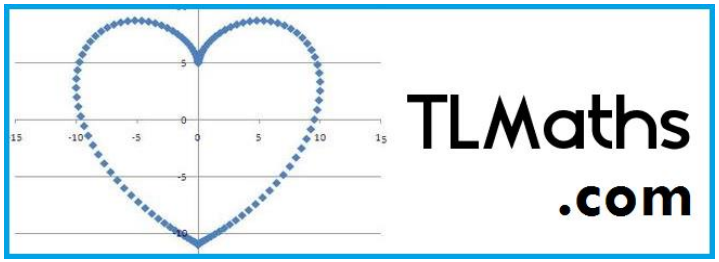
A-Level Maths Videos



Chapter 1: Algebra

A: Proof

[Understand and use the structure of mathematical proof, proceeding from given assumptions through a series of logical steps to a conclusion; use methods of proof, including proof by deduction, proof by exhaustion] **[Disproof by counter example]**	• A1-01 [Introduction to Proof] • A1-02 [Introducing Consequence and Equivalence] • A1-03 [Consequence and Equivalence Examples] • A1-04 [Introducing Proof by Exhaustion] • A1-05 [Proof by Exhaustion Examples] • A1-06 [Introducing Proof by Deduction] • A1-07 [Proof by Deduction Examples] • A1-08 [Introducing Disproof by Counter Example] • A1-09 [Disproof by Counter Example Examples]

B: Algebra and Functions

[Understand and use the laws of indices for all rational exponents]	• B1-00 [Introducing Subsets of Real Numbers] • B1-01 [Indices: The Laws of Indices] • B1-02 [Indices: Examples of Negative Indices] • B1-03 [Indices: Examples of Positive Rational Indices] • B1-04 [Indices: Examples of Negative Rational Indices] • B1-05 [Indices: More Complicated Examples]

[Use and manipulate surds, including rationalising the denominator]	• B2-01 [Surds: Introducing Surds and Simplifying Surds] • B2-02 [Surds: Simplifying Surds Examples] • B2-03 [Surds: Adding / Subtracting Surds] • B2-04 [Surds: Introducing Expanding Single Brackets] • B2-05 [Surds: Expanding Single Brackets Examples] • B2-06 [Surds: Introducing Expanding Double Brackets] • B2-07 [Surds: Expanding Double Brackets Examples] • B2-08 [Surds: Introducing Rationalising the Denominator Part 1] • B2-09 [Surds: Rationalising the Denominator Part 1 Examples] • B2-10 [Surds: Introducing Rationalising the Denominator Part 2] • B2-11 [Surds: Rationalising the Denominator Part 2 Examples] • B2-12 [Surds: More Complicated Examples of Rationalising the Denominator]
[Work with quadratic functions and their graphs; the discriminant of a quadratic function, including the conditions for real and repeated roots; completing the square; solution of quadratic equations including solving quadratic equations in a function of the unknown]	• B3-01 [Quadratics: Factorising Quadratics using the Difference of Two Squares] • B3-02 [Quadratics: Factorising Quadratics of the form x^2 + bx + c] • B3-03 [Quadratics: Factorising Quadratics of the form ax^2 + bx + c] • B3-04 [Quadratics: Introducing Parabolas] • B3-05 [Quadratics: Introducing Sketching Quadratics from Factorised Form] • B3-06 [Quadratics: Examples of Sketching Quadratics from Factorised Form] • B3-07 [Quadratics: Introducing Completing the Square with the form x^2 + bx + c] • B3-08 [Quadratics: Examples of Completing the Square with the form x^2 + bx + c] • B3-09 [Quadratics: Introducing Completing the Square with the form ax^2 + bx + c] • B3-10 [Quadratics: Examples of Completing the Square with the form ax^2 + bx + c] • B3-11 [Quadratics: Introducing Sketching Quadratics from Completed Square Form] • B3-12 [Quadratics: Examples of Sketching Quadratics from Completed Square Form] • B3-13 [Quadratics: Three Ways to Solve a Quadratic Equation]

	• B3-14 [Quadratics: Where the Quadratic Formula Comes From] • B3-15 [Quadratics: Using the Discriminant to Find How Many Roots a Quadratic Has] • B3-16 [Quadratics: Examples of Using the Discriminant to Find How Many Roots a Quadratic Has] • B3-17 [Quadratics: Examples of Using the Quadratic Formula] • B3-18 [Quadratics: Examples of Sketching Quadratics using the Quadratic Formula] • B3-19 [Quadratics: Solving More Complicated Equations Using Quadratic Methods]
[Solve simultaneous equations in two variables by elimination and by substitution, including one linear and one quadratic equation]	• B4-01 [Simultaneous Equations: Examples of Using the Elimination Method] • B4-02 [Simultaneous Equations: Examples of Using the Substitution Method] • B4-03 [Simultaneous Equations: Examples of One Linear Equation and One Quadratic Equation] • B4-04 [Simultaneous Equations: More Complicated Examples]
[Solve linear and quadratic inequalities in a single variable and interpret such inequalities graphically, including inequalities with brackets and fractions] **[Express solutions through correct use of 'and' and 'or', or through set notation]** **[Represent linear and quadratic inequalities such as $y > x + 1$ and $y > ax^2 + bx + c$ graphically]**	• B5-01 [Inequalities: Solving Basic Linear Inequalities] • B5-02 [Inequalities: Solving More Complicated Linear Inequalities] • B5-03 [Inequalities: Solving Linear Inequalities Graphically] • B5-04 [Inequalities: Solving General Inequalities (the BIG IDEA)] • B5-05 [Inequalities: Introducing Solving Quadratic Inequalities] • B5-06 [Inequalities: Examples of Solving Basic Quadratic Inequalities] • B5-07 [Inequalities: Solving More Complicated Quadratic Inequalities] • B5-08 [Inequalities: Introducing Discriminant Inequalities] • B5-09 [Inequalities: Examples of Discriminant Inequalities Part 1] • B5-10 [Inequalities: Examples of Discriminant Inequalities Part 2] • B5-11 [Inequalities: EXTENSION Tricky Example of a Discriminant Inequality] • B5-12 [Inequalities: Finding where Curves Intersect] • B5-13 [Inequalities: Notes on Notation] • B5-14 [Inequalities: Solving Inequalities with Set Notation]

	• B5-15 [Inequalities: EXTENSION Double & Triple Inequalities] • B5-16 [Inequalities: Representing Linear Inequalities Graphically] • B5-17 [Inequalities: Representing Quadratic Inequalities Graphically] • B5-18 [Inequalities: Identifying Regions Graphically]

C: Coordinate Geometry in the (x,y) plane

[Understand and use the equation of a straight line, including the forms $y - y_1 = m(x - x_1)$ and $ax+by+c=0$; gradient conditions for two straight lines to be parallel or perpendicular] **[Be able to use straight line models in a variety of contexts]**	• C1-00 [Introducing Coordinate Geometry] • C1-01 [Coordinate Geometry: Introducing Finding the Midpoint between Two Points] • C1-02 [Coordinate Geometry: Examples of Finding the Midpoint between Two Points] • C1-03 [Coordinate Geometry: Introducing Finding the Distance between Two Points] • C1-04 [Coordinate Geometry: Examples of Finding the Distance between Two Points] • C1-05 [Coordinate Geometry: Finding the Gradient of a Chord between Two Points] • C1-06 [Coordinate Geometry: Examples of Finding the Gradient of a Chord] • C1-07 [Coordinate Geometry: The Equation of a Line in the form y = mx + c] • C1-08 [Coordinate Geometry: The Equation of a Line in the form y-y1 = m(x - x1)] • C1-09 [Coordinate Geometry: Examples of Finding the Equation of a Line] • C1-10 [Coordinate Geometry: Finding the Equation of a Line in the form ax+by+c=0] • C1-11 [Coordinate Geometry: Parallel and Perpendicular Lines] • C1-12 [Coordinate Geometry: Finding the Negative Reciprocal] • C1-13 [Coordinate Geometry: Find a Parallel & Perpendicular Line] • C1-14 [Coordinate Geometry: Introducing Sketching Linear Graphs] • C1-15 [Coordinate Geometry: Examples of Sketching Linear Graphs]

	• C1-16 [Coordinate Geometry: Finding the Perpendicular Bisector of Two Points] • C1-17 [Coordinate Geometry: Examples of Finding the Perpendicular Bisector] • C1-18 [Coordinate Geometry: Finding where Two Lines Intersect] • C1-19 [Coordinate Geometry: Using a Speed / Time Graph]
[Understand and use the coordinate geometry of the circle including using the equation of a circle in the form $(x-a)^2+(y-b)^2=r^2$; **Completing the square to find the centre and radius of a circle; use of the following properties:** • **the angle in a semicircle is a right angle** • **the perpendicular from the centre to a chord bisects the chord** • **the radius of a circle at a given point on its circumference is perpendicular to the tangent to the circle at that point**	• C2-01 [Circles: Introducing the Equation of the Circle] • C2-02 [Circles: Identifying the Centre & Radius] • C2-03 [Circles: Sketching Circles] • C2-04 [Circles: Different Forms of the Equation of a Circle] • C2-05 [Circles: Using Completing the Square to find the Centre & Radius] • C2-06 [Circles: Finding where a Line Intersects a Circle] • C2-07 [Circles: EXTENSION Finding where Two Circles Intersect] • C2-08 [Circles: The Angle in a Semicircle is a Right Angle] • C2-09 [Circles: Proving the Chord joining A and B is a Diameter] • C2-10 [Circles: Perpendicular Bisector of Two Points on a Circle] • C2-11 [Circles: Given 3 Points, Find the Centre & Radius - Example 1] • C2-12 [Circles: Given 3 Points, Find the Centre & Radius - Example 2] • C2-13 [Circles: Tangents & Normals] • C2-14 [Circles: Finding Tangents & Normals] • C2-15 [Circles: Determining whether Two Circles Intersect or Not]

