Mathematics Syllabus A 7360

This subject may only be taken at the May/June examinations. It will be offered for the last time in May/June 2007.

The Examination

There will be three written papers each carrying one-third of the maximum mark. *Paper 1* (Arithmetic and Trigonometry) and *Paper 2* (Algebra) will be of 2 hours duration, *Paper 3* (Geometry) will be of 2 hours 30 minutes duration. Each paper will consist of two sections, Section A and Section B. Section A will consist of six short questions all of which may be attempted, and Section B will contain five questions of which candidates will be required to answer three. Section A will carry 52% of the maximum mark of the paper.

Questions will be set in SI units. Four-figure mathematical tables will be provided by London Examinations.

Calculators may be used in this examination.

The calculators that will be allowed are those which have the following keys: $+, -, \times, \div, \pi, x^2, \sqrt{x}, \frac{1}{x}; x^y$

Importance will be attached to the efficient and effective use of the calculator, resulting in correct answers.

Some questions will be set on Paper 1 which require the use of logarithms or a knowledge of the subject matter of Papers 2 and 3. Knowledge of the symbols $<$, $\leq$, and $>$ will be expected.

In Paper 3:

(i) any proof of a theorem will be accepted which appears to the Examiners to form part of a systematic treatment of the subject;
(ii) some items on the syllabus appear in bold type, proofs of these items may be required;
(iii) the use of hypothetical constructions will be allowed;
(iv) the use of ruler, compasses and protractor may be required;
(v) the use of algebraic and trigonometric symbols and of the properties of similar figures will be allowed.

Syllabus

SYLLABUS	NOTES
Paper 1 (Arithmetic and Trigonometry)	
1. The ordinary processes of number manipulation.	The 'four rules' and combinations of them by use of brackets.
Prime numbers, factors, multiples, indices.	To include finding HCF and LCM in simple cases.
Use of natural numbers, integers, rational and irrational numbers.	
Weights, measures and money.	SI units only will be used. Knowledge that £1 = 100p will be required. In currency conversion questions the exchange rates will be given.

SYLLABUS	NOTES
Vulgar and decimal fractions.	Excluding recurring decimals.
Ratio, proportion.	Including map scales.
Percentages.	To include depreciation and appreciation.
Averages.	Only the arithmetic mean will be expected.
Expressing numbers to a given degree of accuracy.	Correction to a given number of decimal places or significant figures.
2. Measurement of length, area, volume, capacity, weight and time.	
Length of an arc, area of a sector of circle.	Radian measure is excluded.
Mensuration of the rectangle, parallelogram, triangle, trapezium and circle.	
Mensuration of the cylinder, cone, sphere, prism, pyramid and cuboid.	Formulae for the volume and surface area of the cone and sphere will be given on the question paper.
3. Stocks and shares. Investment. Personal and household finance including hire purchase, interest, taxation, discount, loans, wages and salaries.	
Profit and loss.	
Rates of change.	eg, average speed and other applications to everyday life.
4. Use of sine, cosine and tangent of acute angles.	Angles will be measured in degrees and minutes.
Solution of problems in 2 and 3 dimensions by calculation.	
Sine and cosine rule.	
Angles of elevation and depression.	
Bearings.	
Paper 2 (Algebra)	
1. The basic processes of algebra.	
The symbolic expression of general results.	
The construction, interpretation and use of formulae and expressions: their manipulation in simple cases.	
Changing the subject of a formula.	
The factorisation of simple algebraic expressions.	To include the use of the factor theorem and remainder theorem for integer values of the variables.

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	Factorization of the difference of two squares and of a trinomial.
	Extraction of common factors.
The manipulation of simple algebraic fractions.	The denominator being numerical, linear or quadratic.
2. Solution of equations of the 1st or 2nd degree containing one unknown quantity.	Solution by factorization, graph, completing the square and formulae.
Solution of linear simultaneous equations in two unknowns.	
Solution of simultaneous equations of which one is the 1st degree and the other of the 2nd degree.	
3. Use and properties of indices.	Including positive, negative fractional and zero indices.
	Formal proofs will not be required.
Use and properties of logarithms.	To include $\log ab = \log a + \log b$,
	$\log a/b = \log a - \log b$,
	$\log a^c = c \log a$,
	$\log_a a = 1$.
4. Rectangular cartesian coordinates.	To include $y = ax^3 + bx^2 + cx + d$,
Graphs and graphical treatment of equations.	$y = ax^2 + bx + c$, $y = a + b/x$.
5. Variation.	To include the following cases:
	$y \propto x$, $y \propto x^2$, $y \propto 1/x$, $y \propto 1/x^2$.
6. Arithmetic and geometric progressions.	Sum to infinity will not be required.
7. Applications of algebra to the solution of problems.	
Paper 3 (Geometry)	
1. Angle properties at a point and angles made by parallel lines with a transversal.	
Angle properties of parallel lines, triangles and polygons.	Knowledge that if two sides of a triangle are equal the angles opposite to these sides are equal; and the converse will be expected.
	Knowledge that if two sides of a triangle are unequal, the greater side has the greater angle opposite to it, and the converse.
2. Congruence of triangles.	Use of the four tests: SAS, AAS, SSS, RHS

