MATHEMATICS

OBJECTIVES

The objectives of the examination are to test the candidates':

1. knowledge of the mathematical facts, concepts, skills and principles presented in the syllabus;
2. familiarity with and use of mathematical symbols;
3. ability to use appropriate mathematical techniques for solving a variety of problems;
4. ability to communicate ideas and to present arguments mathematically.

THE EXAMINATION

The examination will consist of two papers:

Paper 1 (2 hours) (60%)
This paper will consist of two sections. Section A will consist of questions on the Foundation Part and Section B will consist of questions on the Whole Syllabus. Section A will further be divided into two parts. Section A(1) (33 marks) will consist of 8 to 10 questions of an elementary type and there will be no choice. Section A(2) (33 marks) will consist of 4 to 5 harder questions and there will be no choice. Section B (33 marks) will consist of questions which will be more demanding and candidates will be required to answer 3 out of 4 questions.

Paper 2 ($1\dfrac{1}{2}$ hours) (40%)

This paper will consist of two sections. Section A ($\dfrac{2}{3}$ of the paper mark) will consist of questions on the Foundation Part and Section B

($\dfrac{1}{3}$ of the paper mark) will consist of questions on the Whole Syllabus. All questions in the paper will be multiple-choice questions which

will aim at a full coverage of the syllabus and there will be no choice.

Notes: 1. Candidates are not expected to perform lengthy manipulations.
2. In calculations candidates are expected to give answers to appropriate degrees of accuracy.
3. Electronic calculators* and mathematical drawing instruments may be used in the examination.
4. SI and metric units will be used in the examination wherever appropriate.

THE SYLLABUS

			Notes (Foundation Part)
1	Percentages.	Applications to real-life problems including simple selling problems, simple and compound interest, growth and depreciation, successive and component changes, taxation and rates.	Applications to real-life problems including simple selling problems, simple and compound interest, growth and depreciation, successive and component changes, taxation and rates.
	Rate and ratio.	Including the notation of $a:b$, $a:b:c$. Applications to real-life problems.	Including the notation of $a:b$, $a:b:c$. Applications to real-life problems.
	Variations.	Including direct, inverse, joint and partial variations. Application to real-life problems.	Including direct, inverse, joint and partial variations. Application to real-life problems.
	Estimation.	Numerical estimation. Estimation in measurement.	Numerical estimation. Estimation in measurement.

		Notes (Foundation Part)
2 Polynomials.	Fundamental operations. Simple factorization, including $a^2 - b^2$, $a^2 \pm 2ab + b^2$, $a^3 \pm b^3$, $px^2 + qx + r = (hx + k)(mx + n)$, where h , k , m and n are integers.	Fundamental operations. Simple factorization, including $a^2 - b^2$, $a^2 \pm 2ab + b^2$, $px^2 + qx + r = (hx + k)(mx + n)$, where h , k , m and n are integers.
Remainder theorem.	Including the factorization of polynomials up to degree 3 .	(This topic is not included.)
3 Laws of indices.	Including rational indices. Manipulation of surds, including the rationalization of denominators in the form of $\sqrt{a}$. Inter-convert between simple binary/ hexadecimal numbers to decimal numbers.	Using laws of integral indices to simplify algebraic expressions up to 2 variables.
4 Sequences.	The general terms of sequences. Arithmetic and geometric sequences. Sum to n terms. Sum to infinity of geometric series. Applications to real-life problems.	The general terms of sequences.

		Notes (Foundation Part)
5	Equations in one unknown.	Distinction between identities and equations.	Distinction between identities and equations.
		Linear equation in one unknown.	Linear equation in one unknown.
		Solving quadratic equations by factorization, by formula and by graph. Nature of roots. Simple application problems.	Solving quadratic equations by factorization, by formula and by graph. Nature of roots. Simple application problems.
		Equations which can be transformed to quadratic equations.	
	Simultaneous equations in two unknowns.	Solving equations by reading intersecting points of given graphs. Solving two linear equations, including graphical method. Solving one linear and one quadratic equations by algebraic method.	Solving equations by reading intersecting points of given graphs. Solving two linear equations, including graphical method.
6	Formulas.	Numerical applications. Change of subject, excluding formulas involving radicals. Simple algebraic fractions.	Numerical applications. Change of subject, excluding formulas involving radicals. Simple algebraic fractions.
	Functions and graphs.	Notation for function. Transformation on function.	Notation for function.
		Graphs of $f(x) = ax + b$ and $f(x) = ax^2 + bx + c$.	Graphs of $f(x) = ax + b$ and $f(x) = ax^2 + bx + c$.