Chapter 2: Polynomials and the Binomial Theorem

B: Algebra and Functions

[Manipulate polynomials algebraically, including expanding brackets and collecting like terms,	• B6-01 [Polynomials: Introducing Polynomials] • B6-02 [Polynomials: Adding and Subtracting Polynomials]

factorisation and simple algebraic division; use of the factor theorem]	• B6-03 [Polynomials: Multiplying Polynomials] • B6-04 [Polynomials: Expanding Three or More Brackets] • B6-05 [Polynomials: Polynomial Division using the Grid Method] • B6-06 [Polynomials: Polynomial Division using the Long Division Method] • B6-07 [Polynomials: Polynomial Division using the Inspection Method] • B6-08 [Polynomials: Polynomial Division using the Synthetic Method] • B6-09 [Polynomials: Examples of Polynomial Division] • B6-10 [Polynomials: EXTENSION Harder Examples of Polynomial Division] • B6-11 [Polynomials: Introducing the Factor Theorem] • B6-12 [Polynomials: An Example of Using the Factor Theorem] • B6-13 [Polynomials: Solving Problems and Extending the Factor Theorem] • B6-14 [Polynomials: EXTENSION Proof of the Factor Theorem]
[Understand and use graphs of functions; sketch curves defined by simple equations including polynomials], **[** $y = \frac{a}{x}$ **and** $y = \frac{a}{x^2}$ **(including their vertical and horizontal asymptotes);** **interpret algebraic solution of equations graphically; use intersection points of graphs to solve equations]** **[Understand and use proportional relationships and their graphs]**	• B7-01 [Graphs: Introducing Cubic Graphs] • B7-02 [Graphs: Sketching Quadratics, Cubics, Quartics and Quintics] • B7-03 [Graphs: Examples of Sketching Cubics from Factorised Form] • B7-04 [Graphs: Examples of Sketching Quartics from Factorised Form] • B7-18 [Graphs: Introducing Reciprocal Graphs of the form y = a/x] • B7-19 [Graphs: Examples of Sketching Reciprocal Graphs of the form y = a/x] • B7-20 [Graphs: Introducing Reciprocal Graphs of the form y = a/x^2] • B7-21 [Graphs: Examples of Sketching Reciprocal Graphs of the form y = a/x^2] • B7-22 [Graphs: Examples of Sketching Translated Reciprocal Graphs] • B7-23 [Graphs: Introducing finding Points of Intersection] • B7-24 [Graphs: Examples of finding Points of Intersection between Lines and Curves] • B7-25 [Graphs: Examples of finding Points of Intersection between Two Curves] • B7-26 [Proportion: Introducing Direct Proportion and Inverse

	Proportion] • B7-27 [Proportion: Determining if Two Variables are Proportional] • B7-28 [Proportion: Examples of Finding the Constant of Proportionality] • B7-29 [Proportion: Graphing an Inverse Proportion]
[Understand the effect of simple transformations on the graph of ***y* = f (*x*)including sketching associated graphs:** ***y* = *a*f (*x*), *y*= f (*x*)+ *a*, *y*= f (*x*+ *a*), *y*= f (*ax*)]**,	• B9-01 [Graph Transformations: Beginning an Investigation into Transformations] • B9-02 [Graph Transformations: Investigating y = f(x) + a] • B9-03 [Graph Transformations: Investigating y = f(x - a)] • B9-04 [Graph Transformations: Translations Overview] • B9-05 [Graph Transformations: Investigating y = kf(x)] • B9-06 [Graph Transformations: Investigating y = f(kx)] • B9-07 [Graph Transformations: Stretches Overview] • B9-08 [Graph Transformations: Investigating y = -f(x)] • B9-09 [Graph Transformations: Investigating y = f(-x)] • B9-10 [Graph Transformations: Reflections Overview] • B9-11 [Graph Transformations: Examples of Describing Single Transformations] • B9-12 [Graph Transformations: Examples of Transforming Coordinates] • B9-13 [Graph Transformations: Examples of Transforming y = x^2] • B9-14 [Graph Transformations: Examples of Transforming y = x^3] • B9-15 [Graph Transformations: Examples of Transforming y = (x + 2)(x - 1)(x - 3)] • B9-16 [Graph Transformations: Examples of Transforming y = 1/x] • B9-17 [Graph Transformations: Examples of Transforming y = e^x] • B9-18 [Graph Transformations: Examples of Transforming y = ln(x)] • B9-19 [Graph Transformations: Examples of Transforming a Piecewise Function] • B9-20 [Graph Transformations: Transforming Graphs via 'Replacing']

D: Sequences and Series

[Understand and use the binomial expansion of $(a + bx)^n$ for positive integer n; the notations $n!$ and ${}^nC_r$; link to binomial probabilities]	• D1-00 [Binomial Expansion: Introducing Factorials n!] • D1-01 [Binomial Expansion: Introducing and Linking Pascal's Triangle and nCr] • D1-02 [Binomial Expansion: Explaining where nCr comes from] • D1-03 [Binomial Expansion: Expanding (1+x)^n] • D1-04 [Binomial Expansion: Expanding (a+b)^n] • D1-05 [Binomial Expansion: Fully Expand (1 + 3x)^4] • D1-06 [Binomial Expansion: Fully Expand (3 - 2x)^5] • D1-07 [Binomial Expansion: Fully Expand (x + 4/x)^6] • D1-08 [Binomial Expansion: Fully Expand (3x^2y - 4xy)^4 • D1-09 [Binomial Expansion: Find the coefficient of x^6 in (2 + x)^8] • D1-10 [Binomial Expansion: Find the coefficient of x^2 in (1 + 3x)^16] • D1-11 [Binomial Expansion: Find the coefficient of x^3 in (2 - 5x)^14] • D1-12 [Binomial Expansion: Find the coefficient of x^10 in (1-2x)^5*(2+x)^7] • D1-13 [Binomial Expansion: Approximating 1.03^8 WITHOUT a calculator]

Chapter 3 : Trigonometry

E: Trigonometry

[Understand and use the definitions of sine, cosine and tangent for all arguments; the sine and cosine rules; the area of a triangle in the form $1/2\,ab\sin C$]	• E1-01 [Trigonometry: Introducing sin(x), cos(x) & tan(x)] • E1-02 [Trigonometry: Two Triangles to Learn] • E1-03 [Trigonometry: Using the Two Triangles] • E1-04 [Trigonometry: Examples of Finding Missing Angles] • E1-05 [Trigonometry: Examples of Finding Missing Sides] • E1-06 [Trigonometry: Finding Exact Values of sin(x), cos(x) & tan(x)] • E1-07 [Trigonometry: EXTENSION Proof of the Sine Rule]

	• E1-08 [Trigonometry: Using the Sine Rule] • E1-09 [Trigonometry: When the Sine Rule can lead to Two Triangles] • E1-10 [Trigonometry: EXTENSION Proof of the Cosine Rule] • E1-11 [Trigonometry: Using the Cosine Rule] • E1-12 [Trigonometry: Find all the Missing Sides and Angles of a Triangle] • E1-13 [Trigonometry: EXTENSION Proof of Area of a Triangle ½ absinC] • E1-14 [Trigonometry: Finding the Area of Triangles]
[Understand and use the sine, cosine and tangent functions; their graphs, symmetries and periodicity]	• E3-01 [Trig Graphs: Sketching sin(x), cos(x) & tan(x) from the Unit Circle] • E3-02 [Trig Graphs: The Period of y = sin(x), y = cos(x) and y = tan(x)] • E3-03 [Trig Graphs: The Period of Transformed Trig Graphs] • E3-04 [Trig Graphs: State the Period of the Transformed Trig Graph] • E3-05 [Trig Graphs: Quickly Sketching y = sin(x) in degrees] • E3-06 [Trig Graphs: Quickly Sketching y = cos(x) in degrees] • E3-07 [Trig Graphs: Quickly Sketching y = tan(x) in degrees]
[Understand and use tanθ = sinθ/cosθ]	• E5-01 [Trigonometric Identities: Proving tanθ = sinθ / cosθ] • E5-02 [Trigonometric Identities: Proving sin^2 θ + cos^2 θ = 1] • E5-03 [Trigonometric Identities: Simplifying Expressions] • E5-04 Trigonometric Identities: arcsin(x) = arccos(y)
[Solve simple trigonometric equations in a given interval, including quadratic equations in sin, cos and tan and equations involving multiples of the unknown angle]	• E7-00 [Trig Equations: Introduction to this Section] • E7-01 [Trig Equations: Solve sin(x) = 1/2 between 0 and 360 degrees] • E7-03 [Trig Equations: Solve cos(x) = 1/2 between 0 and 360 degrees] • E7-05 [Trig Equations: Solve tan(x) = 1 between 0 and 360 degrees] • E7-07 [Trig Equations: Solving Basic Trigonometric Equations in degrees] • E7-09 [Trig Equations: Solve 1/cos(x) = 5 between 0 and 360 degrees] • E7-10 [Trig Equations: Solve 1/cos(x) = 5 between 360 and 720 degrees]

	• E7-13 [Trig Equations: Solve sin^2(x) = 1/16 between 0 and 360 degrees] • E7-15 [Trig Equations: Solve 4x^2 = x] • E7-16 [Trig Equations: Solve 4sin^2(x) = sin(x) between 0 and 360 degrees] • E7-18 [Trig Equations: Solve 4sin(x) + 5cos(x) = 0 between 0 and 360 degrees] • E7-20 [Trig Equations: Solving Equations that Involve Transformations] • E7-21 [Trig Equations: Solve sin(x + 65) = 0.7 between 0 and 360 degrees] • E7-23 [Trig Equations: Solve cos(x - 35) = -0.3 between 0 and 360 degrees] • E7-25 [Trig Equations: Solve tan(x + 280) = 4.1 between 0 and 360 degrees] • E7-27 [Trig Equations: Solve sin(2x) = 0.8 between 0 and 360 degrees] • E7-29 [Trig Equations: Solve cos(3x) = 0.7 between 0 and 360 degrees] • E7-31 [Trig Equations: Solve tan(4x) = 3.3 between 0 and 360 degrees] • E7-33 [Trig Equations: Solve sin(3x-54) = 0.25 between 180 and 540 degrees] • E7-35 [Trig Equations: Solve sin^2(x) + 2sin(x) - 3 = 0, 0-360 degrees] • E7-37 [Trig Equations: Solve 5tan^2(x) - 38tan(x) - 16 = 0, 0-360 degrees] • E7-39 [Trig Equations: Solve 3sin^2(x) = 3 - 2cos(x) between 0 and 360 degrees] • E7-41 [Trig Equations: Solve 3sin(x) = 2cos^2(x) between 0 and 360 degrees] • E7-43 [Trig Equations: Solve 7sin^2(x) - 5sin(x) + cos^2(x) = 0, 0-360 degrees] • E7-45 [Trig Equations: Things to Remember about y = sin(x) and y = cos(x)] • E7-46 [Trig Equations: Solve cos(x + 60) = sin(x) between 0 and 360 degrees] • E7-48 [Trig Equations: Solve sin(x - 35) = cos(x) between 0 and 360 degrees]

