Maths Programme of Study

[Y7](#)   [Y8](#)   [Y9](#)   [Y10](#)   [Y11](#)

MISSION

'A commitment that virtually ALL students can learn all important academic knowledge to a level of excellence if…
- allowed the *right* amount of time to learn;
- provided with the *appropriate conditions* to learn.'

At The Purbeck School, we plan and deliver a mastery approach to teaching Maths.

The Purbeck School
Achieving Excellence Together

ASSESS:
- 'Revise and improve' time strengthens the foundations and reduces any gaps.
- Formative assessment is planned throughout our teaching. We check student understanding regularly, identifying and addressing errors and misconceptions.
- 'Review and improve' time celebrate student's successes and provides intervention opportunities.

TEACH/DO:
- Using Example-problem pairs, teachers model worked examples explicitly; mini-whiteboards are used to check student understanding.
- Concrete and pictorial representations make abstract problems more accessible.
- Mathematical language is developed until fluent and confident.

PRACTICE:
- Students are guided towards independent practice, with scaffolds for difficult tasks in order to become confident and fluent.
- Lessons begin with a Knowledge Quiz to support the retention of prior-learning.
- Deliberate practice is planned so that students can use and apply knowledge and skills in a variety of contexts.

Number: Place Value, Addition and Subtraction

Assessment Objectives

	Y7	Y8	Y9	Y10	Y11	NUMBER – PLACE VALUE, ADDITION AND SUBTRACTION
Ⓟ						• understand and use place value (e.g. when working with very large numbers) (N2) • order positive integers; use the symbols =, ≠, <, >, ≤, ≥ (N1) • round numbers and measures, up to 10 000 000 to the nearest 10, 100, 1000, 10 000 and 100 000, to an appropriate degree of accuracy (N15) • read, write, order and compare numbers with up to three decimal places (N1/N2) • add and subtract integers, mentally and using formal written methods (N2) • estimate answers; check integer calculations using approximation and estimation (N14)
①						• order positive and *negative* integers and decimals; use the symbols =, ≠, <, >, ≤, ≥ (N1) • round numbers and measures to a specified number of decimal places (N15) • add and subtract, including mentally and using formal written methods, integers and decimals with a different number of decimal places (N2) • estimate answers; check decimal calculations using approximation and estimation (N14)
②						• round numbers and measures to a specified number of significant figures (N15) • add and subtract, mentally and using formal written methods, integers and decimals – all both positive and *negative* (N2)
③						
④						• use inequality notation to specify simple error intervals due to truncation or rounding (N15)

Number: Multiplication and Division

Assessment Objectives

	Y7	Y8	Y9	Y10	Y11	NUMBER – MULTIPLICATION AND DIVISION Home
Ⓟ						• recall multiplication and division facts for multiplication tables up to 12 × 12 • use the concepts and vocabulary of prime numbers, factors (divisors) and multiples (N4) • multiply and divide integers by 10, 100 and 1000 (N2)
①						• multiply numbers up to 4-digits by a one-digit number using short multiplication (N2) • divide a four-digit number by a one-digit number using short division (N2) • multiply and divide decimals by 10, 100 and 1000 (N2) • use a formal method to multiply or divide a decimal by an integer < 10 (N2)
②						• multiply four-digit numbers by a two-digit number using long multiplication (N2) • divide a four-digit number by a two-digit number using long division (N2) • multiply and divide decimals, including mentally and using formal written methods (N2) • multiply and divide negative integers and decimals (N2) • recognise and use relationships between operations, including inverse operations (e.g. cancellation to simplify calculations) (N3) • use conventional notation for priority of operations, including brackets, powers, roots and reciprocals (N3) • use the concepts and vocabulary of highest common factor and lowest common multiple (N4) • use positive integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5; recognise and use sequences of triangular, square and cube numbers (N6/A24) • estimate answers; check calculations using approximation and estimation (N14)
③						• calculate with roots, and with integer indices (N7) • use the concepts and vocabulary of prime factorisation, including using product notation and the unique factorisation theorem (N4)

