ADDITIONAL MATHEMATICS

OBJECTIVE

The objective of the examination is to test the ability of candidates to understand and to apply more advanced mathematical concepts.

THE EXAMINATION

The examination will consist of one paper of $2\frac{1}{2}$ hours' duration. The paper will be divided into two sections. Section A (62 marks) will consist of 11 to 13 short questions, all of which are to be attempted. Section B (48 marks) will consist of long questions and candidates will be required to answer 4 out of 5 questions.

Notes:
1. Knowledge of topics in the current Mathematics syllabus is assumed.
2. SI and metric units will be used in the examination.
3. Electronic calculators* and mathematical drawing instruments may be used in the examination.

Syllabus Topics	*Notes*
1. The six trigonometric functions of angles of any magnitude and their graphs.	
Formulas for $\sin(A \pm B)$, $\cos(A \pm B)$ and $\tan(A \pm B)$, sum and product formulas.	Proofs of these formulas are not required but their applications to multiple and half angles are expected.
General solution of simple trigonometric equations.	
Problems in two and three dimensions.	Questions harder than those in the Mathematics papers may be set.

Syllabus Topics		*Notes*
2.	Quadratic functions and quadratic equations. Discriminant and nature of roots.	
	Quadratic inequalities in one variable.	
	Use of the absolute value sign.	Excluding its use in relation to inequalities.
3.	Mathematical induction and its simple applications.	Application to proof of inequalities is not required.
4.	The binomial theorem for positive integral indices.	Excluding determination of the greatest term and relations between coefficients.
5.	Plane rectangular coordinates. Area of rectilinear figures. Angle between two lines, distance from a point to a line, family of straight lines.	
	Equations of tangents to a circle.	
	Family of circles.	Families of concentric circles, circles through the intersection of two circles and circles through the intersection of a straight line and a circle.
	Simple locus problems.	Including the use of parameters.

	Syllabus Topics	*Notes*
6.	Vectors in the two-dimensional space. Unit vectors and the zero vector. Position vectors. Representation of a vector by $a\mathbf{i} + b\mathbf{j}$ and by a directed line segment. Sum and difference of vectors. Multiplication of a vector by a scalar. Scalar product (dot product) of two vectors.	The notations used in the examination papers will include : $\overrightarrow{AB}$ — the vector from A to B $\mathbf{i}$、$\mathbf{j}$ — unit coordinate vectors $\mathbf{0}$ — the zero vector $\mathbf{r}$、$\mathbf{p}$ — vectors $\lvert\mathbf{r}\rvert$、$\lvert\overrightarrow{AB}\rvert$ — magnitudes of vectors Although in examination papers vectors may be represented by bold-type letters, candidates are however advised to use appropriate symbols such as $\underline{u}$, $\vec{u}$, $\underline{i}$, $\vec{i}$, $\underline{0}$ or $\vec{0}$ in their working.
	Application of vector method to problems involving parallelism, perpendicularity and division of a line segment.	Candidates are expected to know that if $a_1\mathbf{u} + b_1\mathbf{v} = a_2\mathbf{u} + b_2\mathbf{v}$, where $\mathbf{u}$ and $\mathbf{v}$ are non-parallel, then $a_1 = a_2$ and $b_1 = b_2$.
7.	Differentiation from first principles. Differentiation of powers of x and trigonometric functions. Differentiation of a sum, a product and a quotient of functions. Differentiation of a composite function and an implicit function. Second derivatives.	The differentiation of inverse trigonometric functions will not be examined.
	Application of differentiation to gradients, rates of change, tangents and normals to a curve, maxima and minima, and sketching of simple curves.	Excluding points of inflexion and asymptotes.

	Syllabus Topics	*Notes*
8.	Indefinite integration as the reverse process of differentiation.	Excluding integration of $\frac{1}{x}$ and integration by parts.
	The integrals of $(ax + b)^n$ (excluding $n = -1$), $\sin(ax + b)$ and $\cos(ax + b)$.	Integration by substitution is not required.
	Definite integrals and their simple properties. Applications in finding plane areas and finding volume of solids of revolution formed by revolving about the coordinate axes.	Proofs of these properties are not required.

* See Regulation 5.15.