CAMBRIDGE
UNIVERSITY PRESS & ASSESSMENT

A Level

Mathematics

Session: 1974
Type: Syllabus
Code: 840

MATHEMATICS SYLLABUS A (840)

G.C.E. MATHEMATICS (ADVANCED LEVEL AND SPECIAL PAPER) (840)

H.S.C. MATHEMATICS (PRINCIPAL SUBJECT) (840)

Scheme of Papers

For G.C.E. Mathematics Syllabus A (Advanced Level) and H.S.C. Mathematics Syllabus A (Principal Subject) there will be two papers. Candidates must not give up answers to more than eight questions in either paper, and will be required to reach a satisfactory standard in both the pure and applied (and/or statistics) part of the subject. Successful candidates will be certified as having passed in Mathematics (G.C.E. Advanced or H.S.C. Principal Subject).

Mathematics 1 (3 hours). Pure Mathematics (11 questions),

Mathematics 2 (3 hours). The paper will be divided into two sections. Section 1 will contain 7 questions on Mechanics and 7 questions on Statistics. Section 2 will contain 4 questions on Pure Mathematics. Candidates may not answer more than 2 questions from Section 2.

Note: In the detailed syllabus below, the 'pure' topics printed in roman type will be examined in Paper 1, and the 'pure' topics printed in *italic* type will be examined in Paper 2. It will be appreciated, however, that certain overlaps may occur, and the division is intended for guidance only. It is expected that the syllabus will be treated as a whole.

The Special paper (G.C.E. Home centres only) in Mathematics will be a 3-hour paper which candidates may offer in addition to Papers 1 and 2. The paper will consist of 7 questions on Pure Mathematics, 4 questions on Mechanics, and 4 on Statistics, and at least 9 questions will be based on the syllabus for Papers 1 and 2.

Attention is drawn to the statement concerning units on p. 27.

Detailed Syllabus

Algebra

Indices, logarithms, surds. The remainder theorem.

Arithmetical and Geometrical progressions, including sum of G.P. to infinity.

Simple problems on arrangements and selections. Binomial theorem for a positive integral index. (Questions on the greatest term and on sums and properties of the coefficients will not be asked.) Use of the series for $(1+x)^n$ when n is non-integral. Simple approximations.

Solution of simultaneous linear equations involving not more than three unknowns. Easy simultaneous equations, at least one non-linear, in two unknowns.

Elementary properties of quadratic equations and functions. Locating the roots of an equation by the use of simple graphical and numerical methods.

The manipulation of the signs $<$ and $>$.

Trigonometry

Circular measure. Trigonometrical ratios of angles of any magnitude. Applications to projection. Graphs of simple trigonometrical functions. Formulae for $\sin(A \pm B)$, $\cos(A \pm B)$, $\tan(A \pm B)$; applications to multiple angles and simple identities. Easy trigonometrical equations (including $a\cos x + b\sin x = c$).

Solution of triangles: the half-angle formulae: determination of area. Easy three-dimensional problems.

Geometry

Elementary two-dimensional rectangular cartesian co-ordinate geometry, e.g. distances, angles, area of a triangle.

The linear equation; perpendicular distance from a point to a line. Easy locus problems. Equation of a circle. Simple curve-tracing.

Elementary treatment of the loci $(ct, c/t)$, $(at^2, 2at)$, $(a\cos t, b\sin t)$, including their cartesian equations, chords, tangents, normals.

Calculus

Graphs and derivatives of simple algebraic, trigonometrical, exponential and logarithmic functions (including sums, products, quotients, functions of a function and implicit functions but excluding the inverse trigonometrical functions). Evaluation of dy/dx (but not d^2y/dx^2) for $x = f(t)$, $y = g(t)$. Applications to tangents, normals, maxima and minima and inflexions, sketch-graphs, kinematics, rates of change, small increments (one variable only).

The approximate solution of equations, e.g. by Newton's method.

Simple expansions, e.g. $\sin x$, $\ln(1+x)$, e^x, $(1+x)^n$.

The definite integral and its representation as an area; integration as the inverse of differentiation, including integration by simple change of variable and by use of partial fractions. (Integration by parts is excluded.)

Applications of integration to areas and volumes, and centres of gravity. Problems leading to the differential equations $dy/dx = f(x)$, and $dy/dx = f(y)$, and their solution.

Mechanics

Kinematics of a particle moving in a straight line.

Composition and resolution of velocities and accelerations; relative velocity.

Composition and resolution of forces; moments and couples. (An experimental basis is sufficient. Proofs of the fundamental theorems of statics will not be required.) Centre of gravity. Equilibrium of particles and of rigid bodies under coplanar forces, including simple problems on connected bodies.

Friction. Hooke's Law.

Projectiles.

Newton's laws of motion and the ideas of mass, force, momentum, impulse, energy, work, power. Absolute units. The conservation of momentum in rectilinear motion. Conservation of energy.

Simple harmonic motion. Small oscillations of the simple pendulum. Uniform motion in a circle.

Statistics

(The questions set will test appreciation of method, use of method, and inference rather than mere mechanical calculation.)

Frequency interpretation of probability. Sample and population. Average and expectation. Mean and median. Variance and standard deviation.

Laws of probability (including conditional probability). Binomial distribution.

Continuous distributions. Frequency and cumulative frequency (distribution) functions. Normal distribution, including use of tables.

Presentation of statistical data. Sampling distributions. Properties of a good estimate. Interval estimation (e.g. confidence limits in small samples). Significance testing. (Proof of the formula $\sigma/\sqrt{n}$ will not be required.)

Quality control by means and ranges. Two-sample and paired sample t-tests. Ideas of Association. Rank correlation (preferably Kendall's).