			Notes (Foundation Part)
		Knowledge of the general features of quadratic functions such as vertex, axis of symmetry and intercepts is required. The method of completing the square. Solving $f(x) > k$, $f(x) < k$, $f(x) \geq k$ and $f(x) \leq k$ graphically.	Knowledge of the general features of quadratic functions such as vertex, axis of symmetry and intercepts is required. Solving $f(x) > k$, $f(x) < k$, $f(x) \geq k$ and $f(x) \leq k$ graphically.
7	Inequalities.	Solving linear inequality in one unknown and representing the solution on a number line. Solving systems of linear inequalities in two unknowns graphically. Applications to linear programming.	Solving linear inequality in one unknown and representing the solution on a number line.
8	Exponential and logarithmic functions.	Graphs of exponential and logarithmic functions. Properties of logarithms, excluding the change of base. Applications of logarithm in real-life problems.	(This topic is not included.)

			Notes (Foundation Part)
9	Mensuration of common plane figures and solids.	Including triangles, rectangles, parallelograms, trapezia, polygons, circles, cubes, cuboids, prisms, cylinders, pyramids, right circular cones and spheres.	Including triangles, rectangles, parallelograms, trapezia, polygons, circles, cubes, cuboids, prisms, cylinders, pyramids, right circular cones and spheres.
	Length of an arc and area of a sector of a circle.	By ratio only.	By ratio only.
	Similar plane figures and solids.	Relations between lengths, areas and volumes.	Relations between lengths, areas and volumes.
10	Deductive reasoning of geometry.	The ability to present proofs is expected.	The ability to present proofs is expected.
	Angles and straight lines.	Angles at a point, angles on a straight line and vertically opposite angles. Angle properties relating to parallel lines and triangles. The intercept theorem.	Angles at a point, angles on a straight line and vertically opposite angles. Angle properties relating to parallel lines and triangles.
	Triangles.	Isosceles and equilateral triangles. Congruent and similar triangles. Medians, perpendicular bisectors, altitudes and angle bisectors in a triangle. Triangle inequality. The in-centre, circumcentre, orthocentre, centroid of a triangle. The mid-point theorem.	Isosceles and equilateral triangles. Congruent and similar triangles. Medians, perpendicular bisectors, altitudes and angle bisectors in a triangle.

		Notes (Foundation Part)
Pythagoras' theorem.	Including its converse and its applications in real-life problems.	Including its converse and its applications in real-life problems.
Quadrilaterals and polygons.	Properties of squares, rectangles, rhombuses, parallelograms and trapezia. Sums of interior angles and of exterior angles of a convex polygon. The ability to present proofs related to parallelograms is expected.	Properties of squares, rectangles, rhombuses, parallelograms and trapezia. Sums of interior angles and of exterior angles of a convex polygon.
Circles.	Properties of chords and arcs. Angle properties. Cyclic quadrilaterals. Tangents to circles and angles in the alternate segment.	(This topic is not included.)
Transformation and symmetry in 2-D figures.	Including reflection, rotation, translation, dilation transformations, and reflectional, rotational symmetries.	Including reflection, rotation, translation, dilation transformations, and reflectional, rotational symmetries.
3-D figures.	Reflectional and rotational symmetries of cubes and regular tetrahedra. Identifying angle between two intersecting lines, angle between a line and a plane, angle between two intersecting planes and line of greatest slope.	Reflectional and rotational symmetries of cubes and regular tetrahedra. Identifying angle between two intersecting lines, angle between a line and a plane, angle between two intersecting planes and line of greatest slope.

