Mathletics

England Programme of Studies

Understanding Practice and Fluency (UPF)

Key Stage 3

December, 2021

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1 Number

Outcome	Quests	Content
N.1 understand and use place value for decimals, measures and integers of any size	Use place value	Understanding and using place value
		Partitioning using place value
N.2 order positive and negative integers, decimals and fractions; use the number line as a model for ordering of the real numbers; use the symbols =, ≠, <, >, ≤, ≥	Order and compare numbers	Ordering integers
		Ordering decimals
		Comparing and ordering proper fractions
		Comparing and ordering mixed fractions
		Comparing and ordering fractions and decimals
N.3 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	Products, factors & prime factorisation	Products, factors and prime factorisation
N.4 use the four operations, including formal written methods, applied to integers, decimals, proper and improper fractions, and mixed numbers, all both positive and negative	Use the four operations	Adding and subtracting integers
		Adding and subtracting rational numbers
		Multiplying integers, decimals and fractions
		Dividing with integers
		Dividing with decimals
		Dividing fractions and decimals
		Multiple operations: integers, decimals, fractions
N.5 use conventional notation for the priority of operations, including brackets, powers, roots and reciprocals	Order of operations	Simple order of operations
		Further order of operations
N.6 recognise and use relationships between operations including inverse operations	Inverse operations	Inverse operations
N.7 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	Use powers and real roots	Using powers and real roots
N.8 interpret and compare numbers in standard form A x 10^n 1 ≤ A < 10,	Use standard form	Using standard form with integers

where n is a positive or negative integer or zero		Further standard form: Decimals and calculations
N.9 work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and 7/2 or 0.375 and 3/8)	Terminate decimals & their fractions	Terminating decimals & corresponding fractions
N.10 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%	Work with percentages	Defining, comparing and using percentages
		Further percentages
N.11 interpret fractions and percentages as operators	Fractions & percentages as operators	Interpreting fractions & percentages as operators
N.12 use standard units of mass, length, time, money and other measures, including with decimal quantities	Use standard units	Using the standard unit of mass
		Using the standard unit of length
		Using the standard unit of time
		Using the standard unit of money
N.13 round numbers and measures to an appropriate degree of accuracy [for example, to a number of decimal places or significant figures]	Round numbers	Rounding to a specified number of decimal places
		Rounding to a number of significant figures
N.14 use approximation through rounding to estimate answers and calculate possible resulting errors expressed using inequality notation $a < x \leq b$	Approximation and errors	Using rounding to estimate answers and find errors
N.16 appreciate the infinite nature of the sets of integers, real and rational numbers.	Sets: integers, real & rational numbers	Sets of integers, real & rational numbers

2 Algebra

Outcome	Quests	Content
A.1 use and interpret algebraic notation, including: A.1.a ab in place of a × b A.1.b 3y in place of y + y + y and 3 × y A.1.c a^2 in place of a × a, a^3 in place of a × a × a; a^2b in place of a × a × b A.1.d a/b in place of a ÷ b A.1.e coefficients written as fractions rather than as decimals A.1.f brackets	Algebraic notation and conventions	Algebraic notation and conventions
A.2 substitute numerical values into formulae and expressions, including scientific formulae 3427046	Substitute values into formulae	Substituting values into expressions and formulae
A.3 understand and use the concepts and vocabulary of expressions, equations, inequalities, terms and factors	Understand algebraic vocabulary	Understanding algebraic vocabulary
A.4.a collecting like terms	Work with algebraic expressions	Adding and subtracting algebraic expressions
A.4.b multiplying a single term over a bracket		Multiplying a single term over a bracket
A.4.c taking out common factors		Taking out common factors
A.4.d expanding products of two or more binomials		Expanding products of binomials
A.5 understand and use standard mathematical formulae; rearrange formulae to change the subject	Understand & manipulate formulae	Understanding & manipulating mathematical formulae
A.6 model situations or procedures by translating them into algebraic expressions or formulae and by using graphs	Situations as expressions or graphs	Creating algebraic expressions
		Modelling situations using graphs
A.7 use algebraic methods to solve linear equations in one variable (including all forms that require rearrangement)	Solve linear equations	Solving equations basics
		Solving equations:1-step with addition/subtraction
		Solving equations:1-step with mult/div
		Solving equations:1-step with mixed operations
		Solving equations:2-step with mixed operations
		Solving equations:3-step with mixed operations
		Solving equations: variables on both sides
		Solving equations: involving brackets
A.8 work with coordinates in all four quadrants	Work with coordinates	Working with coordinates