The Purbeck School: Mathematics Schemes of Learning

Calculation

Assessment Objectives

	Y7	Y8	Y9	Y10	Y11	CALCULATION	Home
Ⓟ						See… • Number: Place Value, Addition and Subtraction • Number: Multiplication and Division	
①							
②						• round numbers and measures to a specified number of significant figures (N15) • estimate answers; check calculations using approximation and estimation (N14) • add, subtract, multiply and divide, mentally and using formal written methods, integers and decimals – all both positive and *negative* (N2) • recognise and use relationships between operations, including inverse operations (e.g. cancellation to simplify calculations and expressions); use conventional notation for priority of operations, including brackets, powers, roots and reciprocals (N3) • use the concepts and vocabulary of highest common factor and lowest common multiple (N4) • use positive integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5; recognise and use sequences of triangular, square and cube numbers (N6/A24)	
③						• use the concepts and vocabulary of prime factorisation, including using product notation and the unique factorisation theorem (N4) • calculate with roots, and with integer indices (N7)	
④						• use inequality notation to specify simple error intervals due to truncation or rounding (N15) • **estimate powers and roots of any given positive number (N6)** • interpret standard form $A \times 10^n$, where $1 \le A < 10$ and n is an integer (N9)	
⑤						• apply and interpret limits of accuracy (N16) • calculate with negative integer indices (N7) • calculate with standard form $A \times 10^n$, where $1 \le A < 10$ and n is an integer (N9)	
⑥						• **calculate with roots and fractional indices (N7)** • **calculate exactly with surds; simplify surd expressions involving squares (e.g. $\sqrt{12} = \sqrt{(4 \times 3)} = \sqrt{4} \times \sqrt{3} = 2\sqrt{3}$) (N8)**	
⑦						• **apply and interpret limits of accuracy, including upper and lower bounds (N16)** • **calculate exactly with surds; simplify surd expressions involving squares (e.g. $\sqrt{12} = \sqrt{(4 \times 3)} = \sqrt{4} \times \sqrt{3} = 2\sqrt{3}$) and rationalise denominators (N8)**	

Fractions

Assessment Objectives

	Y7	Y8	Y9	Y10	Y11	FRACTIONS
Ⓟ						• understand fractions as numbers
①						• convert between fractions and decimals using place value
②						• simplify fractions; write equivalent fractions • express one quantity as a fraction of another, where the fraction is less than 1 or greater than 1 (R3) • order fractions and mixed numbers; use the symbols =, ≠, <, >, ≤, ≥ (N1) • work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and 7/2 or 0.375 or 3/8) (N10)
③						• calculate exactly with fractions (N8) • apply the four operations to simple fractions (proper and improper), and mixed numbers (N2) • interpret fractions as operators (N12)
④						
⑤						
⑥						• **change recurring decimals into their corresponding fractions and vice versa (N10)**

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Ratio and Proportion

Assessment Objectives

	Y7	Y8	Y9	Y10	Y11	RATIO AND PROPORTION
①						• define percentage as 'number of parts per hundred' (R9)
②						• express one quantity as a percentage of another; compare two quantities using percentages (R9) • interpret percentages and percentage changes as a fraction or a decimal (R9) • interpret percentages as operators (N12) • use ratio notation, including reduction to simplest form (R4) • identify and work with fractions in ratio problems (N11) • solve problems involving direct proportion (R10)
③						• work with percentages greater than 100% (R9) • solve problems involving percentage change, including percentage increase/decrease (R9) • interpret percentages and percentage changes as a fraction or a decimal multiplicatively (R9) • 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; apply ratio to real contexts and problems (such as those involving conversion, comparison, scaling, mixing, concentrations) (R5) • express a multiplicative relationship between two quantities as a ratio or a fraction (R6) • change freely between related standard units (e.g. time, length, area, volume / capacity, mass) and compound units (e.g. speed, rates of pay, prices) in numerical contexts (R1)
④						• solve problems involving percentage change, including original value problems, and simple interest including in financial mathematics (R9) • set up, solve and interpret the answers in growth and decay problems, including compound interest (R16) • understand and use proportion as equality of ratios (R7) • relate ratios to linear functions (R8) • solve problems involving inverse proportion (R10)
⑤						• use compound units, such as density and pressure (R11) • understand that X is inversely proportional to Y is equivalent to X is proportional to 1/Y; interpret equations that describe direct and inverse proportion (R13) • recognise and interpret graphs that illustrate direct and inverse proportion (R14)
⑥						• **construct equations that describe direct proportion (R13)**
⑦						• **construct equations that describe direct and inverse proportion (R13)**

