Cambridge Assessment

A Level

Mathematics

Session: 1967
Type: Syllabus
Code: 417

MATHEMATICS

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

H.S.C. MATHEMATICS (PRINCIPAL SUBJECT)

Scheme of Papers

For G.C.E. Mathematics (Advanced Level) and H.S.C. Mathematics (Principal Subject) there will be three papers. Candidates must not give up answers to more than eight questions in any paper. In Paper III candidates may choose their questions freely from the whole paper. (See note on p. 31 regarding Entrance Requirements for the University of London.) Successful candidates will be certified as having passed in Mathematics (G.C.E. Advanced or H.S.C. Principal Subject).

Mathematics I (a 2½-hour paper identical with Pure Mathematics I) Algebra and Trigonometry (10 questions). (108 marks.)

Mathematics II (a 2½-hour paper identical with Pure Mathematics II) Geometry and Calculus (10 questions). (108 marks.)

Mathematics III (a 3-hour paper identical with Applied Mathematics I, Statistics I), Mechanics, Statistics, and History of Mathematics. (10 questions on Mechanics, 10 questions on Statistics and 1 question on the History of Mathematics.) (144 marks.)

The Special paper (G.C.E. Home centres only) in Mathematics will be *Mathematics IV* (a 3-hour paper) which candidates may offer in addition to papers Mathematics I, II and III. 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 Mathematics I, II and III, the remainder being based on the additional syllabus for Mathematics IV.

Detailed Syllabus

MATHEMATICS I: PURE MATHEMATICS I

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.

MATHEMATICS II: PURE MATHEMATICS II

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 and inflexions, sketch-graphs, kinematics, rates of change, small increments (one variable only). The approximate solution of equations, e.g. by Newton's method. Maxima and minima.

Simple expansions, e.g. $\sin x$, $\log(1+x)$, 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 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.

MATHEMATICS III: APPLIED MATHEMATICS I: STATISTICS I

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 Bayes' theorem). Games and Decisions. Binomial distribution.

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

Requirements for valid inference. Presentation. Sampling distributions. Properties of a good estimate. Interval estimation (e.g. confidence limits). 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).

History of Mathematics

1965 and 1966. Number systems.

The topic for 1966 and 1967 will be notified later. A list of books which may be found useful is given on p. 30.

MATHEMATICS IV

The syllabus for Mathematics I, II and III above, together with the items specified below.

Algebra, Trigonometry, Calculus

Polynomial and simple rational algebraic functions and their graphs.

The general solution of simple trigonometrical equations.

Inverse circular functions.

Integration by parts, and by change of variable.

Mechanics

Normal and tangential acceleration in circular motion; motion in a vertical circle.

Direct impact of smooth bodies, with or without loss of energy.

Units (c.g.s., M.K.S., foot-pound-second) and dimensions.