A.9 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	Graphs of linear and quadratic functions	Graphs of linear functions with a table of values
		Quadratic functions with a table of values
A.10 interpret mathematical relationships both algebraically and graphically	Algebraic and graphical relationships	Algebraic and graphical relationships
A.11 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	Use the standard form of a line	Understanding the gradient and intercept
		Using the gradient intercept form of a line
A.12 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	Use graphs to find solutions	Using graphs to find approximate solutions
A.13 find approximate solutions to contextual problems from given graphs of a variety of functions, including piece-wise linear, exponential and reciprocal graphs	Solve contextual problems from graphs	Solving contextual problems from graphs
A.14 generate terms of a sequence from either a term-to-term or a position-to-term rule	Generate terms of a sequence	Generating terms of a sequence
A.15 recognise arithmetic sequences and find the nth term	Find the nth term in sequences	Finding the nth term in arithmetic sequences
A.16 recognise geometric sequences and appreciate other sequences that arise.	Work with geometric sequences	Working with geometric sequences

3 Ratio, Proportion and Rates of Change

Outcome	Quests	Content
RP.1 change freely between related standard units [for example time, length, area, volume/capacity, mass]	Convert between standard units	Converting between standard units
RP.2 use scale factors, scale diagrams and maps	Use scale factors	Using numerical scale factors
		Using scale factors in ratio form
RP.3 express one quantity as a fraction of another, where the fraction is less than 1 and greater than 1	One quantity as a fraction of another	Expressing one quantity as a fraction of another
RP.4 use ratio notation, including reduction to simplest form	Understand and simplify ratios	Understanding and simplifying ratios
		Ratios involving fractions and decimals
RP.5 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	Solve problems with ratios	Solving problems with ratios
RP.6 understand that a multiplicative relationship between two quantities can be expressed as a ratio or a fraction	Multiplicative relationships as ratios	Multiplicative relationships expressed as a ratio
RP.7 relate the language of ratios and the associated calculations to the arithmetic of fractions and to linear functions	Relate ratios to fractions & functions	Relating ratios to fractions and linear functions
RP.8 solve problems involving percentage change, including: percentage increase, decrease and original value problems and simple interest in financial mathematics	Percentage change and simple interest	Solving problems involving percentage change
		Solving problems involving simple interest
RP.9 solve problems involving direct and inverse proportion, including graphical and algebraic representations	Solve problems involving proportion	Solving problems involving direct proportion
		Graphing directly proportional relationships
		Solving problems involving indirect proportion
		Problems involving direct & indirect proportion
RP.10 use compound units such as speed, unit pricing and density to solve problems.	Solve problems with compound units	Working with compound units
		Solving problems involving speed

4 Geometry and Measures

Outcome	Quests	Content
GM.1 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)	Perimeter of 2-D shapes	Perimeter of 2-D shapes
	Area of 2-D shapes	Area of triangles
		Area of rectangles
		Area of parallelograms
		Area of a trapezium
		Area of a rhombus
		Area of a kite
		Area of composite shapes
	Volume of 3-D shapes	Volume of prisms
		Volume of cuboids
		Volume of triangular prisms
		Solving problems with prisms
		Volume of cylinders
GM.2 calculate and solve problems involving: perimeters of 2-D shapes (including circles), areas of circles and composite shapes	Perimeter of composite 2-D shapes	Perimeters of composite shapes
	Circumference of circles	Understanding circles and finding circumference
		Finding perimeters of quadrants and semicircles
		Finding arc lengths and perimeters of sectors
	Area of a circle	Finding the area of a circle
		Finding the area of parts of circles
GM.3 draw and measure line segments and angles in geometric figures, including interpreting scale drawings	Geometric figures and scale drawings	Line segments, angles, interpreting scale drawings
GM.5 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 rotationally symmetric	Geometrical conventions and language	Using geometry conventions
		Identifying parallel and perpendicular lines
GM.6 use the standard conventions for labelling the sides and angles of triangle ABC, and know and use the criteria for congruence of triangles	Triangle conventions	Using the conventions for angles and triangles
		Understanding criteria for triangle congruence
		Applying properties of congruent triangles
GM.7 derive and illustrate properties of triangles, quadrilaterals, circles, and other plane figures [for example, equal lengths and angles] using appropriate language and technologies	Properties of 2-D shapes	Properties of 2-D shapes
		Understanding translations