Chapter 4: Differentiation and Integration

G: Differentiation

[Understand and use the derivative of f(x) as the gradient of the tangent to the graph of y = f (x) at a general point (x, y); the gradient of the tangent as a limit; interpretation as a rate of change; sketching the gradient function for a given curve; second derivatives; differentiation from first principles for small positive integer powers of x] and for sin x and cos x **[Understand and use the second derivative as the rate of change of gradient]**;	• G1-01 [Differentiation: Gradient of a Straight Line] • G1-02 [Differentiation: Gradient Functions of Straight Lines] • G1-03 [Differentiation: Gradient of a Curve] • G1-04 [Differentiation: Differentiating Polynomials] • G1-05 [Differentiation: Graphs of Functions and Gradient Functions] • G1-06 [Differentiation: Second Derivatives] • G1-07 [Differentiation: Graphing the Second Derivative] • G1-08 [Differentiation: Graphing f'(x) and f''(x) Example 1] • G1-09 [Differentiation: Graphing f'(x) and f''(x) Example 2] • G1-10 [Differentiation: Graphing f'(x) and f''(x) Example 3] • G1-11 [Differentiation: Differentiation From First Principles] • G1-12 [Differentiation: Differentiate x^2 from First Principles] • G1-13 [Differentiation: Differentiate x^2 + 2x + 1 from First Principles] • G1-14 [Differentiation: Differentiate x^3 from First Principles] • G1-15 [Differentiation: Differentiate 4x^3 - 3x^2 from First Principles]
[Differentiate x^n, for rational values of n, and related constant multiples, sums and differences]	• G2-01 [Differentiation: Differentiate x^n, n a positive integer] • G2-02 [Differentiation: Proof of the Sum Rule for Differentiation] • G2-03 [Differentiation: Differentiating Polynomials] • G2-04 [Differentiation: Differentiating with Fractional and Negative Indices] • G2-05 [Differentiation: Dealing with Indices]
[Apply differentiation to find gradients, tangents and normals, maxima and minima and stationary points], **[Identify where functions are increasing or decreasing]**	• G3-01 [Gradients: Gradients of Functions] • G3-02 [Gradients: Introducing Tangents and Normals] • G3-03 [Gradients: Equations of Tangents] • G3-05 [Gradients: Equations of Normals] • G3-07 [Gradients: Introducing Stationary Points]

	• G3-08 [Gradients: Examples of Finding Stationary Points] • G3-10 [Gradients: Where Functions are Increasing and Decreasing] • G3-11 [Gradients: The Second Derivative Test Part 1] • G3-13 [Gradients: Examples of Determining Types of Stationary Points Part 1] • G3-14 [Gradients: Examples of Determining Types of Stationary Points Part 2] • G3-24 [Optimisation: Rectangular Fence Problem] • G3-25 [Optimisation: Maximising Volume of a Box] • G3-26 [Optimisation: Minimising Surface Area of a Box] • G3-27 [Optimisation: Maximising Volume of a Prism]

H: Integration

[Know and use the Fundamental Theorem of Calculus]	• H1-01 [Integration: Introducing the Fundamental Theorem of Calculus]
[Integrate *x^n* (excluding *n* = -1), and related sums, differences and constant multiples]	• H2-01 [Integration: Integrating ax^n] • H2-02 [Integration: Examples of Integrating ax^n] • H2-03 [Integration: Examples of Integrating dy/dx] • H2-04 [Integration: Finding the Constant of Integration] • H2-05 [Integration: Examples of Finding the Constant of Integration]
[Evaluate definite integrals; use a definite integral to find the area under a curve]	• H3-01 [Integration: Finding the Exact Area under a Line] • H3-02 [Integration: Finding the Exact Area under a Curve] • H3-03 [Integration: Indefinite vs Definite Integrals] • H3-04 [Integration: Examples of Definite Integrals 1] • H3-05 [Integration: Examples of Definite Integrals 2] • H3-06 [Integration: A Definite Integral Problem] • H3-07 [Integration: Areas Under the x-axis] • H3-08 [Integration: Examples of Finding Areas 1] • H3-09 [Integration: Examples of Finding Areas 2] • H3-10 [Integration: EXTENSION: Definite Integrals Across Asymptotes]

Chapter 5: Exponentials and Logarithms

F: Exponentials and Logarithms

[Know and use the function *a*^*x* and its graph, where *a* is positive] **[Know and use the function e^x and its graph]**	• F1-01 [Exponentials: Introducing the function a^x] • F1-02 [Exponentials: Examples of Sketching functions of the form a^x] • F1-03 [Exponentials: Sketching Transformations of y = 2^x] • F1-04 [Exponentials: Introducing Asymptotes] • F1-05 [Exponentials: Sketching y = a^x + b] • F1-06 [Exponentials: Sketching y = a^(x+c) + b] • F1-07 [Exponentials: Maximise (20/x)^x] • F1-09 [Exponentials: Introducing e via Compound Interest] • F1-11 [Exponentials: Sketching y = e^x]
[Know that the gradient of e^kx is equal to *k*e^kx and hence understand why the exponential model is suitable in many applications]	• F2-01 [Exponential Model: Another way of deriving e] • F2-02 [Exponential Model: The Gradient of e^kx] • F2-03 [Exponential Model: Examples of Gradient Functions of e^kx] • F2-04 [Exponential Model: Finding a Gradient] • F2-05 [Exponential Model: The Insect Problem]
[Know and use the definition of $\log_a x$ as the inverse of *a*^*x* , where *a* is positive and $x \geq 0$] **[Know and use the function ln *x* and its graph]** **[Know and use ln *x* as the inverse function of e^x]**	• F3-01 [Logarithms: Introducing Logarithms] • F3-02 [Logarithms: Converting between Exponential and Logarithmic Form] • F3-03 [Logarithms: Graphing Logarithmic Functions] • F3-04 [Logarithms: The Natural Logarithm ln(x)] • F3-05 [Logarithms: Sketching Transformations of y = ln(x)]
[Understand and use the laws of logarithms: **log *x*+log *y*=log (*xy*); log *x*–log *y*=log *x*/*y* ; *k*log *x*=log x^k** **(including, for example, *k* = -1 and *k*=-1/2)]**	• F4-01 [Laws of Logarithms: Introducing the Laws of Logarithms] • F4-02 [Laws of Logarithms: Key Examples] • F4-03 [Laws of Logarithms: Further Examples] • F4-04 [Laws of Logarithms: Writing Expressions in terms of ln(x)]
[Solve equations of the form *a*^*x* = *b*]	• F5-01 [Exponential Equations: Solve 2^x = 5] • F5-02 [Exponential Equations: Examples]

	• F5-03 [Exponential Equations: Hidden Quadratics] • F5-04 [Exponential Equations: Solving an Inequality] • F5-05 [Exponential Equations: EXTENSION Solve 5^(x+3) = 3^(9-x)] • F5-06 [Exponential Equations: Solve e^x = 5] • F5-07 [Exponential Equations: Examples involving e and ln] • F5-08 [Logarithmic Equations: Examples]
[Use logarithmic graphs to estimate parameters in relationships of the form *y=ax^n* and *y=kb^x*, given data for *x* and *y*]	• F6-01 [Reduction to Linear Form: The Basic Idea] • F6-02 [Reduction to Linear Form: Reducing y = ax^n to Linear Form] • F6-03 [Reduction to Linear Form: Straight Line to Curve Example 1] • F6-04 [Reduction to Linear Form: Reducing y = kb^x to Linear Form] • F6-05 [Reduction to Linear Form: Straight Line to Curve Example 2] • F6-06 [Reduction to Linear Form: The Whole Process Example 1] • F6-07 [Reduction to Linear Form: The Whole Process Example 2]
[Understand and use exponential growth and decay; use in modelling (examples may include the use of e in continuous compound interest, radioactive decay, drug concentration decay, exponential growth as a model for population growth); consideration of limitations and refinements of exponential models]	• F7-01 [Exponential Growth & Decay: The Investment Problem] • F7-02 [Exponential Growth & Decay: The Rabbits Problem] • F7-03 [Exponential Growth & Decay: The Dosage Problem] • F7-04 [Exponential Growth & Decay: The Metal Ball Problem]

Chapter 6: Vectors

J: Vectors

[Use vectors in two dimensions]	• J1-01 [Vectors: What is a Vector?] • J1-02 [Vectors: Notation] • J1-03 [Vectors: Finding the Vector between Two Points in 2D]

	• J1-04 [Vectors: Examples of Finding the Vector between Two Points]
[Calculate the magnitude and direction of a vector and convert between component form and magnitude/direction form]	• J2-01 [Vectors: The Magnitude / Length of a 2D Vector] • J2-02 [Vectors: The Direction of a Vector] • J2-03 [Vectors: From Component Form to Magnitude - Direction Form] • J2-04 [Vectors: Examples of Component to Magnitude - Direction Form] • J2-05 [Vectors: From Magnitude - Direction Form to Component Form] • J2-06 [Vectors: Examples of Magnitude - Direction to Component Form] • J2-07 [Vectors: Finding the Angle between Two Vectors] • J2-08 [Vectors: Examples of Angles between Vectors]
[Add vectors diagrammatically and perform the algebraic operations of vector addition and multiplication by scalars, and understand their geometrical interpretations]	• J3-01 [Vectors: Introducing Resultant Vectors] • J3-02 [Vectors: Examples of finding Resultant Vectors] • J3-03 [Vectors: Parallel Vectors] • J3-04 [Vectors: Unit Vectors] • J3-05 [Vectors: Show that Three Points are Collinear]
[Understand and use position vectors; calculate the distance between two points represented by position vectors]	• J4-01 [Vectors: Introducing Position Vectors] • J4-02 [Vectors: Finding the Distance between Two Points]
[Use vectors to solve problems in pure mathematics and in context, including forces]	• J5-01 [Vectors: Vectors Problem 1] • J5-02 [Vectors: Vectors Problem 2] • J5-03 [Vectors: Vectors Problem 3] • J5-04 [Vectors: Forces in Equilibrium Problem]

Chapter 7: Units and Kinematics

P: Quantities and Units in Mechanics

[Understand and use fundamental quantities and units	• P1-01 [S.I. Units: Length, Time, Mass and Derived Quantities] • P1-03 [S.I. Units: Conversions]

in the S.I. system: length, time, mass] **[Understand and use derived quantities and units: velocity, acceleration, force, weight]**,	

Q: Kinematics

[Understand and use the language of kinematics: position; displacement; distance travelled; velocity; speed; acceleration]	• Q1-01 [Kinematics: Position vs Displacement vs Distance] • Q1-02 [Kinematics: Velocity vs Speed] • Q1-03 [Kinematics: Acceleration and Deceleration]
[Understand, use and interpret graphs in kinematics for motion in a straight line: displacement against time and interpretation of gradient; velocity against time and interpretation of gradient and area under the graph]	• Q2-01 [Kinematics: Displacement / Time Graphs] • Q2-02 [Kinematics: Displacement / Time Graph Example 1] • Q2-03 [Kinematics: Displacement / Time Graph Example 2] • Q2-04 [Kinematics: Velocity / Time Graphs] • Q2-05 [Kinematics: Velocity / Time Graph Example 1] • Q2-06 [Kinematics: Velocity / Time Graph Example 2] • Q2-07 [Kinematics: Acceleration / Time Graphs] • Q2-08 [Kinematics: Acceleration / Time Graph Example] • Q2-09 [Kinematics: Drawing Graphs Problem] • Q2-10 [Kinematics: A Tricky Problem]
[Understand, use and derive the formulae for constant acceleration for motion in a straight line];	• Q3-01 [SUVAT: Deriving the Constant Acceleration Formulae] • Q3-02 [SUVAT: Using the Formulae Example 1] • Q3-03 [SUVAT: Using the Formulae Example 2] • Q3-04 [SUVAT: Using the Formulae Example 3] • Q3-05 [SUVAT: Using the Formulae Example 4] • Q3-06 [SUVAT: Using the Formulae Example 5] • Q3-07 [SUVAT: Introducing Gravity] • Q3-08 [SUVAT: More Complicated Problem 1] • Q3-09 [SUVAT: More Complicated Problem 2] • Q3-10 [SUVAT: More Complicated Problem 3] • Q3-11 [SUVAT: More Complicated Problem 4] • Q3-12 [SUVAT: More Complicated Problem 5]
[Use calculus in kinematics for motion in a straight line:	• Q4-01 [Calculus in Kinematics: Introduction to General Motion] • Q4-02 [Calculus in Kinematics: Example 1] • Q4-03 [Calculus in Kinematics: Example 2]

