of 3-D shapes [for example, a circle on a cylinder and a triangle on a pyramid]	
NC	Compare and sort common 2-D and 3-D shapes and everyday objects	
RtP 2G-1	Use precise language to describe the properties of 2D and 3D shapes, and compare shapes by reasoning about similarities and differences in properties	RtP p. 35

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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	Order and arrange combinations of mathematical objects in patterns and sequences	
NC	Use mathematical vocabulary to describe position, direction and movement, including movement in a straight line and distinguishing between rotation as a turn and in terms of right angles for quarter, half and three-quarter turns (clockwise and anti-clockwise)	

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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 simple pictograms, tally charts, block diagrams and simple tables	
NC	Ask and answer simple questions by counting the number of objects in each category and sorting the categories by quantity	
NC	Ask and answer questions about totalling and comparing categorical data	

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Summary

- 48 statements in total (NC and RtP)
- 44 green (92%)
- 4 Amber (8%)
- 0 red (0%)