Algebra

Assessment Objectives

	Y7	Y8	Y9	Y10	Y11	ALGEBRA Home
②						• use and interpret algebraic notation, including: ab in place of a × b, 3y in place of y + y + y and 3 × y, a² in place of a × a, a³ in place of a × a × a, a/b in place of a ÷ b, brackets (A1) • understand and use the concepts and vocabulary of expressions, equations, formulae and terms (A3) • simplify and manipulate algebraic expressions by collecting like terms (A4) • substitute numerical values into formulae and expressions; use conventional notation for priority of operations, including brackets (A2/N3)
③						• use and interpret algebraic notation, including: a²b in place of a × a × b, coefficients written as fractions rather than as decimals (A1) • interpret simple expressions as functions with inputs and outputs (A7) • substitute numerical values into scientific formulae; understand and use standard mathematical formulae (A2/A5) • simplify and manipulate algebraic expressions by multiplying a single term over a bracket, by taking out common factors and simplifying expressions involving sums, products and powers, including the laws of indices (A4)
④						• simplify and manipulate algebraic expressions by expanding products of two binomials and factorising quadratic expressions of the form x² + bx + c, including the difference of two squares (A4)
⑤						• argue mathematically to show algebraic expressions are equivalent, and use algebra to support and construct arguments (A6)
⑥						• **manipulate algebraic expressions by expanding products of more than two binomials (A4)** • **manipulate algebraic expressions by factorising quadratic expressions of the form ax² + bx + c (A4)** • **complete the square (A11)** • **simplify algebraic fractions (A4)** • **understand and use f(x) (A7)**
⑦						• **simplify and manipulate algebraic expressions and algebraic fractions (A4)** • **interpret the reverse process as the 'inverse function'; interpret the succession of two functions as a 'composite function' (A7)**

Equations

Assessment Objectives

	Y7	Y8	Y9	Y10	Y11	EQUATIONS
②						
③						• understand and use the concepts and vocabulary of expressions, equations, identities and inequalities (A3) • solve linear equations and inequalities in one unknown algebraically (A17/A22) • represent the solution set to an inequality on a number line (A22) • rearrange formulae to change the subject (A5)
④						• solve linear equations and inequalities with the unknown on both sides of the equation (A17/A22)
⑤						• solve two linear simultaneous equations in two variables algebraically; find approximate solutions using a graph (A19) • derive an equation (or two simultaneous equations), solve the equation(s) and interpret the solution (A21) • solve quadratic equations algebraically by factorising; find approximate solutions to using a graph (A18)
⑥						• **solve quadratic equations algebraically by factorising, including those that require rearrangement (A18)**
⑦						• **solve quadratic equations algebraically by factorising, including by completing the square and by using the quadratic formula (A18)** • **solve quadratic inequalities in one variable (A22)** • **solve two simultaneous equations in two variables where one is quadratic algebraically (A19)** • **find approximate solutions to equations numerically using iteration (A20)**