$v = \frac{dr}{dt},\ a = \frac{dv}{dt} = \frac{d^2r}{dt^2},\ r = \int v\ dt,\ v = \int a\ dt$]	• Q4-04 [Calculus in Kinematics: Example 3] • Q4-05 [Calculus in Kinematics: Example 4] • Q4-06 [Calculus in Kinematics: Example 5]

Chapter 8: Forces and Newton's Laws

R: Forces and Newton's Laws

[Understand the concept of a force; understand and use Newton's first law]	• R1-01 [Forces: What is a Force?] • R1-02 [Forces: Simplifying Assumptions] • R1-03 [Forces: Types of Force] • R1-04 [Forces: Drawing Force Diagrams] • R1-05 [Forces: Resultant Forces] • R1-06 [Forces: Newton's First Law] • R1-07 [Forces: Resultant Forces and Describing the Motion of Particles] • R1-08 [Forces: Particles in Equilibrium] • R1-09 [Forces: Resolving to get Simultaneous Equations]
[Understand and use Newton's second law for motion in a straight line (restricted to forces in two perpendicular directions or simple cases of forces given as 2-D vectors)];	• R2-01 [Forces: Newton's Second Law] • R2-02 [Forces: F=ma Example 1] • R2-03 [Forces: F=ma Example 2] • R2-04 [Forces: With SUVAT Example 1] • R2-05 [Forces: With SUVAT Example 2] • R2-06 [Forces: With SUVAT Example 3 Vectors]
[Understand and use weight and motion in a straight line under gravity; gravitational acceleration, *g*, and its value in S.I. units to varying degrees of accuracy] **[(The inverse square law for gravitation is not required and *g* may be assumed to be constant, but students should be aware that *g* is not a universal constant but depends on location)]**	• R3-01 [Forces: F=ma with Weight and Tension] • R3-02 [Forces: A Falling Bucket] • R3-03 [Forces: A Bucket Being Pulled Up] • R3-04 [Forces: Maximum Tension Problem] • R3-05 [Forces: Ball Dropped Off A Cliff Problem]
[Understand and use Newton's third law; equilibrium of	• R4-01 [Forces: Newton's Third Law]

forces on a particle and motion in a straight line (restricted to forces in two perpendicular directions or simple cases of forces given as 2-D vectors); application to problems involving smooth pulleys and connected particles];	• R4-02 [Forces: Car and a Trailer Problem] • R4-03 [Forces: Railway Engine and a Carriage Problem] • R4-04 [Forces: Cable, Crate, Rope, Box Problem] • R4-05 [Forces: Introducing Pulley Problems] • R4-06 [Forces: Pulley Example 1] • R4-07 [Forces: Pulley Example 2] • R4-08 [Forces: Pulley Example 3 with SUVAT] • R4-09 [Forces: Pulley Example 4] • R4-10 [Forces: Pulley Example 5 with SUVAT] • R4-11 [Forces: Pulley Example 6 with SUVAT]

Chapter 9: Collecting, representing and interpreting data

K: Statistical Sampling

[Understand and use the terms 'population' and 'sample'] **[Use samples to make informal inferences about the population]** **[Understand and use sampling techniques, including simple random sampling and opportunity sampling]** **[Select or critique sampling techniques in the context of solving a statistical problem, including understanding that different samples can lead to different conclusions about the population]**	• K1-00 [The Large Data Set: My Take] • K1-01 [Sampling: Population vs Sample] • K1-02 [Sampling: Discrete vs Continuous] • K1-03 [Sampling: Quantitative vs Qualitative] • K1-04 [Sampling Methods: Census] • K1-05 [Sampling Methods: Simple Random Sampling] • K1-06 [Sampling Methods: Systematic Sampling] • K1-07 [Sampling Methods: Stratified Sampling] • K1-08 [Sampling Methods: Quota Sampling] • K1-09 [Sampling Methods: Opportunity Sampling] • K1-10 [Sampling Methods: Cluster Sampling] • K1-11 [Sampling Method: Self-Selection Sampling]

L: Data Presentation and Interpolation

[Interpret diagrams for single-variable data, including understanding that area in a histogram represents	• L1-01 [Data: An Introduction to Data Presentation] • L1-02 [Data: Box Plots / Box and Whisker Diagrams]

frequency] **[Connect to probability distributions]**	• L1-03 [Data: Comparing Box Plots] • L1-04 [Data: Cumulative Frequency Curves] • L1-05 [Data: Median and Quartiles from Cumulative Frequency] • L1-06 [Data: Histograms] • L1-07 [Data: Median and Quartiles from Histograms] • L1-08 [Data: Histogram Problem]
[Interpret scatter diagrams and regression lines for bivariate data, including recognition of scatter diagrams which include distinct sections of the population (calculations involving regression lines are excluded)] **[Understand informal interpretation of correlation]** **[Understand that correlation does not imply causation]**	• L2-01 [Scatter Graphs: Bivariate Data] • L2-02 [Scatter Graphs: Correlation and Association] • L2-03 [Scatter Graphs: Correlation does not imply Causation] • L2-04 [Scatter Graphs: The Product Moment Correlation Coefficient] • L2-05 [Scatter Graphs: 'Guessing' the PMCC] • L2-06 [Scatter Graphs: EXTENSION Introducing Regression Lines] • L2-07 [Scatter Graphs: Interpolation vs Extrapolation]
[Interpret measures of central tendency and variation, extending to standard deviation] **[Be able to calculate standard deviation, including from summary statistics]**	• L3-01 [Data: Finding the Mean from Discrete Data] • L3-02 [Data: Finding the Mode from Discrete Data] • L3-03 [Data: Finding the Median and Quartiles from Discrete Data] • L3-04 [Data: Estimating the Mean from Grouped Continuous Data] • L3-05 [Data: Finding the Modal Class from Grouped Continuous Data] • L3-06 [Data: Estimating the Median from Grouped Continuous Data] • L3-07 [Data: Estimating the Quartiles from Grouped Continuous Data] • L3-08 [Data: The Interquartile Range] • L3-09 [Data: OCR MEI ONLY The Midrange] • L3-10 [Data: Comparing Data Sets Problem 1] • L3-11 [Data: Comparing Data Sets Problem 2] • L3-12 [Data: Introducing the Variance and Standard Deviation] • L3-13 [Data: Comparing Data Sets Problem 2 AGAIN!] • L3-14 [Data: The Sample Standard Deviation] • L3-15 [Data: OCR MEI and the Standard Deviation] • L3-16 [Data: EXTENSION Alternative Formulae for the Standard Deviation] • L3-17 [Data: The Standard Deviation from Summary Statistics]

	• L3-18 [Data: Introducing Linear Coding] • L3-19 [Data: Example of Linear Coding]
[Recognise and interpret possible outliers in data sets and statistical diagrams] **[Select or critique data presentation techniques in the context of a statistical problem]** **[Be able to clean data, including dealing with missing data, errors and outliers]**	• L4-01 [Outliers: Using the Quartiles and Interquartile Range] • L4-02 [Outliers: Using the Mean and Standard Deviation] • L4-03 [Data: Critiquing Data Example] • L4-04 [Data: Cleaning Data Example]

Chapter 10: Probability and discrete random variables

M: Probability

[Understand and use mutually exclusive and independent events when calculating probabilities] **[Link to discrete and continuous distributions]**	• M1-01 [Probability: Basic Probability Concepts and Notation] • M1-02 [Probability: Venn Diagrams - Union and Intersection] • M1-03 [Probability: Finding Probabilities from a Venn Diagram] • M1-04 [Probability: Finding Missing Probabilities] • M1-05 [Probability: Drawing a Venn Diagram] • M1-06 [Probability: A 3-circle Venn Diagram Problem] • M1-07 [Probability: A Trickier Venn Diagram Problem] • M1-08 [Probability: Independent or Mutually Exclusive?] • M1-09 [Probability: Are A and B Independent?] • M1-10 [Probability: With Replacement and Without Replacement] • M1-11 [Probability: Picking Three at Random Problem] • M1-12 [Probability: Tree Diagram Example 1] • M1-13 [Probability: Tree Diagram Example 2] • M1-14 [Probability: Two-Way Table Example 1] • M1-15 [Probability: Two-Way Table Example 2] • M1-16 [Probability: Histogram Example]

N: Statistical Distributions

[Understand and use simple, discrete probability distributions (calculation of mean and variance of discrete random variables is excluded), including the binomial distribution, as a model; calculate probabilities using the binomial distribution]	• N1-01 [DRV: Introducing Discrete Random Variables] • N1-02 [DRV: Tabular Example 1] • N1-03 [DRV: Tabular Example 2] • N1-04 [DRV: Tabular Example 3] • N1-05 [DRV: Tabular Example 4] • N1-06 [DRV: A Problem involving a Probability Tree] • N1-07 [DRV: Representing as an Algebraic Function] • N1-08 [DRV: Algebraic Function Example 1] • N1-09 [DRV: Algebraic Function Example 2] • N1-10 [DRV: Algebraic Function Example 3] • N1-11 [DRV: Discrete Uniform Distributions] • N1-12 [DRV: Introducing the Cumulative Distribution Function] • N1-13 [DRV: Cumulative Distribution Function Example] • N1-14 [Binomial Distribution: Introducing Binomial Probabilities] • N1-15 [Binomial Distribution: Introducing the Binomial Distribution] • N1-16 [Binomial Distribution: Using the Formula] • N1-17 [Binomial Distribution: Tabulating Probabilities] • N1-18 [Binomial Distribution: Words to Inequalities] • N1-19 [Binomial Distribution: Finding Probabilities] • N1-20 [Binomial Distribution: A Worded Problem]

