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 7,8,9 Curriculum

Number

Aims of number:

Children extend their understanding of the number system and place value to include decimals, fractions, powers and roots. They select and use appropriate calculation strategies to solve increasingly complex problems. They reason about connections between number relationships and interpret when the structure of a number problem requires additive, multiplicative or proportional reasoning.

Key ideas in number:

- Number is concerned about the relations between quantities.
- One structure (relation) is additive reasoning, another structure is multiplicative reasoning.
- Children need to be exposed to the idea that partitioning a number can be done in a variety of ways (e.g. 1.7 can be partitioned into 1 and 0.7, 0.5 and 1.2, and so on).
- Children need plenty of experience of estimating quantities before counting them to check, which helps to develop their number sense.

Number

Key: Y7 = green; Y8 = orange (+ green); Y9 = blue (+ green and orange)

NC	Statement	Teaching Guidance
NC	Understand and use place value for decimals, measures and integers of any size	
NC	Order positive and negative integers, decimals and fractions; use the number line as a model for ordering of the real numbers	
NC	Use the concepts and vocabulary of prime numbers, factors (or divisors), multiples, common factors, common multiples, highest common factor, lowest common multiple, prime factorisation, including using product notation and the unique factorisation property	
NC	Use the four operations, including formal written methods*, applied to integers, decimals, proper and improper fractions, and mixed numbers, all both positive and negative	
NC	Use conventional notation for the priority of operations, including brackets, powers, roots and reciprocals	
NC	Recognise and use relationships between operations including inverse operations	
NC	Use integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5 and distinguish between exact representations of roots and their decimal approximations	

NC	Interpret and compare numbers in standard form A x 10^n $1 \leq A < 10$, where n is a positive or negative integer or zero	
NC	Work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and $^7/_2$ or 0.375 and $^3/_8$)	
NC	Define percentage as 'number of parts per hundred', interpret percentages and percentage changes as a fraction or a decimal, interpret these multiplicatively, express one quantity as a percentage of another, compare two quantities using percentages and work with percentages greater than 100%	
NC	Interpret fractions and percentages as operators	
NC	Use standard units of mass, length, time, money and other measures, including with decimal quantities	
NC	Round numbers and measures to an appropriate degree of accuracy (for example, to a number of decimal places or significant figures)	
NC	Use approximation through rounding to estimate answers and calculate possible resulting errors expressed using inequality notation $a < x \leq b$	
NC	Use a calculator and other technologies to calculate results accurately and then interpret them appropriately	

NC	Appreciate the infinite nature of the sets of integers, real and rational numbers	

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

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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:

- Algebraic reasoning involves formulating, transforming and understanding generalisations of numerical and spatial situations and relations.
- Relations between quantities can be understood without knowing actual quantities.
- 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 (algebraic manipulation without any meaning or purpose leads to confusion and misconceptions).

Algebra

Key: Y7 = green; Y8 = orange (+ green); Y9 = blue (+ green and orange)

NC	Statement	Teaching guidance
NC	Use and interpret algebraic notation, including: ab in place of $a \times b$; $3y$ in place of $y + y + y$ and $3 \times y$; a^2 in place of $a \times a$, a^3 in place of $a \times a \times a$; a^2b in place of $a \times a \times b$; a/b in place of $a \div b$; coefficients written as fractions rather than as decimals; brackets	
NC	Substitute numerical values into formulae and expressions, including scientific formulae	
NC	Understand and use the concepts and vocabulary of expressions, equations, inequalities, terms and factors	
NC	Simplify and manipulate algebraic expressions to maintain equivalence by: collecting like terms; multiplying a single term over a bracket; taking out common factors; expanding products of two or more binomials	
NC	Understand and use standard mathematical formulae; rearrange formulae to change the subject	
NC	Model situations or procedures by translating them into algebraic expressions or formulae and by using graphs	
NC	Use algebraic methods to solve linear equations in one variable (including all forms that require rearrangement)	
NC	Work with coordinates in all four quadrants	
NC	Recognise, sketch and produce graphs of linear and quadratic functions of one variable with appropriate scaling, using equations in x and y and the Cartesian plane	

NC	Interpret mathematical relationships both algebraically and graphically	
NC	Reduce a given linear equation in two variables to the standard form $y = mx + c$; calculate and interpret gradients and intercepts of graphs of such linear equations numerically, graphically and algebraically	
NC	Use linear and quadratic graphs to estimate values of y for given values of x and vice versa and to find approximate solutions of simultaneous linear equations	
NC	Find approximate solutions to contextual problems from given graphs of a variety of functions, including piece-wise linear, exponential and reciprocal graphs	
NC	Generate terms of a sequence from either a term-to-term or a position-to-term rule	
NC	Recognise arithmetic sequences and find the nth term	
NC	Recognise geometric sequences and appreciate other sequences that arise.	

Fen Rivers Year 7,8,9 Curriculum

Ratio, proportion and rates of change

Aims of ratio, proportion and rates of change:

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, proportion and rates of change:

- 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, proportion and rates of change

Key: Y7 = green; Y8 = orange (+ green); Y9 = blue (+ green and orange)

NC	Statement	Teaching Guidance
NC	Change freely between related standard units (for example, time, length, area, volume/capacity, mass)	
NC	Use scale factors, scale diagrams and maps	
NC	Express one quantity as a fraction of another, where the fraction is less than 1 and greater than 1	
NC	Use ratio notation, including reduction to simplest form	
NC	Divide a given quantity into two parts in a given part-part or part-whole ratio; express the division of a quantity into two parts as a ratio	
NC	Understand that a multiplicative relationship between two quantities can be expressed as a ratio or as a fraction	
NC	Relate the language of ratios and the associated calculations to the arithmetic of fractions and to linear functions	
NC	Solve problems involving percentage change, including: percentage increase, decrease and original value	

	problems and simple interest in financial mathematics	
NC	Solve problems involving direct and inverse proportion, including graphical and algebraic representations	
NC	Use compound units such as speed, unit pricing and density to solve problems	

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Geometry and measures

Aims of geometry and measures:

Children develop their fluency of geometric reasoning by continuing to explore spatial thinking and visualisation, whilst also using deductive reasoning that employs, as appropriate, transformation and/or congruency. They begin to reason deductively in geometry using geometric constructions and formalise their knowledge of ratio and proportion in working with measures and geometry.