Sequences and Graphs

Assessment Objectives

	Y7	Y8	Y9	Y10	Y11	SEQUENCES AND GRAPHS
②						• generate terms of a sequence from a term-to-term rule (A23) • work with coordinates in all four quadrants (A8) • understand and use lines parallel to the axes, y = x and y = -x (A9)
③						• generate terms of a sequence from a position-to-term rule (A23) • deduce expressions to calculate the nth term of linear sequences (A25) • recognise and use sequences of triangular, square and cube numbers (A24) • solve geometrical problems on coordinate axes (G11) • plot graphs of equations that correspond to straight-line graphs in the coordinate plane (A9)
④						• recognise and use Fibonacci type sequences and quadratic sequences (A24) • identify and interpret gradients and intercepts of linear functions graphically and algebraically (A10) • interpret the gradient of a straight-line graph as a rate of change (R14) • use the form y = mx + c to identify parallel lines (A9) • recognise, sketch and interpret graphs of linear functions and simple quadratic functions (A12); find approximate solutions to quadratic equations using a graph (A18) • plot and interpret graphs and graphs of non-standard (piece-wise linear) functions in real contexts, to find approximate solutions to problems such as simple kinematic problems involving distance and speed (A14);
⑤						• recognise and use simple geometric progressions (r^n where n is an integer, and r is a rational number > 0) (A24) • find the equation of the line through two given points, or through one point with a given gradient (A9) • recognise, sketch and interpret graphs of quadratic functions and simple cubic functions and the reciprocal function (A12) • identify and interpret roots, intercepts, turning points of quadratic functions graphically; deduce roots algebraically (A11) • plot and interpret graphs (including reciprocal graphs) and graphs of non-standard functions in real contexts, to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration (A14)
⑥						• deduce expressions to calculate the nth term of quadratic sequences (A24) • use the form y = mx + c to identify perpendicular lines (A9) • solve linear inequalities in two variables (A22) • recognise, sketch and interpret graphs of exponential functions $y = k^x$ for positive values of k; plot and interpret exponential graphs and graphs of non-standard functions in real contexts, to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration (A12/A14) • recognise and use the equation of a circle with centre at the origin (A16)
⑦						• recognise and use simple geometric progressions (r^n where n is an integer, and r is a rational number > 0 or a surd) and other sequences (A24) • solve linear inequalities in two variables; represent the solution set to an inequality using set notation and, on a graph (A22) • deduce roots of quadratic functions algebraically and turning points by completing the square (A11) • sketch translations and reflections of a given function (A13) • find the equation of a tangent to a circle at a given point (A16) • calculate or estimate gradients of graphs and areas under graphs (including quadratic and other non-linear graphs), and interpret results in cases such as distance-time graphs, velocity-time graphs and graphs in financial contexts (A15) • interpret the gradient at a point on a curve as the instantaneous rate of change; apply the concepts of average and instantaneous rate of change (gradients of chords and tangents) in numerical, algebraic and graphical contexts (R15)

Geometry

Assessment Objectives

	Y7	Y8	Y9	Y10	Y11	GEOMETRY Home
①						• use conventional terms and notations: points, lines, vertices, edges, planes, parallel lines, perpendicular lines, right angles, polygons, regular polygons and polygons with reflection and/or rotation symmetries; use the standard conventions for labelling and referring to the sides and angles of triangles (G1) • know angles are measured in degrees: estimate and compare acute, obtuse and reflex angles (G1) • derive and apply the properties and definitions of: special types of quadrilaterals, including square, rectangle, parallelogram, trapezium, kite and rhombus; and triangles and other plane figures using appropriate language (G4) • draw given angles; measure line segments and angles in geometric figures; draw 2-D shapes using given dimensions and angles (G15) • identify properties of the faces, surfaces, edges and vertices of: cubes, cuboids, prisms, cylinders, pyramids, cones and spheres (G12) • recognise, describe and build simple 3-D shapes, including making nets
②						• draw diagrams from written description (G1) • apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles (G3)
③						• derive and use the sum of angles in a triangle (e.g. to deduce and use the angle sum in any polygon, and to derive properties of regular polygons) (G3) • understand and use alternate and corresponding angles on parallel lines (G3) • construct and interpret plans and elevations of 3D shapes (G13) • use and interpret scale factors, scale diagrams and maps (G2/G15)
④						• understand and use of bearings (G15) • use the standard ruler and compass constructions (perpendicular bisector of a line segment, constructing a perpendicular to a given line from/at a given point, bisecting a given angle) (G2)
⑤						• use these to construct given figures and solve loci problems; know that the perpendicular distance from a point to a line is the shortest distance to the line (G2)
⑥						• **apply and prove the standard circle theorems concerning angles, radii, tangents and chords, and use them to prove related results (G10)**