		Notes (Foundation Part)
11	Introduction to coordinates.	Translation. Reflection with respect to lines parallel to coordinate axes. Rotation about the origin through multiples of 90°. Areas of plane figures that can be cut into common 2-D rectilinear figures. Distance between two points. Coordinates of mid-point. Internal division of a line segment. Polar coordinates.	Translation. Reflection with respect to lines parallel to coordinate axes. Rotation about the origin through multiples of 90°. Areas of plane figures that can be cut into common 2-D rectilinear figures. Distance between two points. Coordinates of mid-point. Polar coordinates.
	Coordinate geometry of straight lines.	Slope (gradient) of a straight line. Conditions for parallel lines and perpendicular lines. Equation of a straight line. Knowledge of equations in different forms is not required. However, given two points, or one point and the slope, candidates should be able to find the equation of the straight line. On the other hand, given the equation of a straight line, candidates should be able to find its slope and intercepts. Intersection of straight lines.	Slope (gradient) of a straight line. Conditions for parallel lines and perpendicular lines. Equation of a straight line. Knowledge of equations in different forms is not required. However, given two points, or one point and the slope, candidates should be able to find the equation of the straight line. On the other hand, given the equation of a straight line, candidates should be able to find its slope and intercepts. Intersection of straight lines.

		Notes (Foundation Part)
Coordinate geometry of circles.	Equation of a circle. Coordinates of centre and length of radius.	(This topic is not included.)
12 Measure of angles.	In degrees only.	In degrees only.
Trigonometric ratios.	Sine, cosine and tangent of angles in the interval $0°$ to $360°$. Graphs and periodicity of sine, cosine and tangent. The exact values of trigonometric ratios on special angles $30°$, $45°$ and $60°$. Simplification of sine, cosine and tangent of the angles $90° - A$, $180° \pm A$ and $360° - A$. $\tan A = \dfrac{\sin A}{\cos A}$ and $\sin^2 A + \cos^2 A = 1$.	Sine, cosine and tangent of angles in the interval $0°$ to $90°$. The exact values of trigonometric ratios on special angles $30°$, $45°$ and $60°$. Simplification of sine, cosine and tangent of the angle $90° - A$. $\tan A = \dfrac{\sin A}{\cos A}$ and $\sin^2 A + \cos^2 A = 1$.
Simple trigonometric equations.	Solutions in the interval $0°$ to $360°$ only. Including graphical method.	Equations of the type $a \sin \theta = b$, $a \cos \theta = b$ and $a \tan \theta = b$ only. Only solutions in the interval $0°$ to $90°$ are required.

		Notes (Foundation Part)
Applications of trigonometric ratios.	Finding measures of 2-D figures. Knowledge of bearings, gradients, angles of elevation and depression. Simple 2-D problems. Sine and cosine formulas. The formula $\frac{1}{2}ab\sin C$ and the Heron's formula for area of a triangle. Angle between two intersecting lines, angle between a line and a plane and angle between two intersecting planes. Simple 3-D problems.	Finding measures of 2-D figures. Knowledge of bearings, gradients, angles of elevation and depression. Simple 2-D problems.
13 Probability.	Calculation of probabilities by listing the sample space and counting. (The notations $n!$, P_r^n and C_r^n will not appear in the question papers.) The addition law and the multiplication law. Simple idea of conditional probability, excluding Bayes' Theorem.	Calculation of probabilities by listing the sample space and counting. (The notations $n!$, P_r^n and C_r^n will not appear in the question papers.)

			Notes (Foundation Part)
14	Organization and representation of numerical data.	Frequency and cumulative frequency tables; broken line graphs, bar charts, pie charts, histograms, stem-and-leaf diagrams, scatter diagrams, frequency polygons and curves, cumulative frequency polygons and curves. Including the construction and interpretation of these statistical diagrams.	Frequency and cumulative frequency tables; broken line graphs, bar charts, pie charts, histograms, stem-and-leaf diagrams, scatter diagrams, frequency polygons and curves, cumulative frequency polygons and curves. Including the construction and interpretation of these statistical diagrams.
	Measures of central tendency.	Mean, weighted mean, mode and median for ungrouped data. Mean, weighted mean, modal class and median for grouped data.	Mean, weighted mean, mode and median for ungrouped data. Mean, weighted mean, modal class and median for grouped data.
	Measures of dispersion.	Range, inter-quartile range and standard deviation. Box-and-whisker diagrams.	Range, inter-quartile range and standard deviation. Box-and-whisker diagrams. Working steps are not required for calculating standard deviation. For the determination of interquartile range for grouped data, use of cumulative frequency polygon/curve only.
	Uses and abuses of statistics.	Sampling and data collection method. Analysis and interpretation on the data.	(This topic is not included.)

* See Regulation 5.15.