

## Advance Information for Summer 2022

### A Level

### Further Mathematics B (MEI)

### H645

We have produced this advance information to support teachers and students with revision for the Summer 2022 examinations.

#### Information

- This notice covers all examined components.
- There are no restrictions on who can use this notice.
- You are **not** permitted to take this notice into the exam.
- This document has **4** pages.

#### Advice

- Students and teachers can discuss this advance information.
- It is advised that teaching and learning should still cover the entire subject content in the specification.
- A Level Further Mathematics assumes all subject content of A Level Mathematics.
- The information is presented in specification order by the main topic of each question and not in question order.
- Topics not explicitly given in the list may appear in low tariff items or via synoptic questions.

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**Y420 Core Pure**

- Proof by induction
- The Argand diagram
- de Moivre's theorem
- The  $n$ th roots of a complex number
- Linear transformations and their associated matrices
- Points, lines and planes
- Roots and coefficients of a polynomial equation
- Summation of series
- Improper integral
- Partial fractions
- Polar coordinates
- Hyperbolic equation
- Hyperbolic functions, Maclaurin series
- Solving a 1<sup>st</sup> order differential equation
- Modelling with 2<sup>nd</sup> order differential equations in kinematics

**Y421 Mechanics major**

- Dimensional analysis
- Friction: momentum and impulse treated as vectors
- Equilibrium of a particle
- Equilibrium of a rigid body
- Concepts of work and energy
- The work-energy principle in the context of circular motion
- Conservation of linear momentum; direct impact
- Oblique impact
- Modelling circular motion with uniform speed
- Use of calculus to find centre of mass
- Velocity and position vector; vectors and variable forces
- The equation of the path of a particle in 2 dimensions
- 2<sup>nd</sup> order differential equations in the context of variable acceleration; extension of an elastic string

**Y422 Statistics major**

- Expectation and variance
- Discrete probability distribution
- Poisson distribution
- Geometric distribution
- Spearman's rank correlation, hypothesis test
- Regression line equation, goodness of fit
- Chi-squared test for contingency table
- Cumulative distribution function
- Normal distribution
- Kolmogorov-Smirnov test, hypothesis test for an average
- Confidence intervals
- Simulation of random variables, the discrete uniform distribution

**Y431 Mechanics minor**

- Dimensional analysis
- Vector treatment of forces, friction
- Equilibrium of a rigid body
- Work and energy
- Direct impact, conservation of linear momentum, kinetic energy
- Centre of mass

**Y432 Statistics minor**

- Discrete random variable; expectation and variance
- Discrete probability distribution
- Discrete uniform distribution
- Spearman's rank correlation coefficient; sampling
- Regression lines
- Chi-squared test for goodness of fit of a Poisson model

**Y433 Modelling with algorithms**

- Algorithms
- Sorting algorithms
- Networks and graphs, network flows
- Dijkstra's algorithm, solving network problems using technology
- Critical path analysis
- Formulating an LP problem, graphical solution of an LP
- Simplex method

**Y434 Numerical methods**

- Use of spreadsheets and calculators, solution of equations
- Relative error, chopping/rounding
- Newton-Raphson iteration, fixed point iteration, convergence
- Relaxation, fixed point iteration
- Numerical differentiation
- Midpoint rule, trapezium rule, Simpson's rule
- Polynomial interpolation in context

**Y435 Extra Pure**

- Investigation of recurrence relations
- Solution of recurrence relations
- Sets, axioms of a group
- Cayley-Hamilton theorem, diagonalisation of a matrix
- Stationary points, contours, surfaces, tangent plane

**Y436 Further Pure with technology**

- Properties of curves, use of software
- Differential equations, analytical solutions, tangent fields, Euler method
- Write programmes for number theory problems, modular arithmetic, Fermat's little theorem

**END OF ADVANCE INFORMATION**

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