Perimeter, Area and Volume

Assessment Objectives

	Y7	Y8	Y9	Y10	Y11	PERIMETER AREA AND VOLUME Home
①						• use standard units of measure and related concepts (length, area) (N13/G14) • calculate perimeters of 2D shapes (G17) • know and apply formulae to calculate the area of a rectangle (G16)
②						• know and apply formulae to calculate the area of triangles and parallelograms (G16) • identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference (G9)

③						• know and apply formulae to calculate: (G16)
						   o area of trapezia
						   o surface area of cuboids
						   o volume of cuboids
						• know the formulae: circumference of a circle = 2πr = πd, area of a circle = πr²; calculate perimeters and areas of circles (G17)
						• know and apply formulae to calculate volume of right prisms (including cylinders) (G16)

④						• change freely between related standard units (e.g. area, volume/capacity) (R1) identify and apply circle definitions and properties, including: tangent, arc, sector and segment (G9) • calculate perimeters and areas of 2D shapes, including circles and composite shapes (G17) • calculate exactly with multiples of π (N8) • calculate surface area of right prisms (including cylinders) (G17)
⑤						• calculate arc lengths, angles and areas of sectors of circles (G18) • calculate surface area and volume of spheres, pyramids, cones and composite solids (G17)

Transformations

Assessment Objectives

	Y7	Y8	Y9	Y10	Y11	TRANSFORMATIONS
③						• identify, describe and construct congruent and similar shapes, including on coordinate axes, by considering rotation, reflection and translation (G7) • describe translations as 2D vectors (G24)
④						• apply the concepts of congruence and similarity, including the relationships between lengths in similar figures; make links between similarity and scale factors (G19/R12) • identify, describe and construct similar shapes, including on coordinate axes, by considering enlargement (G7)
⑤						• use the basic congruence criteria for triangles (SSS, SAS, ASA, RHS) (G5) • identify, describe and construct similar shapes, including on coordinate axes, by considering enlargement (including fractional scale factors) (G7) • apply addition and subtraction of vectors, multiplication of vectors by a scalar, and diagrammatic and column representations of vectors (G25)
⑥						• **identify, describe and construct similar shapes, including on coordinate axes, by considering enlargement (including negative scale factors) (G7)** • **describe the changes and invariance achieved by combinations of rotations, reflections and translations (G8)** • **apply the concepts of congruence and similarity, including the relationships between length, areas and volumes in similar figures (G19)**
⑦						• **use vectors to construct geometric arguments and proofs (G25)**

