Edexcel Level 3 Advanced GCE in Mathematics (9MA0)

Two-year Scheme of Work

Students studying A Level Mathematics will take 3 papers at the end of Year 13 as indicated below. All students will study Pure, Statistics and Mechanics.

<table>
<tr><th colspan="2">A level Mathematics</th></tr>
<tr><td>Paper 1:
Pure Mathematics
33%, 2 hours, 100 marks</td><td rowspan="2">Any pure content can be assessed on either paper</td></tr>
<tr><td>Paper 2:
Pure Mathematics
33%, 2 hours, 100 marks</td></tr>
<tr><td>Paper 3:
Statistics and Mechanics
33%, 2 hours, 100 marks</td><td>Section A: Statistics (50 marks)
Section B: Mechanics (50 marks)</td></tr>
</table>

Year 1: AS Mathematics pure content
Pure Mathematics

Unit	Title
1	**Algebra and functions**
a	Algebraic expressions – basic algebraic manipulation, indices and surds
b	Quadratic functions – factorising, solving, graphs and the discriminants
c	Equations – quadratic/linear simultaneous
d	Inequalities – linear and quadratic (including graphical solutions)
e	Graphs – cubic, quartic and reciprocal
f	Transformations – transforming graphs – f(x) notation
2	**Coordinate geometry in the (x, y) plane**
a	Straight-line graphs, parallel/perpendicular, length and area problems
b	Circles – equation of a circle, geometric problems on a grid
3	**Further algebra**
a	Algebraic division, factor theorem and proof
b	The binomial expansion
4	**Trigonometry**
a	Trigonometric ratios and graphs
b	Trigonometric identities and equations
5	**Vectors (2D)**
a	Definitions, magnitude/direction, addition and scalar multiplication
b	Position vectors, distance between two points, geometric problems
6	**Differentiation**
a	Definition, differentiating polynomials, second derivatives
b	Gradients, tangents, normals, maxima and minima
7	**Integration**
a	Definition as opposite of differentiation, indefinite integrals of x^n
b	Definite integrals and areas under curves
8	**Exponentials and logarithms:** Exponential functions and natural logarithms

Year 1: AS Mathematics applied content
Statistics and Mechanics

Unit	Title
	Section A – Statistics
1	**Statistical sampling**
a	Introduction to sampling terminology; Advantages and disadvantages of sampling
b	Understand and use sampling techniques; Compare sampling techniques in context
2	**Data presentation and interpretation**
a	Calculation and interpretation of measures of location; Calculation and interpretation of measures of variation; Understand and use coding
b	Interpret diagrams for single-variable data; Interpret scatter diagrams and regression lines; Recognise and interpret outliers; Draw simple conclusions from statistical problems
3	**Probability:** Mutually exclusive events; Independent events
4	**Statistical distributions:** Use discrete distributions to model real-world situations; Identify the discrete uniform distribution; Calculate probabilities using the binomial distribution (calculator use expected)
5	**Statistical hypothesis testing**
a	Language of hypothesis testing; Significance levels
b	Carry out hypothesis tests involving the binomial distribution
	Section B – Mechanics
6	**Quantities and units in mechanics**
a	Introduction to mathematical modelling and standard S.I. units of length, time and mass
b	Definitions of force, velocity, speed, acceleration and weight and displacement; Vector and scalar quantities
7	**Kinematics 1 (constant acceleration)**
a	Graphical representation of velocity, acceleration and displacement
b	Motion in a straight line under constant acceleration; *suvat* formulae for constant acceleration; Vertical motion under gravity
8	**Forces & Newton's laws**
a	Newton's first law, force diagrams, equilibrium, introduction to **i**, **j** system
b	Newton's second law, '$F = ma$', connected particles (no resolving forces or use of $F = \mu R$); Newton's third law: equilibrium, problems involving smooth pulleys
9	**Kinematics 2 (variable acceleration)**
a	Variable force; Calculus to determine rates of change for kinematics
b	Use of integration for kinematics problems i.e. $r = \int v\,\mathrm{d}t,\ v = \int a\,\mathrm{d}t$

