

**EXTRA MASTER (FOREIGN-GOING).**

**61. Qualifications.**—The examination for an extra master's certificate is voluntary, and intended for such persons as wish to prove their superior qualifications and are desirous of having certificates of the highest grade granted by the Marine Department. The certificate will entitle the holder to go to sea as master of any mechanically-propelled vessel. There is no certificate or endorsement as extra master, sailing-ships, but a candidate for extra master who wishes to be qualified to act as master of sailing-ships may, provided that he has performed the necessary sea service in sailing-ships, be examined at the same time for a sailing-ship endorsement as master.

The extra examination may take place when the candidate is qualified to go up for examination for a master's foreign-going certificate, or at any time subsequent to his having passed the examination for that certificate.

**SYLLABUS.****62. General.**

The mathematical and scientific knowledge required from candidates is such as to enable them to have a thorough understanding of their technical subjects.

Candidates will be examined orally in seamanship. Their orals will also include a *viva voce* on the syllabuses of their written papers, and will give them an opportunity to improve the marks made in them (*see* para. 72).

**MATHEMATICS. (3 hours.)****63. Paper 1.**

(a) Mensuration and Drawing. (Proofs not required.)

Areas, perimeters, and general properties of triangles, parallelograms, polygons, circles, segments, and sectors of circles. Areas of irregular figures and waterplanes. Volumes and surface areas of parallelepipeds, cones, cylinders, spheres, wedges, and ship-shaped bodies. Simple drawing in plan and elevation (*i.e.*, elements of solid geometrical drawing). Reading of simple engineering and shipbuilding drawings.

(b) Algebra.—The evaluation of formulæ. The solution of equations of the first degree with one or two variables; quadratics; problems involving these. Powers and indices. Logarithms and their properties. Arithmetical and geometrical progressions. Simple graphical methods, including graphical solution of equations. Use of curves.

(c) Geometry.—A knowledge of the substance of the geometrical properties of the following so far as they are dealt with in the propositions of Euclid indicated:—

Straight lines .. .. .	Bk. I.	13, 14, 15.
Parallel Straight lines .. .. .	Bk. I.	27, 28, 29, 30.
Properties of angles of triangles .. .. .	Bk. I.	32 (and cor.).
Congruence of triangles and properties of triangles .. .. .	Bk. I.	4, 8, 26, 5, 6.
Parallelograms .. .. .	Bk. I.	33, 34.
Areas .. .. .	Bk. I.	35-41 and 43.
Relation between squares on sides of right-angled triangle .. .. .	Bk. I.	47.
Notions on loci.		
Geometry of Circle:—		
Chords .. .. .	Bk. III.	3, 14, 15.
Properties of angles in a circle .. .. .	Bk. III.	20, 21, 22, 31, 33, 26-29.
Tangent properties .. .. .	Bk. III.	16, 18, 19.

**Practical Geometry:—**

Bisection of angles and straight lines.

Construction of perpendiculars to straight lines.

Drawing of parallels to given straight line.

Construction of triangles and quadrilaterals from given data.

Division of straight lines into any number of equal parts.

Construction of circle through three points or circumscribing a triangle.

Construction of tangents to a circle at a given point or from an external point.

Construction of common tangent to two circles.

Construction of circle touching the three sides of a given triangle.

Construction of circles from sufficient data.

Construction of segment of circle containing a given angle.

Elementary ideas on solid geometry—*e.g.*, angle between planes, angle between line and plane, geometry of the sphere.