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 3 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 from 0 in multiples of 4, 8, 50 and 100; find 10 or 100 more or less than a given number	
NC	Recognise the place value of each digit in a three-digit number (hundreds, tens, ones)	
NC	Compare and order numbers up to 1000	
NC	Identify, represent and estimate numbers using different representations	
NC	Read and write numbers up to 1000 in numerals and in words	
NC	Solve number problems and practical problems involving these ideas	
RtP 3NPV-1	Know that 10 tens are equivalent to 1 hundred, and that 100 is 10 times the size of 10; apply this to identify and work out how many 10s there are in other three-digit multiples of 10	RtP p. 13
RtP 3NPV-2	Recognise the place value of each digit in three-digit numbers, and compose and decompose three-digit numbers using standard and non-standard partitioning	RtP p. 15
RtP 3NPV-3	Reason about the location of any three-digit number in the linear number system, including identifying the previous and next multiple of 100 and 10	RtP p. 18
RtP 3NPV-4	Divide 100 into 2, 4, 5, and 10 equal parts, and read scales/number lines marked in multiples of 100 with 2, 4, 5 and 10 equal parts	RtP p. 22
RtP 3NF-3	Apply place-value knowledge to known additive and multiplicative number facts (scaling facts by 10)	RtP p. 30

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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	Add and subtract numbers mentally, including: a three-digit number and ones	
NC	Add and subtract numbers mentally, including: a three-digit number and tens	
NC	Add and subtract numbers mentally, including: a three-digit number and hundreds	
NC	Add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction*	
NC	Estimate the answer to a calculation and use inverse operations to check answers	
NC	Solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction	
RtP 3NF-1	Secure fluency in addition and subtraction facts that bridge 10, through continued practice	RtP p. 25
RtP 3AS-1	Calculate complements to 100	RtP p. 33
RtP 3AS-2	Add and subtract up to three-digit numbers using columnar methods*	RtP p. 36
RtP 3AS-3	Manipulate the additive relationship: Understand the inverse relationship between addition and subtraction, and how both relate to the part-part-whole structure. Understand and use the commutative property of addition, and understand the related property for subtraction	RtP p. 40

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

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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 3, 4 and 8 multiplication tables	
NC	Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods	
NC	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 objects	
RtP 3NF-2	Recall multiplication facts, and corresponding division facts, in the 10, 5, 2, 4 and 8 multiplication tables, and recognise products in these multiplication tables as multiples of the corresponding number	RtP p. 27
RtP 3MD-1	Apply known multiplication and division facts to solve contextual problems with different structures, including quotative and partitive division	RtP p. 44

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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	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	
NC	Recognise, find and write fractions of a discrete set of objects: unit fractions and non-unit fractions with small denominators	
NC	Recognise and use fractions as numbers: unit fractions and non-unit fractions with small denominators	
NC	Recognise and show, using diagrams, equivalent fractions with small denominators	
NC	Add and subtract fractions with the same denominator within one whole [for example, 5/7 + 1/7 = 6/7]	
NC	Compare and order unit fractions, and fractions with the same denominators	
NC	Solve problems that involve all of the above	
RtP 3F-1	Interpret and write proper fractions to represent 1 or several parts of a whole that is divided into equal parts	RtP p. 47
RtP 3F-2	Find unit fractions of quantities using known division facts (multiplication fluency)	RtP p. 51
RtP 3F-3	Reason about the location of any fraction within 1 in the linear number system	RtP p. 54
RtP 3F-4	Add and subtract fractions with the same denominator, within 1	RtP p. 58

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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	Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)	
NC	Measure the perimeter of simple 2-D shapes	
NC	Add and subtract amounts of money to give change, using both £ and p in practical contexts	
NC	Tell and write the time from an analogue clock, including using Roman numerals from I to XII, and 12-hour and 24-hour clocks	
NC	Estimate and read time with increasing accuracy to the nearest minute; record and compare time in terms of seconds, minutes and hours; use vocabulary such as o'clock, a.m./p.m., morning, afternoon, noon and midnight	
NC	Know the number of seconds in a minute and the number of days in each month, year and leap year	
NC	Compare durations of events [for example to calculate the time taken by particular events or tasks]	

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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 and make 3-D shapes using modelling materials; recognise 3-D shapes in different orientations and describe them	
NC	Recognise angles as a property of shape or a description of a turn	
NC	Identify right angles, recognise that two right angles make a half-turn, three make three quarters of a turn and four a complete turn; identify whether angles are greater than or less than a right angle	
NC	Identify horizontal and vertical lines and pairs of perpendicular and parallel lines	
RtP 3G-1	Recognise right angles as a property of a shape or a description of a turn, and identify right angles in 2D shapes presented in different orientations	RtP p. 61
RtP 3G-2	Draw polygons by joining marked points, and identify parallel and perpendicular sides	RtP p. 64

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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

There are no NC objectives for this year group, so the Y2 and Y4 ones are copied here.

Year 2

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)	

Year 4

NC/RtP	Statement	Teaching guidance
NC	Describe position on a 2D grid as coordinates in the first quadrant	
NC	Describe movements between positions as translations of a given unit to the left/right and up/down	
NC	Plot specified points and draw sides to complete a given polygon	

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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 present data using bar charts, pictograms and tables	
NC	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	

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Summary

- 57 statements in total (NC and RtP) (which includes Y2 and Y4 NC objectives for position and direction)
- 41 green (72%)
- 16 Amber (28%)
- 0 red (0%)