Chapter 11: Hypothesis Testing

O: Statistical Hypothesis Testing

[Understand and apply the language of statistical hypothesis testing, developed through a binomial model: null hypothesis, alternative hypothesis, significance level, test statistic, 1-tail test, 2-tail test, critical value, critical region, acceptance region, *p*-value]	• O1-01 [Hypothesis Testing: An Introduction] • O1-02 [Hypothesis Testing: Explaining the Significance Level] • O1-03 [Hypothesis Testing: One-Tail or Two-Tail Test?] • O1-04 [Hypothesis Testing: Critical & Acceptance Regions]

[Conduct a statistical hypothesis test for the proportion in the binomial distribution and interpret the results in context] **[Understand that a sample is being used to make an inference about the population and appreciate that the significance level is the probability of incorrectly rejecting the null hypothesis]**	• O2-01 [Binomial Hypothesis Testing: Less Than Example 1] • O2-02 [Binomial Hypothesis Testing: Less Than Example 2] • O2-03 [Binomial Hypothesis Testing: More Than Example 1] • O2-04 [Binomial Hypothesis Testing: More Than Example 2] • O2-05 [Binomial Hypothesis Testing: Two-Tail Example 1] • O2-06 [Binomial Hypothesis Testing: Two-Tail Example 2] • O2-07 [Binomial Hypothesis Testing: Finding the Critical Region] • O2-08 [Binomial Hypothesis Testing: Critical Region Method 1] • O2-09 [Binomial Hypothesis Testing: Critical Region Method 2] • O2-10 [Binomial Hypothesis Testing: Two-Tail Critical Region Method 1] • O2-11 [Binomial Hypothesis Testing: Two-Tail Critical Region Method 2]

Chapter 12: Algebra 2

A: Proof

Proof by contradiction (including proof of the irrationality of $\sqrt{2}$ and the infinity of primes, and application to unfamiliar proofs)	• A1-10 Introducing Proof by Contradiction • A1-11 Proving √2 is Irrational • A1-12 Proving √3 is Irrational • A1-13 Proving there are Infinitely Many Primes • A1-14 Proof by Contradiction Examples

B: Algebra and Functions

Simplify rational expressions including by factorising and cancelling, and algebraic division (by linear expressions only)	• B6-15 Rational Expressions: Basic Simplifying of Fractions • B6-16 Rational Expressions: Introducing Simplifying Algebraic Fractions • B6-17 Rational Expressions: Examples of Simplifying Algebraic Fractions • B6-18 Rational Expressions: Basic Adding and Subtracting Fractions • B6-19 Rational Expressions: Examples of Adding / Subtracting Algebraic Fractions

	• B6-20 Rational Expressions: Simplifying using Polynomial Division
the modulus of a linear function,	• B7-05 Graphs: Introducing the Modulus Function • B7-06 Graphs: Sketching the Modulus of a Linear Function • B7-07 Graphs: Examples of Sketching the Modulus of a Linear Function • B7-08 Graphs: Solving Modulus Equations • B7-09 Graphs: Examples of Solving Modulus Equations • B7-09 Graphs: Solving Modulus Inequalities • B7-10 Graphs: EXTENSION Sketching the Modulus of Other Functions • B7-11 Graphs: EXTENSION Sketching y=f(|x|)
Understand and use composite functions; inverse functions and their graphs	• B8-01 Functions: What is a Function? • B8-02 Functions: Introducing the Domain and Range of a Function • B8-03 Functions: Examples of Finding the Domain and Range • B8-04 Functions: One-to-One, Many-to-One, One-to-Many, Many-to-Many • B8-05 Functions: Restricting the Domain • B8-06 Functions: Even & Odd Functions • B8-07 Functions: Introducing Composite Functions • B8-08 Functions: Examples of Composite Functions • B8-09 Functions: The Domain of a Composite Function • B8-10 Functions: Introducing Inverse Functions and Restricting the Domain • B8-11 Functions: Finding an Inverse Function • B8-12 Functions: Examples of finding Inverse Functions • B8-13 Functions: A Consequence of Inverse Functions • B8-14 Functions: Domain and Range of an Inverse Function • B8-15 Functions: Set Notation for Domain and Range
Combinations of these transformations	• B9-21 Graph Transformations: Combining Transformations - Does the Order Matter? • B9-22 Graph Transformations: Examples of Describing Two Transformations • B9-23 Graph Transformations: Examples of Two Transformations of y = x(x - 2) • B9-24 Graph Transformations: Examples of Two

	• Transformations of y = arccos(x) • B9-25 Graph Transformations: Two Transformations via 'Replacing'
Decompose rational functions into partial fractions (denominators not more complicated than squared linear terms and with no more than 3 terms, numerators constant or linear)	• B10-01 Algebraic Fractions: Proper Fractions & Improper Fractions • B10-02 Algebraic Fractions: Adding and Subtracting Algebraic Fractions • B10-03 Algebraic Fractions: Introducing Partial Fractions via Substitution • B10-04 Algebraic Fractions: Partial Fractions via Comparing Coefficients • B10-05 Algebraic Fractions: Examples of Partial Fractions • B10-06 Algebraic Fractions: THREE Partial Fractions • B10-07 Algebraic Fractions: Examples of THREE Partial Fractions • B10-08 Algebraic Fractions: How we deal with Repeated Factors in the Denominator • B10-09 Algebraic Fractions: Examples of Repeated Factors in the Denominator • B10-10 Algebraic Fractions: EXTENSION Quadratic Terms in the Denominator • B10-11 Algebraic Fractions: EXTENSION Examples of Quadratics in the Denominator • B10-12 Algebraic Fractions: EXTENSION How we deal with Improper Fractions
Use of functions in modelling, including consideration of limitations and refinements of the models	• B11-00 Introduction to Modelling • B11-01 Modelling: The Microbiologist Problem • B11-02 Modelling: The Fish in a Lake Problem • B11-03 Modelling: The Playground Problem • B11-04 Modelling: The Football Problem

C: Coordinate Geometry in the (x,y) plane

Understand and use the parametric equations of curves and conversion between Cartesian and parametric forms	• C3-01 Parametric Equations: Introducing Parametric Equations • C3-02 Parametric Equations: The Difference between Cartesian & Parametric

	• C3-03 Parametric Equations: Cartesian to Parametric • C3-04 Parametric Equations: Find where x=t^3-4t, y=t^2+t meets y=20 • C3-05 Parametric Equations: What does x=t^3-4t, y=t^2+t look like? • C3-06 Parametric Equations: What does x=2sin(t), y=4cos(t-pi/4) look like? • C3-07 Parametric Equations: Parametric to Cartesian • C3-08 Parametric Equations: Defining an Ellipse Parametrically
Use parametric equations in modelling in a variety of contexts	• C4-01 Parametric Equation Modelling: Parametric to Cartesian • C4-02 Parametric Equation Modelling: A Projectiles Problem

Chapter 13: Sequences

D: Sequences and Series

[Understand and use the binomial expansion of $(a + bx)^n$ for positive integer n; the notations $n!$ and ^nC_r; link to binomial probabilities] Extend to any rational n, including its use for approximation; be aware that the expansion is valid for $bx < 1$. (proof not required)	• D1-14 Binomial Expansion: EXTENSION Extending Binomial Expansion • D1-15 Binomial Expansion: Writing (a + bx)^n in the form p(1 + qx)^n • D1-16 Binomial Expansion: Find the first four terms of (1 + x)^(-1) • D1-17 Binomial Expansion: Find the first four terms of (1 + 2x)^(-2) • D1-18 Binomial Expansion: Find the first four terms of (1 - 3x)^(-3) • D1-19 Binomial Expansion: Find the first four terms of (2 + 4x)^(-5) • D1-20 Binomial Expansion: Find the first four terms of (9 - 3x)^(1/2) • D1-21 Binomial Expansion: Introducing the Range of Validity • D1-22 Binomial Expansion: Examples on Determining the Range of Validity • D1-23 Binomial Expansion: Two Trickier Binomial Expansions • D1-24 Binomial Expansion: Two Trickier Range of Validity

	• D1-25 Binomial Expansion: New Formula, Old Question
Work with sequences including those given by a formula for the *n*th term and those generated by a simple relation of the form $x_{n+1} = f(x_n)$; increasing sequences; decreasing sequences; periodic sequences	• D2-01 Sequences: GCSE Revision on Linear and Quadratic Sequences • D2-02 Sequences: Inductive Definitions and Recurrence Relations • D2-03 Sequences: Finding the First Five Terms of an Inductive Definition • D2-04 Sequences: EXTENSION The Logistic Map • D2-05 Sequences: Investigating Limits of Inductive Definitions • D2-06 Sequences: Describing Sequences
Understand and use sigma notation for sums of series	• D3-01 Sigma Notation: Introducing Sigma Notation • D3-02 Sigma Notation: Writing a Series in Sigma Notation • D3-03 Sigma Notation: Examples of Evaluating Series • D3-04 Sigma Notation: When to Expand Brackets and When Not
Understand and work with arithmetic sequences and series, including the formulae for *n*th term and the sum to *n* terms	• D4-01 Arithmetic Sequences: Introducing Arithmetic Sequences • D4-02 Arithmetic Sequences: Finding the nth term • D4-03 Arithmetic Sequences: Finding the 2300th term • D4-04 Arithmetic Sequences: How many terms are there? • D4-05 Arithmetic Sequences: A Sequences Problem • D4-06 Arithmetic Sequences: Introducing Arithmetic Series • D4-07 Arithmetic Sequences: Examples of Finding the Sum of Arithmetic Series • D4-08 Arithmetic Sequences: Words to Algebra • D4-09 Arithmetic Sequences: 4th term is 9, 20th term is 73 • D4-10 Arithmetic Sequences: 21st term is 118, Sum of the first 132 terms is 48609 • D4-11 Arithmetic Sequences: Sum of 1st-10th is 506.5, Sum of 8th-16th is 321.3
Understand and work with geometric sequences and series including the formulae for the *n*th term and the sum of a finite geometric series; the sum to infinity of a convergent geometric series, including the use of $\|r\| < 1$; modulus notation	• D5-01 Geometric Sequences: Introducing Geometric Sequences • D5-02 Geometric Sequences: Finding the nth term • D5-03 Geometric Sequences: Finding the 13th term • D5-04 Geometric Sequences: How many terms are there? • D5-05 Geometric Sequences: A Sequences Problem • D5-06 Geometric Sequences: Introducing Geometric Series

	• D5-07 Geometric Sequences: Examples of Finding the Sum of Geometric Series • D5-08 Geometric Sequences: Introducing Summing to Infinity • D5-09 Geometric Sequences: Examples of Finding the Sum to Infinity • D5-10 Geometric Sequences: Words to Algebra • D5-11 Geometric Sequences: 3rd term is 16, 6th term is 1.024 • D5-12 Geometric Sequences: Sum of 1st & 2nd is 1080, Sum of 4th & 5th is 8.64 • D5-13 Geometric Sequences: 4th term is 24, Sum of the first 4 terms is 21 • D5-14 Geometric Sequences: 2nd term is 4, Sum to Infinity is 25 • D5-15 Geometric Sequences: Exam-Style Problem
Use sequences and series in modelling	• D6-01 Modelling with Sequences: The Gardener Problem • D6-02 Modelling with Sequences: The Medicine Problem