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3. Defining a parallelogram as a quadrilateral with both pairs of opposite sides parallel, then in any parallelogram	
(i) the opposite sides are equal,	
(ii) the opposite angles are equal,	
(iii) the diagonals bisect each other.	
If in a quadrilateral	
(i) both pairs of opposite sides are equal, or (ii) one pair of opposite sides are	
equal and parallel, or (iii) the opposite angles are equal, or (iv) the diagonals bisect each other, then the quadrilateral is a parallelogram.	
Area of a parallelogram.	Area = base × perpendicular height
Area of a triangle.	Area = ½ × base × perpendicular height
4. In a right-angled triangle, the square described on the hypotenuse is equal to the sum of the squares on the sides containing the right angle; and the converse. **The square on the side of a triangle is greater or less than the sum of the squares on the other two sides, according as the angle contained by those sides is obtuse or acute.**	
The difference is twice the rectangle contained by one of the two sides and the projection on it by the other.	
In any triangle, the sum of the squares on any two sides is equal to twice the square on half the third side together with twice the square on the median which bisects the third side.	
5. Locus of a point which is a constant distance from one point.	A circle, centre the point.
Locus of a point which is equidistant from two points.	The perpendicular bisector of the line joining the points.
Locus of a point which is equidistant from two lines.	The pair of lines which bisect the angle between the given lines.

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6. The tangent at any point of a circle and the radius through the point are perpendicular to each other.

Tangents to a circle from an external point are equal and equally inclined to the line joining the point to the centre of the circle.

If two circles touch, the point of contact lies on the straight line through the centres.

If two chords of a circle intersect either inside or outside the circle, the rectangle contained by the parts of the one is equal to the rectangle contained by the parts of the other; and the converse.

If from any point outside a circle, a secant and a tangent are drawn, the rectangle contained by the whole secant and the part of it outside the circle is equal to the square on the tangent; and the converse. **A straight line drawn from the centre of a circle to bisect a chord which is not a diameter is at right angles to the chord; conversely, the perpendicular to a chord from the centre bisects the chord.**

Equal chords of a circle are equidistant from the centre; and the converse.

7. The angle which an arc of a circle subtends at the centre is twice that which it subtends at any point on the remaining part of the circumference.

Angles in the same segment of a circle are equal; and if the line joining two points subtends equal angles at two other points on the same side of it, the four points lie on a circle.

The opposite angles of any quadrilateral inscribed in a circle are supplementary; and the converse.

In equal circles (or in the same circle)

(i) if two arcs subtend equal angles at the centres, they are equal;

(ii) conversely, if two arcs are equal, they subtend equal angles at the centre.

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In equal circles (or in the same circle)

(i) if two chords are equal, they cut off equal arcs;

(ii) conversely, if two arcs are equal, the chords of the arcs are equal.

If a straight line touches a circle, and from the point of contact a chord is drawn, the angles which this chord makes with the tangent are equal to the angles in the alternate segments; and the converse.

8. If a straight line is drawn parallel to one side of a triangle, the other two sides are divided proportionally; and the converse.

If two triangles are equiangular their corresponding sides are proportional; and the converse.

If two triangles have one angle of the one equal to one angle of the other and the sides about these equal angles proportional, the triangles are similar.

If a perpendicular is drawn from the right angle of a right-angled triangle to the hypotenuse, the triangles on each side of the perpendicular are similar to the whole triangle and to one another.

The internal bisector of an angle of a triangle divides the opposite side internally in the ratio of the sides containing the angle, and likewise the external bisector externally; and the converse.

The ratio of the area of similar triangles is equal to the ratio of the squares on the corresponding sides.

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9. There will be a construction question in both Section A and Section B. These will contain constructions selected from the list below and may contain simple applications of the theorems listed in the rest of the syllabus.

All figures must be drawn accurately and distinctly, and construction lines should not be erased. Constructions need not be described unless the question specifically states that a description is required. Proofs need not be given unless the question specifically states they are required.

Constructions using ruler and compasses only:

Bisection of angles and of straight lines.

Construction of perpendiculars to straight lines.

Construction of an angle equal to a given angle.

Construction of angles of 60°, 45°.

Division of straight lines into a given number of equal parts or into two or more parts in a given proportion.

Construction of a triangle equal in area to a given quadrilateral.

Construction of tangents to a circle and of common tangents to two circles.

Construction of circumscribed, inscribed and escribed circles of a triangle.

Construction of a square equal in area to a given quadrilateral.

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