GM.8 identify properties of, and describe the results of, translations, rotations and reflections applied to given figures	Understand transformations	Understanding reflections
		Understanding rotations
		Understanding all transformations
GM.9 identify and construct congruent triangles, and construct similar shapes by enlargement, with and without coordinate grids	Congruent and similar triangles	Identify and construct congruent triangles
		Construct similar shapes by enlargement
GM.10 apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles	Properties of angle relationships	Properties of angle relationships
GM.11 understand and use the relationship between parallel lines and alternate and corresponding angles	Angle relationships on parallel lines	Angle relationships on parallel lines
GM.12 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	Explore the angle sum of a triangle	Exploring the angle sum of a triangle
GM.14 use Pythagoras' Theorem and trigonometric ratios in similar triangles to solve problems involving right-angled triangles	Pythagoras' Theorem	Introducing the Pythagoras' Theorem
		Finding the shorter side using Pythagoras' Theorem
		Finding the hypotenuse using Pythagoras' Theorem
		Solving problems using Pythagoras' Theorem
		Pythagoras' Theorem: triads and the converse
	Trigonometry	Trigonometry introduction
		Trigonometric relationships
		Trigonometry and the calculator
		Using trigonometric ratios to find missing sides
		Using trigonometric ratios to find missing angles
		Solving problems using trigonometry
GM.15 use the properties of faces, surfaces, edges and vertices of cubes, cuboids, prisms, cylinders, pyramids, cones and spheres to solve problems in 3-D	Use properties of 3-D shapes	Using properties of 3-D shapes to solve problems
GM.16 interpret mathematical relationships both algebraically and geometrically.	Interpret mathematical relationships	Relationships algebraically and geometrically

5 Probability

Outcome	Quests	Content
P.1 record, describe and analyse 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	Understand probability	Language and concepts of probability
		Expressing and interpreting probabilities
		Probability experiments
P.2 understand that the probabilities of all possible outcomes sum to 1	Complementary probabilities	Complementary probabilities
P.3 enumerate sets and unions/intersections of sets systematically, using tables, grids and Venn diagrams	Venn diagrams, set theory & 2-way tables	Introducing Venn diagrams
		Using Venn diagrams to solve problems
		Two-way tables
		Venn Diagrams and two-way tables
		Introducing set theory
P.4 generate theoretical sample spaces for single and combined events with equally likely, mutually exclusive outcomes and use these to calculate theoretical probabilities.	Sample spaces and probability	Sample spaces and probability

6 Statistics

Outcome	Quests	Content
S.1 describe, interpret and compare observed distributions of a single variable through: appropriate graphical representation involving discrete, continuous and grouped data; and appropriate measures of central tendency (mean, mode, median) and spread (range, consideration of outliers)	Understand data language	Understanding data language
	Central tendency & data analysis	Mean, median, mode and range
		Data analysis
S.2 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	Represent & interpret data displays	Construct and interpret tables and pictograms
		Construct and interpret vertical line charts
		Construct and interpret dot plots
		Construct & interpret ordered stem and leaf plots
		Construct and interpret divided bar graphs
		Construct and interpret pie charts
		Construct and interpret line graphs
		Interpreting data in a variety of forms
S.3 describe simple mathematical relationships between two variables (bivariate data) in observational and experimental contexts and illustrate using scatter graphs.	Bivariate data	Understanding bivariate data
		Understanding scatter graphs

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