Chapter 14: Trigonometric Identities

E: Trigonometry

Work with radian measure, including use for arc length and area of sector	• E1-15 Trigonometry: Introducing Radians • E1-16 Trigonometry: Converting Between Degrees and Radians • E1-17 Trigonometry: Deriving a Formula for Arc Length in Radians • E1-18 Trigonometry: Using the Formula for Arc Length in Radians • E1-19 Trigonometry: Deriving a Formula for Sector Area in Radians • E1-20 Trigonometry: Using the Formula for Area of a Sector in Radians
Understand and use the standard small angle approximations of sine, cosine and tangent	• E2-01 Small-Angle Approximation: Geometrical Derivation • E2-02 Small-Angle Approximation: EXTENSION Taylor Series Derivation

$\sin\theta \approx \theta$, $\cos\theta \approx 1 - \theta_2$, $\tan\theta \approx \theta$ where θ is in radians	• E2-03 Small-Angle Approximation: Approximate sin(π/12), cos(π/12) & tan(π/12) • E2-04 Small-Angle Approximation: Approximate sin(10°), cos(10°) & tan(10°) • E2-05 Small-Angle Approximation: Percentage Error Investigation • E2-06 Small-Angle Approximation: Trig Functions as Polynomials
[Understand and use the sine, cosine and tangent functions; their graphs, symmetries and periodicity] Know and use exact values of sin and cos for 0, π/6 , π/4 , π/3 , π/2 , π and 2π multiples thereof, and exact values of tan for 0, π/6 , π/4 , π/3 , π/2 and multiples thereof	• E3-08 Trig Graphs: Two Triangles in Radians to Learn • E3-09 Trig Graphs: Testing Yourself on Exact Values of sin(x), cos(x) & tan(x) • E3-10 Trig Graphs: Quickly Sketching y = sin(x) in radians • E3-11 Trig Graphs: Quickly Sketching y = cos(x) in radians • E3-12 Trig Graphs: Quickly Sketching y = tan(x) in radians
Understand and use the definitions of secant, cosecant and cotangent and of arcsin, arccos and arctan; their relationships to sine, cosine and tangent; understanding of their graphs; their ranges and domains	• E4-01 Trigonometry: Introducing cosec(x), sec(x) & cot(x) • E4-02 Trigonometry: Given sin(x) = 3/7, exact values of cosec(x), sec(x) & cot(x) • E4-03 Trigonometry: Sketching y = cosec(x) • E4-04 Trigonometry: Sketching y = sec(x) • E4-05 Trigonometry: Sketching y = cot(x) • E4-06 Trigonometry: Transformations of y = cosec(x), y = sec(x) & y = cot(x) • E4-07 Trigonometry: Why we Restrict the Domain to find an Inverse Function • E4-08 Trigonometry: Introducing Arcsin(x) • E4-09 Trigonometry: Introducing Arccos(x) • E4-10 Trigonometry: Introducing Arctan(x) • E4-11 Trigonometry: Transformations of Arcsin(x), Arccos(x) & Arctan(x)
Understand and use sec^2θ = 1 + tan^2θ and cosec^2θ = 1 + cot^2θ	• E5-05 Trigonometric Identities: Proving sec^2 θ = 1 + tan^2 θ • E5-06 Trigonometric Identities: Proving cosec^2 θ = 1 + cot^2 θ • E5-07 Trigonometric Identities: Simplifying Further Expressions •

Understand and use double angle formulae; use of formulae for sin($A \pm B$), cos($A \pm B$) and tan($A \pm B$) ; understand geometrical proofs of these formulae Understand and use expressions for $a\cos\theta + b\sin\theta$ in the equivalent forms of $r\cos(\theta \pm \alpha)$ or $r\sin(\theta \pm \alpha)$	• **E6-01 Compound Angles: Proving the Compound Angle Formulae** • **E6-02 Compound Angles: Exact Values of sin(105°), cos(150°) & tan(15°)** • **E6-03 Compound Angles: Using the Formulae Backwards** • **E6-04 Compound Angles: Introducing the Double Angle Formulae** • **E6-05 Compound Angles: Using Double Angle Formulae to Integrate** • **E6-06 Compound Angles: Using Double Angle Formulae to Solve Equations** • **E6-07 Equivalent Forms: Writing acosθ + bsinθ in the form rcos(θ±α) or rsin(θ±α)** • **E6-08 Equivalent Forms: Writing 4cosθ + 3sinθ in the form rsin(θ+α)** • **E6-09 Equivalent Forms: Writing 3cosθ - 8sinθ in the form rcos(θ+α)** • **E6-10 Equivalent Forms: Solve 10sinθ - 6cosθ = 5**
[Solve simple trigonometric equations in a given interval, including quadratic equations in sin, cos and tan and equations involving multiples of the unknown angle]	• **E7-02 Trig Equations: Solve sin(x) = 1/2 between 0 and 2π** • **E7-04 Trig Equations: Solve cos(x) = 1/2 between 0 and 2π** • **E7-06 Trig Equations: Solve tan(x) = 1 between 0 and 2π** • **E7-08 Trig Equations: Solving Basic Trigonometric Equations in radians** • **E7-11 Trig Equations: Solve 1/cos(x) = 5 between 0 and 2π** • **E7-12 Trig Equations: Solve 1/cos(x) = 5 between 2π and 4π** • **E7-14 Trig Equations: Solve sin^2(x) = 1/16 between 0 and 2π** • **E7-17 Trig Equations: Solve 4sin^2(x) = sin(x) between 0 and 2π** • **E7-19 Trig Equations: Solve 4sin(x) + 5cos(x) = 0 between 0 and 2π** • **E7-22 Trig Equations: Solve sin(x + π/3) = 0.7 between 0 and 2π** • **E7-24 Trig Equations: Solve cos(x - π/4) = -0.3 between 0 and 2π** • **E7-26 Trig Equations: Solve tan(x + 3π) = 4.1 between 0 and 2π** • **E7-28 Trig Equations: Solve sin(2x) = 0.8 between 0 and 2π** • **E7-30 Trig Equations: Solve cos(3x) = 0.7 between 0 and 2π** • **E7-32 Trig Equations: Solve tan(4x) = 3.3 between 0 and 2π**

	• E7-34 Trig Equations: Solve sin(3x-0.8) = 0.25 between π and 3π • E7-36 Trig Equations: Solve sin^2(x) + 2sin(x) - 3 = 0 between 0 and 2π • E7-38 Trig Equations: Solve 5tan^2(x) - 38tan(x) - 16 = 0 between 0 and 2π • E7-40 Trig Equations: Solve 3sin^2(x) = 3 - 2cos(x) between 0 and 2π • E7-42 Trig Equations: Solve 3sin(x) = 2cos^2(x) between 0 and 2π • E7-44 Trig Equations: Solve 7sin^2(x) - 5sin(x) + cos^2(x) = 0 between 0 and 2π • E7-47 Trig Equations: Solve cos(x + π/3) = sin(x) between 0 and 2π • E7-49 Trig Equations: Solve sin(x - π/7) = cos(x) between 0 and 2π • E7-50 Trig Equations: Solve cosec(x) = 5 between 0 and 2π • E7-51 Trig Equations: Solve sec(x) = 7 between 0 and 2π • E7-52 Trig Equations: Solve cot(x) = 1/6 between 0 and 2π • E7-53 Trig Equations: Solve sec^2(x) = 4 + 2tan(x) between 0 and 2π • E7-54 Trig Equations: Solve cosec^2(x) = 3cot(x) + 5 between 0 and 2π • E7-55 Trig Equations: Solve sec(x) = tan(x) between 0 and 2π • E7-56 Trig Equations: Solve sin(x) = cot(x) between 0 and 2π
Construct proofs involving trigonometric functions and identities	• E8-01 Proving Trigonometric Identities: The Methods • E8-02 Proving Trigonometric Identities: Example 1 • E8-03 Proving Trigonometric Identities: Example 2 • E8-04 Proving Trigonometric Identities: Example 3 • E8-05 Proving Trigonometric Identities: Example 4 • E8-06 Proving Trigonometric Identities: Example 5
Use trigonometric functions to solve problems in context, including problems involving vectors, kinematics and forces	• E9-01 Trigonometry in Context: The Canoe Problem • E9-02 Trigonometry in Context: The Two Particles Problem

Chapter 15: Differentation 2

G: Differentiation

[Understand and use the derivative of f(*x*) as the gradient of the tangent to the graph of *y* = f (*x*) at a general point (*x*, *y*); the gradient of the tangent as a limit; interpretation as a rate of change; sketching the gradient function for a given curve; second derivatives; differentiation from first principles for small positive integer powers of *x*] and for sin *x* and cos *x* **[Understand and use the second derivative as the rate of change of gradient]**; connection to convex and concave sections of curves and points of inflection	• G1-16 Differentiation: Differentiate sin(x) from First Principles • G1-17 Differentiation: Differentiate cos(x) from First Principles • G1-18 Differentiation: Convex & Concave / Concave Up & Concave Down • G1-19 Differentiation: Convexity & The Second Derivative
[Differentiate x^n, for rational values of *n*, and related constant multiples, sums and differences] Differentiate e^kx and *a*^*kx* , sin*kx*, cos*kx*, tan*kx* and related sums, differences and constant multiples Understand and use the derivative of ln *x*	• G2-06 Differentiation: Differentiating e^(kx) • G2-07 Differentiation: Differentiating a^(kx) • G2-08 Differentiation: Differentiating sin(kx) and cos(kx) • G2-09 Differentiation: Differentiating tan(kx) • G2-10 Differentiation: Differentiating ln(kx)
[Apply differentiation to find gradients, tangents and normals, maxima and minima and stationary points], points of inflection **[Identify where functions are increasing or decreasing]**	• G3-04 Gradients: Equations of Tangents • G3-06 Gradients: Equations of Normals • G3-09 Gradients: Examples of Finding Stationary Points • G3-12 Gradients: The Second Derivative Test Part 2 • G3-15 Gradients: Determining Types of Stationary Points • G3-16 Gradients: Finding Points of Inflection • G3-17 Gradients: Finding where a Curve is Convex & Concave • G3-18 Gradients: Examples of Convex & Concave Curves • G3-19 Gradients: EXTENSION Points of Inflection of the Standard Normal Distribution • G3-20 Gradients: EXTENSION Points of Inflection of the Normal Distribution