Year 2: Remaining A Level Mathematics pure content
Pure Mathematics

Unit		Title
1		**Proof:** Examples including proof by deduction* and proof by contradiction
2		**Algebraic and partial fractions**
	a	Simplifying algebraic fractions
	b	Partial fractions
3		**Functions and modelling**
	a	Modulus function
	b	Composite and inverse functions
	c	Transformations
	d	Modelling with functions* *examples may be Trigonometric, exponential, reciprocal etc.
4		**Series and sequences**
	a	Arithmetic and geometric progressions (proofs of 'sum formulae')
	b	Sigma notation
	c	Recurrence and iterations
5		**The binomial theorem**
	a	Expanding $(a + bx)^n$ for rational n; knowledge of range of validity
	b	Expansion of functions by first using partial fractions
6		**Trigonometry**
	a	Radians (exact values), arcs and sectors
	b	Small angles
	c	Secant, cosecant and cotangent (definitions, identities and graphs); Inverse trigonometrical functions; Inverse trigonometrical functions
	d	Compound* and double (and half) angle formulae *geometric proofs expected
	e	$R\cos(x \pm \alpha)$ or $R\sin(x \pm \alpha)$
	f	Proving trigonometric identities
	g	Solving problems in context (e.g. mechanics)
7		**Parametric equations**
	a	Definition and converting between parametric and Cartesian forms
	b	Curve sketching and modelling

Unit	Title
8	**Differentiation**
a	Differentiating sin x and cos x from first principles
b	Differentiating exponentials and logarithms
c	Differentiating products, quotients, implicit and parametric functions.
d	Second derivatives (rates of change of gradient, inflections)
e	Rates of change problems* (including growth and kinematics) *see Integration (part 2) – Differential equations
9	**Numerical methods***
a	Location of roots
b	Solving by iterative methods (knowledge of 'staircase and cobweb' diagrams)
c	Newton-Raphson method
d	Problem solving
	*See Integration (part 2) for the trapezium rule
10	**Integration (part 1)**
a	Integrating x^n (including when $n = -1$), exponentials and trigonometric functions
b	Using the reverse of differentiation, and using trigonometric identities to manipulate integrals
11	**Integration (part 2)**
a	Integration by substitution
b	Integration by parts
c	Use of partial fractions
d	Areas under graphs or between two curves, including understanding the area is the limit of a sum (using sigma notation)
e	The trapezium rule
f	Differential equations (including knowledge of the family of solution curves)
12	**Vectors (3D):** Use of vectors in three dimensions; knowledge of column vectors and **i**, **j** and **k** unit vectors

Year 2: Remaining A Level Mathematics applied content
Statistics and Mechanics

Unit	Title
	Section A – Statistics
1	**Regression and correlation**
a	Change of variable
b	Correlation coefficients Statistical hypothesis testing for zero correlation
2	**Probability**
a	Using set notation for probability Conditional probability
b	Questioning assumptions in probability
3	**The Normal distribution**
a	Understand and use the Normal distribution
b	Use the Normal distribution as an approximation to the binomial distribution Selecting the appropriate distribution
c	Statistical hypothesis testing for the mean of the Normal distribution
4	**Moments:** Forces' turning effect
5	**Forces at any angle**
a	Resolving forces
b	Friction forces (including coefficient of friction μ)
6	**Applications of kinematics:** Projectiles
7	**Applications of forces**
a	Equilibrium and statics of a particle (including ladder problems)
b	Dynamics of a particle
8	**Further kinematics**
a	Constant acceleration (equations of motion in 2D; the **i**, **j** system)
b	Variable acceleration (use of calculus and finding vectors $\dot{\boldsymbol{r}}$ and $\ddot{\boldsymbol{r}}$ at a given time)