Pythagoras and Trigonometry

Assessment Objectives

	Y7	Y8	Y9	Y10	Y11	PYTHAGORAS AND TRIGONOMETRY
④						• know the formulae for Pythagoras' theorem, $a^2 + b^2 = c^2$ and apply it to find lengths in right-angled triangles in two dimensional figures (G20)
⑤						• make links between similarity (including trigonometric ratios) and scale factors (R12) • know the trigonometric ratios, $\sin\theta$ = opposite/hypotenuse, $\cos\theta$ = adjacent/hypotenuse, $\tan\theta$ = opposite/adjacent and apply them to find angles and lengths in two dimensional figures (G20) • know the exact values of $\sin\theta$ and $\cos\theta$ for θ = 0°, 30°, 45°, 60° and 90°; know the exact value of $\tan\theta$ for θ = 0°, 30°, 45° and 60° (G21)
⑥						• apply Pythagoras' theorem and the trigonometric ratios to find angles and lengths in right-angled triangles and, where possible, general triangles in three dimensional figures (G20)
⑦						• know and apply the sine rule, a/sinA = b/sinB = c/sinC, and the cosine rule, a² = b² + c² - 2bc cosA, to find unknown lengths and angles (G22) • know and apply area = ½ab sinC to calculate the area, sides or angles of any triangle (G23) • recognise, sketch and interpret graphs of trigonometric functions (with arguments in degrees) y = sin x, y = cos x and y = tan x for angles of any size (A12)

Statistics

Assessment Objectives

	Y7	Y8	Y9	Y10	Y11	STATISTICS
②						• interpret and construct tables, charts and diagrams, including frequency tables, bar charts and pictograms for categorical data and know their appropriate use (S2)
③						• interpret and construct tables, charts and diagrams, including pie charts for categorical data, vertical line charts for ungrouped discrete numerical data and know their appropriate use (S2) • interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate measures of central tendency (median, mean and mode) and spread (range) (S4)

④						• interpret, analyse and compare the distributions of data sets from univariate empirical distributions through: (S4)
						  ○ appropriate graphical representation involving discrete, continuous and grouped data
						  ○ appropriate measures of central tendency (median, mean, mode and modal class) and spread (range, including consideration of outliers)
						• apply statistics to describe a population (S5)
						• use and interpret scatter graphs of bivariate data; recognise correlation (S6)

⑤						• know correlation does not indicate causation; draw estimated lines of best fit; make predictions; interpolate and extrapolate apparent trends whilst knowing the dangers of so doing (S6) • interpret and construct tables, charts and diagrams, including tables and line graphs for time series data and know their appropriate use (S2) • infer properties of populations or distributions from a sample, whilst knowing the limitations of sampling (S1)

⑥						• **interpret, analyse and compare the distributions of data sets from univariate empirical distributions through: (S4)**
						  ○ **appropriate measures of central tendency including quartiles and inter-quartile range**
						  ○ **appropriate graphical representation involving discrete, continuous and grouped data, including box plots**
						• **construct and interpret diagrams for grouped discrete data and continuous data, i.e. cumulative frequency graphs, and know their appropriate use (S3)**

⑦						• **construct and interpret diagrams for grouped discrete data and continuous data, i.e. histograms with equal and unequal class intervals and know their appropriate use (S3)**

Probability

Assessment Objectives

	Y7	Y8	Y9	Y10	Y11	PROBABILITY Home
②						• know and use the vocabulary of probability • apply systematic listing strategies (N5)
③						• record describe and analyse the frequency of outcomes of probability experiments using tables and frequency trees (P1) • relate relative expected frequencies to theoretical probability, using appropriate language and the 0 - 1 probability scale (P3) • apply the property that the probabilities of an exhaustive set of outcomes sum to 1; apply the property that the probabilities of an exhaustive set of mutually exclusive events sum to 1 (P4)
④						• apply ideas of randomness, fairness and equally likely events to calculate expected outcomes of multiple future experiments (P2); • understand that empirical unbiased samples tend towards theoretical probability distributions, with increasing sample size (P5) • enumerate sets and combinations of sets systematically, using tree diagrams (P6) • construct theoretical possibility spaces for single and combined experiments with equally likely outcomes and use these to calculate theoretical probabilities (P7)
⑤						• enumerate sets and combinations of sets systematically, using tables, grids and Venn diagrams (P6) • calculate the probability of independent and dependent combined events, including using tree diagrams and other representations, and know the underlying assumptions (P8)
⑥						• apply systematic listing strategies including use of the product rule for counting (N5)
⑦						• calculate and interpret conditional probabilities through representation using expected frequencies with two-way tables, tree diagrams and Venn diagrams (P9)