Differentiate using the product rule, the quotient rule and the chain rule, including problems involving connected rates of change and inverse functions	• G4-01 Differentiation: Introducing the Chain Rule • G4-02 Differentiation: Examples of using the Chain Rule Part 1 (long method) • G4-03 Differentiation: Examples of using the Chain Rule Part 2 (short method) • G4-04 Differentiation: Further Examples of using the Chain Rule • G4-05 Differentiation: Introducing Connected Rates of Change • G4-06 Differentiation: Connected Rates of Change Example 1 • G4-07 Differentiation: Connected Rates of Change Example 2 • G4-08 Differentiation: Connected Rates of Change Example 3 • G4-09 Differentiation: Tricky Factorisation • G4-10 Differentiation: Introducing the Product Rule • G4-11 Differentiation: Examples of using the Product Rule Part 1 • G4-12 Differentiation: Examples of using the Product Rule Part 2 (Factorising) • G4-13 Differentiation: Further Examples of using the Product Rule • G4-14 Differentiation: Simplifying Algebraic Fractions • G4-15 Differentiation: Introducing the Quotient Rule • G4-16 Differentiation: Examples of using the Quotient Rule • G4-17 Differentiation: Choosing Between Rules • G4-18 Differentiation: Gradient Problems • G4-19 Differentiation: Differentiating an Inverse Function
Differentiate simple functions and relations defined implicitly or parametrically, for first derivative only	• G5-01 Differentiation: Introducing Implicit and Explicit Equations • G5-02 Differentiation: Introducing Implicit Differentiation • G5-03 Differentiation: Examples of Implicit Differentiation • G5-04 Differentiation: Implicit Differentiation and Gradients • G5-05 Differentiation: Introducing Parametric Differentiation • G5-06 Differentiation: Examples of Parametric Differentiation • G5-07 Differentiation: Parametric Differentiation and Gradients • G5-08 Differentiation: A Tricky Parametric Differentiation Problem

Chapter 16: Integration and Differential Equations

G: Differentiation

Construct simple differential equations in pure mathematics and in context, (contexts may include kinematics, population growth and modelling the relationship between price and demand)	• G6-00 Differential Equations: Introducing Differential Equations • G6-01 Differential Equations: Direct & Inverse Proportion • G6-02 Differential Equations: Examples of Forming DEs

H: Integration

[Integrate *x*^*n* (excluding *n* = -1), and related sums, differences and constant multiples] Integrate e^kx , 1/*x* , sin *kx* , cos *kx* and related sums, differences and constant multiples	• H2-06 Integration: Integrating e^(kx) • H2-07 Integration: Integrating 1/x • H2-08 Integration: Integrating sin(kx) & cos(kx) • H2-09 Integration: Further Examples of Integration
[Evaluate definite integrals; use a definite integral to find the area under a curve] and the area between two curves	• H3-11 Integration: Finding the Area between Two Curves Example 1 • H3-12 Integration: Finding the Area between Two Curves Example 2 • H3-13 Integration: Finding the Area between Two Curves Example 3 • H3-14 Integration: Finding the Area between Two Curves Example 4 • H3-15 Integration: Introducing Parametric Integration • H3-16 Integration: Parametric Integration Example 1 • H3-17 Integration: Parametric Integration Example 2
Understand and use integration as the limit of a sum	• H4-01 Integration: Integration as the Limit of a Sum • H4-02 Integration: An Example of finding an Area as the Limit of a Sum
Carry out simple cases of integration by substitution and	• H5-01 Further Integration: Reversing the Chain Rule

integration by parts; understand these methods as the inverse processes of the chain and product rules respectively (Integration by substitution includes finding a suitable substitution and is limited to cases where one substitution will lead to a function which can be integrated; integration by parts includes more than one application of the method but excludes reduction formulae)	• H5-02 Further Integration: Examples of Reversing the Chain Rule Part 1 • H5-03 Further Integration: More Reversing the Chain Rule • H5-04 Further Integration: Examples of Reversing the Chain Rule Part 2 • H5-05 Further Integration: Reversing the Chain Rule with Trigonometry • H5-06 Further Integration: Examples of Reversing the Chain Rule Part 3 • H5-07 Further Integration: Reversing the Chain Rule with Exponentials • H5-08 Further Integration: Examples of Reversing the Chain Rule Part 4 • H5-09 Further Integration: Reversing the Chain Rule with Reciprocals • H5-10 Further Integration: Examples of Reversing the Chain Rule Part 5 • H5-11 Further Integration: Introducing Integration by Substitution • H5-12 Further Integration: Examples of Integration by Substitution Part 1 • H5-13 Further Integration: Integrating x(2x^2 + 3)^6 • H5-14 Further Integration: Examples of Integration by Substitution 2 • H5-15 Further Integration: Integrating (2x - 5)(2x + 7)^8 • H5-16 Further Integration: Examples of Integration by Substitution 3 • H5-17 Further Integration: Integrating cos(x)*sin^2(x) • H5-18 Further Integration: Examples of Integration by Substitution 4 • H5-19 Further Integration: Definite Integrals with Integration by Substitution • H5-20 Further Integration: Examples of Definite Integrals Part 1 • H5-21 Further Integration: Examples of Definite Integrals Part 2 • H5-22 Further Integration: Find the Area Between Two Curves • H5-23 Further Integration: Tricky Integration by Substitution Problems • H5-24 Further Integration: A Tough Integration by Substitution Problem • H5-25 Further Integration: Introducing Integration by Parts &

	LATE • H5-26 Further Integration: When Integration by Parts goes Right • H5-27 Further Integration: When Integration by Parts goes Wrong • H5-28 Further Integration: Integration by Parts with Definite Integrals • H5-29 Further Integration: Examples of Integration by Parts • H5-30 Further Integration: Integrate x*(x+1)^5 by Parts • H5-31 Further Integration: Integrating ln(x) • H5-32 Further Integration: Integrating by Parts Twice • H5-33 Further Integration: Examples of Integration by Parts Twice • H5-34 Further Integration: Tabular Method for Integration by Parts • H5-35 Further Integration: Examples of the Tabular Method • H5-36 Further Integration: Find the Area Between Two Curves • H5-37 Further Integration: EXTENSION Integrate sin(x)*e^x
Integrate using partial fractions that are linear in the denominator	• H6-01 Integration with Partial Fractions: Example 1 • H6-02 Integration with Partial Fractions: Example 2 • H6-03 Integration with Partial Fractions: Example 3 • H6-04 Integration with Partial Fractions: Example 4 • H6-05 Integration with Partial Fractions: Example 5 • H6-06 Integration with Partial Fractions: Example 6 • H6-07 Integration with Partial Fractions: Example 7 • H6-08 Integration with Partial Fractions: EXTENSION Example 8
Evaluate the analytical solution of simple first order differential equations with separable variables, including finding particular solutions (Separation of variables may require factorisation involving a common factor)	• H7-01 Differential Equations: Introducing Differential Equations • H7-02 Differential Equations: The Method of Separation of Variables • H7-03 Differential Equations: Examples of Finding General Solutions • H7-04 Differential Equations: Examples of Finding Particular Solutions • H7-05 Differential Equations: Tougher Examples

Interpret the solution of a differential equation in the context of solving a problem, including identifying limitations of the solution; includes links to kinematics	• H8-01 Differential Equations: A Worded Example 1 • H8-02 Differential Equations: A Worded Example 2 • H8-03 Differential Equations: A Worded Example 3

Chapter 17: Numerical Methods

I: Numerical Methods

Locate roots of f(x) = 0 by considering changes of sign of f(x)in an interval of x on which f(x)is sufficiently well-behaved Understand how change of sign methods can fail	• I1-01 Locating Roots: Introducing the Change of Sign Method • I1-02 Locating Roots: The Change of Sign Method Example 1 • I1-03 Locating Roots: The Change of Sign Method Example 2 • I1-04 Locating Roots: Failure of the Change of Sign Method
Solve equations approximately using simple iterative methods; be able to draw associated cobweb and staircase diagrams Solve equations using the Newton-Raphson method and other recurrence relations of the form $x_{n+1} = g(x_n)$ Understand how such methods can fail	• I2-01 Locating Roots: Introducing the x=g(x) Method • I2-02 Locating Roots: Cobweb and Staircase Diagrams • I2-03 Locating Roots: The x=g(x) Method Example 1 • I2-04 Locating Roots: The x=g(x) Method Example 2 • I2-05 Locating Roots: Failure of the x=g(x) Method • I2-06 Locating Roots: Introducing the Newton-Raphson Method • I2-07 Locating Roots: The Newton-Raphson Method Example 1 • I2-08 Locating Roots: The Newton-Raphson Method Example 2 • I2-09 Locating Roots: Failure of the Newton-Raphson Method
Understand and use numerical integration of functions, including the use of the trapezium rule and estimating the approximate area under a curve and limits that it must lie between	• I3-01 Numerical Integration: Estimating using Rectangles • I3-02 Numerical Integration: Estimating using Trapeziums • I3-03 Numerical Integration: Introducing the Trapezium Rule • I3-04 Numerical Integration: Examples of Using the Trapezium Rule • I3-05 Numerical Integration: Overestimate or Underestimate? • I3-06 Numerical Integration: EXTENSION Monte Carlo Integration
Use numerical methods to solve problems in context	• I4-01 Numerical Methods: Contextual Problem 1 • I4-02 Numerical Methods: Contextual Problem 2

Chapter 18: Motion in two dimensions

J: Vectors

[Use vectors to solve problems in pure mathematics and in context, including forces] and kinematics	• J5-05 Vectors: Kinematics Problem

Q: Kinematics

[Understand, use and derive the formulae for constant acceleration for motion in a straight line]; extend to 2 dimensions using vectors	• Q3-13 SUVAT: The Constant Acceleration Formulae in 2D • Q3-14 SUVAT: 2D Example 1 • Q3-15 SUVAT: 2D Example 2 • Q3-16 SUVAT: 2D Example 3 • Q3-17 SUVAT: 2D Example 4 • Q3-18 SUVAT: 2D Example 5
[Use calculus in kinematics for motion in a straight line: $v = \frac{\mathrm{d}r}{\mathrm{d}t},\ a = \frac{\mathrm{d}v}{\mathrm{d}t} = \frac{\mathrm{d}^2r}{\mathrm{d}t^2},\ r = \int v\ \mathrm{d}t,\ v = \int a\ \mathrm{d}t$ **]** ; extend to 2 dimensions using vectors	• Q4-07 Calculus in Kinematics: General Motion in 2D • Q4-08 Calculus in Kinematics: 2D Example 1 • Q4-09 Calculus in Kinematics: 2D Example 2 • Q4-10 Calculus in Kinematics: 2D Example 3 • Q4-11 Calculus in Kinematics: 2D Example 4 • Q4-12 Calculus in Kinematics: 2D Example 5
Model motion under gravity in a vertical plane using vectors; projectiles	• Q5-01 Projectiles: Introducing Projectiles • Q5-02 Projectiles: From the Ground Example 1 SUVAT Method • Q5-03 Projectiles: From the Ground Example 1 Integration Method • Q5-04 Projectiles: From the Ground Example 2 SUVAT Method • Q5-05 Projectiles: From the Ground Example 2 Integration Method • Q5-06 Projectiles: From the Ground Example 3 SUVAT Method • Q5-07 Projectiles: From the Ground Example 3 Integration Method • Q5-08 Projectiles: From the Ground Example 4 SUVAT Method • Q5-09 Projectiles: From the Ground Example 4 Integration Method