Key ideas in geometry and measures:

- Children learn about geometry of the plane (such as points, lines, triangles, polygons and circles).
- Children learn about sold geometry, dealing with 3-D objects such as various polyhedral (e.g. cube, tetrahedron, etc).
- Children explore the measurement and calculation of geometrical entities, such as length, area and volume, and also angle.

Geometry and measures

Key: Y7 = green; Y8 = orange (+ green); Y9 = blue (+ green and orange)

NC	Statement	Teaching Guidance
NC	Derive and apply formulae to calculate and solve problems involving: perimeter and area of triangles, parallelograms, trapezia, volume of cuboids (including cubes) and other prisms (including cylinders)	
NC	Calculate and solve problems involving: perimeters of 2-D shapes (including circles), areas of circles and composite shapes	
NC	Draw and measure line segments and angles in geometric figures, including interpreting scale drawings	
NC	Derive and use the standard ruler and compass construction (perpendicular bisector of a line segment, constricting a perpendicular to a given line from/at a given point, a line as the shortest distance to the line	
NC	Describe, sketch and draw using conventional terms and notations: points, lines, parallel lines, perpendicular lines, right angles, regular polygons, and other polygons that are reflectively and rotational symmetric	
NC	Use the standard conventions for labelling the sides and angles of triangle ABC, and know and use the criteria for congruence of triangles	
NC	Derive and illustrate properties of triangles, quadrilaterals, circles and other plane figures (for example, equal lengths and angles) using appropriate language and technologies	

NC	Identify proprieties of, and describe the results of, translations, rotations and reflections applied to given figures	
NC	Identify and construct congruent triangles, and construct similar shapes by enlargement with and without coordinate grids	
NC	Apply the properties of angles and a point, angles at a point on a straight line, vertically opposite angles	
NC	Understand and use the relationship between parallel lines and alternate and corresponding angles	
NC	Derive and use the sum of angles in a triangle and use it to deduce the angle sum in any polygon, and to derive properties of regular polygons	
NC	Apply angle facts, triangle congruence, similarity and properties of quadrilaterals to derive results about angles and sides, including Pythagoras' Theorem, and use known results to obtain simple proofs	
NC	Use Pythagoras' Theorem and trigonometric rations in similar triangles to solve problems involving right-angled triangles	
NC	Use the properties of faces, surfaces, edges and vertices of cubes, cuboids, prisms, cylinders, pyramids, cones and spheres to solve problems in 3-D	
NC	Interpret mathematical relationships both algebraically and geometrically	

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Probability

Aims of probability:

Children develop their fluency by exploring what can and cannot be inferred in probabilistic settings and begin to express their arguments formally. They embrace randomness and use it as a means of modelling the uncertainty itself.

Key ideas in probability:

- A measure of the strength of our belief that some event will occur, based on evidence presented or gathered.
- Begin to model situations mathematically an express the results using a range of formal mathematical representations.
- Many everyday examples can challenge the idea of making sense of situations that are unpredictable.

Probability

Key: Y7 = green; Y8 = orange (+ green); Y9 = blue (+ green and orange)

NC	Statement	Teaching guidance
NC	Record and describe the frequency of outcomes of simple probability experiments involving randomness, fairness, equally and unequally likely outcomes, using appropriate language and the 0-1 probability scale	
NC	Understand that the probabilities of all possible outcomes sum to 1	
NC	Enumerate sets and unions/intersections of sets systematically, using tables, grids and Venn diagrams	
NC	Generate theoretical sample spaces for single and combined events with equally likely, mutually exclusive outcomes and use these to calculate theoretical probabilities	

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Statistics

Aims of statistics:

Children engage with, and are challenged by, statistical enquiry, which harnesses digital technology to explore data embracing a full investigative cycle. They should continue to develop graphical fluency and use the language and properties to analyse numbers, algebraic expressions, 2-D and 3-D shapes, probabilities and statistics.

Key ideas in statistics:

- Variability is a key characteristic in statistics which children need to describe, model and comprehend.
- Children need to explore what can and cannot be inferred in statistical settings.
- The misleading effect of suppressing zero in a frequency graph.
- Learning to sort data according to given criteria.

Statistics

Key: Y7 = green; Y8 = orange (+ green); Y9 = blue (+ green and orange)

NC	Statement	Teaching Guidance
NC	Describe, interpret and compare observed distributions of a single variable through: appropriate graphical representation involving discrete, including grouped, data; and appropriate measures of central tendency (mean, mode, median) and spread (range, consideration of outliers)	
NC	Construct and interpret appropriate tables, charts and diagrams, including frequency tables, bar charts, pie charts, and pictograms for categorical data, and vertical line (or bar) charts for ungrouped and grouped numerical data	
NC	Describe mathematical relationships between two variables (bivariate data) in observational and experimental contexts and illustrate using scatter graphs	

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Summary

- 65 statements in total (Y7,8,9)
- 28 Y7 green (43%)
- 19 Y8 orange (29%)
- 18 Y9 blue (28%)