	• Q5-10 Projectiles: From the Ground Example 5 SUVAT Method • Q5-11 Projectiles: From the Ground Example 5 Integration Method • Q5-12 Projectiles: From a Height Example 1 SUVAT Method • Q5-13 Projectiles: From a Height Example 1 Integration Method • Q5-14 Projectiles: From a Height Example 2 SUVAT Method • Q5-15 Projectiles: From a Height Example 2 Integration Method • Q5-16 Projectiles: From a Height Example 3 SUVAT Method • Q5-17 Projectiles: From a Height Example 3 Integration Method • Q5-18 Projectiles: Derive a Formula for Maximum Height SUVAT Method • Q5-19 Projectiles: Derive a Formula for Maximum Distance SUVAT Method • Q5-20 Projectiles: Derive a Formula for Maximum Height Integration Method • Q5-21 Projectiles: Derive a Formula for Maximum Distance Integration Method

Chapter 19: Forces 2

J: Vectors

[Use vectors in two dimensions] and in three dimensions	• J1-05 Vectors: Introducing 3D Vectors
[Calculate the magnitude and direction of a vector and convert between component form and magnitude/direction form]	• J2-09 Vectors: Finding the Magnitude / Length of a 3D vector • J2-10 Vectors: Examples of Finding the Magnitude of 3D Vectors • J2-11 Vectors: Finding the Angle between Two 3D Vectors Method 1 • J2-12 Vectors: Finding the Angle between Two 3D Vectors Method 2
[Use vectors to solve problems in pure mathematics and in context, including forces] and kinematics	• J5-06 Vectors: 3D Vectors Problem

P: Quantities and Units in Mechanics

[Understand and use fundamental quantities and units in the S.I. system: length, time, mass] **[Understand and use derived quantities and units: velocity, acceleration, force, weight]**, moment	• P1-02 S.I. Units: Moments

R: Forces and Newton's Laws

[Understand the concept of a force; understand and use Newton's first law]	• R1-10 Forces: Writing Forces in Component Form • R1-11 Forces: Finding the Magnitude and Direction of a Resultant Force • R1-12 Forces: Resolving Forces Example 1 • R1-13 Forces: Resolving Forces Example 2 • R1-14 Forces: Resolving Forces Example 3 • R1-15 Forces: Resolving Forces Example 4 • R1-16 Forces: Resolving Forces Example 5
[Understand and use Newton's second law for motion in a straight line (restricted to forces in two perpendicular directions or simple cases of forces given as 2-D vectors)]; extend to situations where forces need to be resolved (restricted to 2 dimensions)	• R2-07 Forces: With SUVAT Example 4 • R2-08 Forces: With SUVAT Example 5 • R2-09 Forces: With SUVAT Example 6 Vectors
[Understand and use Newton's third law; equilibrium of forces on a particle and motion in a straight line (restricted to forces in two perpendicular directions or simple cases of forces given as 2-D vectors); application to problems involving smooth pulleys and connected particles]; resolving forces in 2 dimensions; equilibrium of a particle under coplanar forces	• R4-12 Forces: Introducing Smooth Inclined Planes • R4-13 Forces: Smooth Inclined Plane Example 1 • R4-14 Forces: Smooth Inclined Plane Example 2 • R4-15 Forces: Smooth Inclined Plane Example 3 • R4-16 Forces: Introducing Rough Inclined Planes • R4-17 Forces: Rough Inclined Plane Example 1 • R4-18 Forces: Rough Inclined Plane Example 2 • R4-19 Forces: Rough Inclined Plane Example 3 • R4-20 Forces: Pulley on Inclined Plane Example 1 • R4-21 Forces: Pulley on Inclined Plane Example 2 • R4-22 Forces: Pulley on Inclined Plane Example 3
Understand and use addition of forces; resultant forces;	• R5-01 Forces: Magnitude and Direction of Acceleration

dynamics for motion in a plane	• R5-02 Differential Equations: Introducing F=ma as a DE • R5-03 Differential Equations: Example 1 • R5-04 Differential Equations: Example 2 • R5-05 Differential Equations: Example 3 • R5-06 Differential Equations: Example 4
Understand and use the $F \leq \mu R$ model for friction; coefficient of friction; motion of a body on a rough surface; limiting friction and statics	• R6-01 Forces: Introducing the Coefficient of Friction • R6-02 Forces: Coefficient of Friction Example 1 • R6-03 Forces: Coefficient of Friction Example 2 • R6-04 Forces: Coefficient of Friction Example 3 • R6-05 Forces: Coefficient of Friction and Pulley Example 1 • R6-06 Forces: Coefficient of Friction and Pulley Example 2 • R6-07 Forces: Coefficient of Friction and Inclined Plane Example 1 • R6-08 Forces: Coefficient of Friction and Inclined Plane Example 2 • R6-09 Forces: Coefficient of Friction and Inclined Plane Example 3 • R6-10 Forces: Coefficient of Friction and Inclined Plane Example 4

S: Moments

Understand and use moments in simple static contexts	• S1-01 Moments: What is a Moment? • S1-02 Moments: Basic Examples of Finding Moments 1 • S1-03 Moments: Basic Examples of Finding Moments 2 • S1-04 Moments: What is a Lamina? • S1-05 Moments: The Moment of a Force on a Lamina • S1-06 Moments: Total Moment of Forces on a Lamina 1 • S1-07 Moments: Total Moment of Forces on a Lamina 2 • S1-08 Moments: Total Moment of Forces on a Lamina 3 • S1-09 Moments: Total Moment of Forces on a Rod • S1-10 Moments: Centre of Mass • S1-11 Moments: Lamina Held in Equilibrium • S1-12 Moments: Lamina Held in Equilibrium at an Angle • S1-13 Equilibrium of a Rigid Body: An Introduction • S1-14 Equilibrium of a Rigid Body: Basic Examples • S1-15 Equilibrium of a Rigid Body: Example 1

	• S1-16 Equilibrium of a Rigid Body: Example 2 • S1-17 Equilibrium of a Rigid Body: Example 3 • S1-18 Equilibrium of a Rigid Body: Example 4 • S1-19 Tilting: An Introduction • S1-20 Tilting: Example 1 • S1-21 Tilting: Example 2 • S1-22 Tilting: Example 3 • S1-23 Tilting: Example 4 • S1-24 Non-Parallel Forces: An Introduction to Pivots • S1-25 Non-Parallel Forces: An Introduction to Ladders • S1-26 Non-Parallel Forces: Example 1 • S1-27 Non-Parallel Forces: Example 2 • S1-28 Non-Parallel Forces: Example 3 • S1-29 Non-Parallel Forces: Example 4

Chapter 20: Probability and Continuous Random Variables

M: Probability

Understand and use conditional probability, including the use of tree diagrams, Venn diagrams, two-way tables Understand and use the conditional probability formula $P(A\|B) = P(A \cap B) / P(B)$	• M2-01 Probability: Introducing Conditional Probability • M2-02 Probability: Conditional Probability Formulae • M2-03 Probability: Determining whether Two Events are Independent • M2-04 Probability: Venn Diagram Example • M2-05 Probability: Tree Diagram Example • M2-06 Probability: Two-Way Table Example
Modelling with probability, including critiquing assumptions made and the likely effect of more realistic assumptions	• M3-01 Modelling with Probability: Binomial Distribution • M3-02 Modelling with Probability: Normal Distribution

N: Statistical Distributions

[Understand and use simple, discrete probability distributions (calculation of mean and variance of	• N1-20 Binomial Distribution: Mean and Variance

discrete random variables is excluded), including the binomial distribution, as a model; calculate probabilities using the binomial distribution]	
Understand and use the Normal distribution as a model; find probabilities using the Normal distribution Link to histograms, mean, standard deviation, points of inflection and the binomial distribution	• N2-01 Normal Distribution: Introducing the Bell Curve • N2-02 Normal Distribution: Introducing the Normal Distribution • N2-03 Normal Distribution: Finding Probabilities Example 1 • N2-04 Normal Distribution: Finding Probabilities Example 2 • N2-05 Normal Distribution: A Worded Problem 1 • N2-06 Normal Distribution: The Inverse Normal • N2-07 Normal Distribution: Inverse Normal Example • N2-08 Normal Distribution: Simultaneous Equations • N2-09 Normal Distribution: A Worded Problem 2 • N2-10 Normal Distribution: Normal to Binomial Problem • N2-11 Normal Distribution: Normal to Histogram • N2-12 Normal Distribution: Approximating a Binomial Distribution • N2-13 Normal Distribution: Continuity Correction Examples • N2-14 Normal Distribution: Approximating a Binomial Example
Select an appropriate probability distribution for a context, with appropriate reasoning, including recognising when the binomial or Normal model may not be appropriate	• N3-01 Probability Distributions: Appropriate Distributions • N3-02 Probability Distributions: Approximating μ and σ

Chapter 21: Hypothesis Testing 2

O: Statistical Hypothesis Testing

[Understand and apply the language of statistical hypothesis testing, developed through a binomial model: null hypothesis, alternative hypothesis, significance level, test statistic, 1-tail test, 2-tail test, critical value, critical region, acceptance region, *p*-value]; extend to correlation coefficients as measures of how close data points lie to a straight line and be able to interpret a given correlation	• O1-05 Hypothesis Testing: PMCC Introduction • O1-06 Hypothesis Testing: PMCC Example 1 • O1-07 Hypothesis Testing: PMCC Example 2 • O1-08 Hypothesis Testing: PMCC Example 3 • O1-09 Hypothesis Testing: OCR MEI ONLY Rank Correlation • O1-10 Hypothesis Testing: OCR MEI ONLY Rank Correlation Example 1 • O1-11 Hypothesis Testing: OCR MEI ONLY Rank Correlation

coefficient using a given p-value or critical value (calculation of correlation coefficients is excluded)	**Example 2** • **O1-12 Hypothesis Testing: OCR MEI ONLY Rank Correlation Example 3**
Conduct a statistical hypothesis test for the mean of a Normal distribution with known, given or assumed variance and interpret the results in context	• **O3-01 Sample Means: The Distribution of Sample Means** • **O3-02 Sample Means: Hypothesis Test Example 1** • **O3-03 Sample Means: Hypothesis Test Example 2** • **O3-04 Sample Means: Hypothesis Test Example 3** • **O3-05 Sample Means: Hypothesis Test Example 4** • **O3-06 Sample Means: Finding a Critical Region**